

Attaining Global Health: Challenges and Opportunities

by Scott C. Ratzan, Gary L. Filerman,
and John W. LeSar

Social and economic factors play a major role in determining health.

Attaining global health will require action from the individual to the international level.

New technologies will change the way health care is delivered.

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The authors hope this publication will spur debate and dialogue about global health, so that our children and their children will inherit a healthier world.

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The 20th century witnessed a revolution in human health and well-being. Average life expectancy at birth in many industrialized countries nearly doubled from around 45 years in 1900 to more than 70 years in 1999.¹ Less developed countries also enjoyed dramatic, albeit less extensive, improvements in living standards and declines in mortality. The sweeping improvements in health and success at controlling such ancient human foes as smallpox and cholera created expectations that everyone could attain good health.

As some health threats have receded, however, other threats have emerged—such as HIV/AIDS and new cancer-causing substances. Some disease-causing microbes have become resistant to medicines commonly used to treat them. Aspects of modern life appear to encourage unhealthy behavior, such as smoking and high-fat diets.

And, there is a substantial gap in mortality and disability among and within countries. A growing recognition of this disparity prompted the World Health Organization (WHO) to mount an international effort to attain “health for all.”²

Can the world attain good health in the 21st century? The health revolution will continue, driven by marvelous new technologies and a wealth of new medical knowledge. These medical advances may enable health

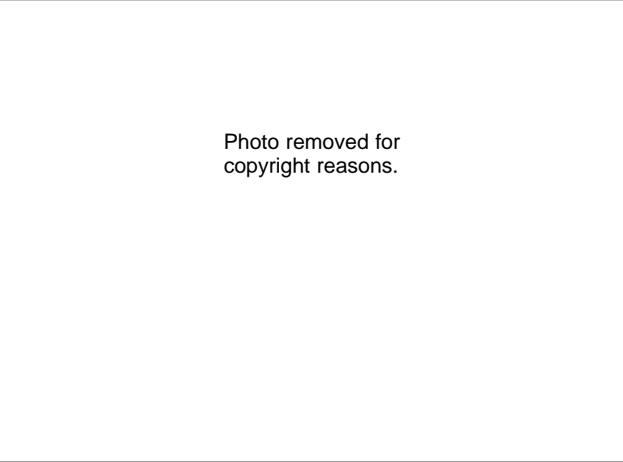


Photo removed for copyright reasons.

A Thai health care worker examines hill tribe populations. Screening for health problems is a proactive intervention that promotes public health.

professionals to conquer these new health threats and future world citizens may live long and healthy lives. But many factors other than medical services—from the individual level to the international arena—play a role in attaining and maintaining health. A population’s educational level, economic well-being, and access to health information and services, for example, have a profound influence on health. These population characteristics reflect many socioeconomic and political variables.

This *Population Bulletin* will survey the health trends in more and less developed regions using the most readi-

ly available measures—mortality and morbidity—and other measures such as the disability-adjusted life year, or DALY.

The *Bulletin* will also assess the challenge of improving health worldwide. Although each country and population group has a unique set of cultural, ethnic, linguistic, ethical, environmental, and even genetic characteristics, there are common denominators in the global challenge to improve health:

- An individual's health status reflects the interplay of many factors, including the physical environment, political stability, and community and family structure.
- A population's level of health is directly related to educational levels within that population. The average educational attainment of women is of particular importance.
- Increasing the funds spent on health does not ensure better health, but a prudent use of existing resources may contribute to a healthier public.
- Private-sector as well as public-sector resources are vital for attaining the best health possible.
- Creating an effective infrastructure for health delivery often requires fundamental changes in how governments and health systems operate.
- Policies to promote passive health measures, such as fluoridation of water and nutritional supplements, are key components of community health efforts.

Measuring Health

The challenge of attaining health requires innovative ways to measure health. WHO—the first multinational organization with a charter to promote health—defines health in positive terms, as “a state of complete mental, physical, and social well-being and not merely the absence of disease.”³ But such a concept is difficult to measure, and without such measurement it is difficult to know whether

a population is “healthy,” whether health is improving, and how the health status of one population compares to that of other populations.

One obstacle to measuring health is that health may be defined differently in one population than in another depending on demographic variables, the socioeconomic setting, beliefs and cultural factors, medical resources, and other factors. In high-mortality African villages, for example, deaths among infants and young children occur 10 times more frequently than among the elderly. The preponderance of childhood deaths reflects the large proportion of children in these high-fertility populations as well as a high incidence of infectious diseases.

In low-fertility, low-mortality settings such as the United States, infant and child deaths have become extremely rare relative to adult deaths.⁴ An infant mortality rate of 50 deaths per 1,000 births in a sub-Saharan African village would signal a welcome improvement in infant health, while the same rate would mean a significant deterioration in health for a U.S. city.

Mortality is most often used to assess a population's health status and to compare the status of different populations. Almost every country records deaths and publishes death rates with various levels of detail, coverage, and accuracy. Death rates may show the age, sex, and ethnicity of the person who died, and the probable cause of death. In countries with high mortality rates, illnesses may rapidly progress to death and cause-specific mortality rates may provide a meaningful snapshot of the population's health.

In low-mortality countries, however, death is often the terminal event after a long series of increasingly debilitating diseases. Also, many people live with chronic health problems that never lead to death but prevent them from having healthy children or from fully participating in working and family lives. Morbidity provides a clearer picture of a population's health status in such a country. Relatively little com-

parable information on the incidence and prevalence of disease and disability is available on the national level, especially in less developed countries. But the body of data is expanding through international efforts to standardize vital statistics and hospital records, and through household surveys about health status, knowledge, and behavior. Since the 1980s, for example, demographic and health surveys conducted in more than 50 less developed countries provide comparable data on infant feeding practices, use of family planning, childhood immunization, and other maternal and child health indicators.⁵

In another major effort to produce comparable international measures of health, researchers at the World Bank, WHO, and Harvard University collaborated on the multiyear “Global Burden of Disease” project. The researchers created a new way to assess and compare the health of populations: the disability-adjusted life year (DALY). DALYs are quantitative indicators derived to reflect the number of years of healthy life lost to all causes, whether from premature mortality or from temporary or permanent disability. These disabilities can be physical or mental. The DALY was designed to assist in setting health service priorities; identifying disadvantaged groups and targeting health interventions; and providing comparable measures for planning and evaluating programs.⁶

The number of DALYs estimated at any moment reflect the amount of health care already being provided to the population, as well as the effects of all other actions that protect or damage health. Where treatment—whether preventive, curative, or palliative—is possible, the effectiveness of the intervention is the reduction in the disease burden that the treatment produces. Effectiveness is measured in the same units (DALYs) as disease burden, and can be compared across interventions that treat different problems and produce different outcomes. In other words, the DALY can be used to measure the gains in

health attributable to different factors or health interventions. There are a number of other indicators used to assess health. One is the quality-adjusted life year (QALY), which is commonly used to measure the cost-effectiveness of health interventions. The QALY estimates the number of years of life added by a successful treatment, adjusted for the quality of life (as affected by any lingering disability from the health problem).⁷

Health Transition

The 20th-century declines in mortality rates and increases in life expectancy in much of the world were unprecedented in human history. These trends precipitated a massive increase in population size and altered the regional distribution of world population. The population age structure changed to include larger percentages of elderly people.

These remarkable improvements in health have been described as a broader health transition that is spurred by elements of economic development, including urbanization, rising incomes and educational levels, and expanded health systems. Researchers define the health transition using various models, but it is commonly described as encompassing the demographic transition from high to low fertility and mortality rates and the epidemiologic or mortality transition in which the predominant causes of death shift from communicable diseases to noncommunicable diseases.⁸

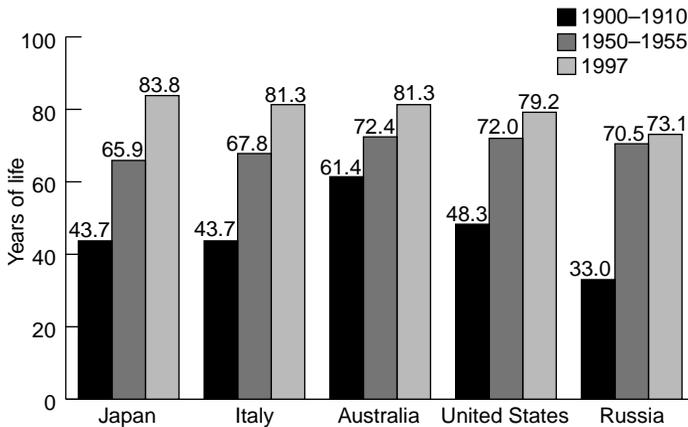
The health transition involves more than changes in mortality and fertility rates and in the leading causes of death. It signals “a shift in the ways that individuals and communities perceive and respond to their own health and ill-health.”⁹ As such, it emphasizes the role of social and economic influences on health.

Countries may stagnate or regress in the trend toward lower mortality and fertility, for example, as when mortality rates increased in Russia

The health transition emphasizes social and economic influences on health.

Figure 1

Increase in Female Life Expectancy at Birth, Selected Developed Countries, 1900 to 1997



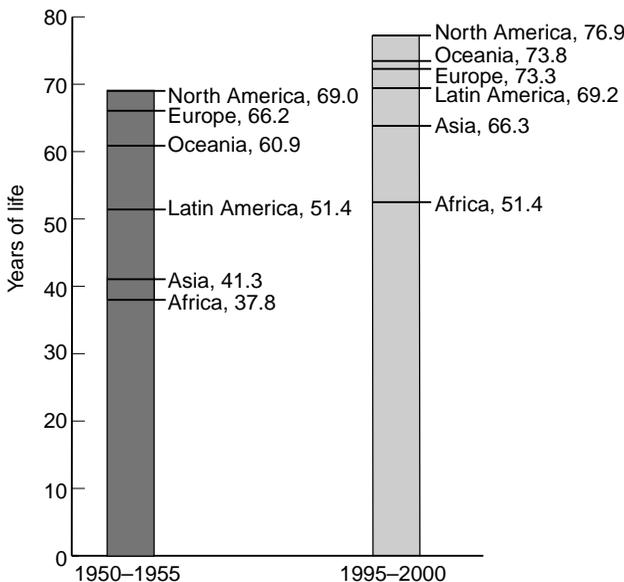
Source: Alan Lopez "Morbidity and Mortality, Changing Patterns in the Twentieth Century," in *Encyclopedia of Biostatistics*, Vol. 4 (1998); and Carl Haub and Diana Cornelius, *1999 World Population Data Sheet* (1999).

after the breakup of the Soviet Union. Life expectancy at birth for Russian men lost more than seven years between 1987 and 1994.¹⁰ This unusual decline was attributed to increased adult mortality related to social and economic stress generated by the transition from a communist to capitalist economy, and deterioration in Russia's health care services. While Russia's life expectancy improved in the late 1990s, it is still among the lowest in the more developed world. In the late 1990s, life expectancy for Russian males was 61 years compared with 74 years for U.S. males.

The transitions do not necessarily occur smoothly, and they may not have an endpoint. Some researchers, for example, suggest that the world may be entering a new stage of mortality transition, in which infectious diseases are re-emerging as major health problems.¹¹

Figure 2

Life Expectancy in Major World Regions, 1950-1955 and 1995-2000



Source: United Nations, *World Population Prospects: The 1998 Revision*, Vol. 1 (1998).

Demographic Transition

The demographic transition describes the shift from high fertility and mortality common in less developed countries to the low fertility and mortality rates typical of modern industrial countries. Mortality usually falls first, followed by fertility, but the timing and pace of change follow different patterns throughout the world.¹²

The most dramatic improvements in life expectancy for the more developed countries occurred in the first half of the 20th century. In some countries, mortality declines continued trends that began in the 19th century. Life expectancy at birth for American females was 48.3 years in 1900, jumped to 72.0 years by 1950 to 1955, but increased by relatively few years in the last half of the century to reach 79.2 by 1997 (see Figure 1). Japanese females, who have the world's longest life expectancy (83.8 years in 1997), also enjoyed greater gains in average life expectancy in the first half of the century than in the second half. The United Nations (UN) estimates the average female life expectancy in more developed

countries was about 65 years in the 1950 to 1955 period and rose to 75 years in the 1995 to 2000 period.

While most regions of the world experienced an improvement in survival in the first half of the 20th century, mortality did not decline substantially in many less developed regions until after 1950. In Africa, life expectancy rose from about 38 years in the 1950s to 51 years in the late 1990s. In Latin America, average life expectancy at birth was already 51 years in the 1950s and had climbed to 69 years by the late 1990s, as shown in Figure 2.

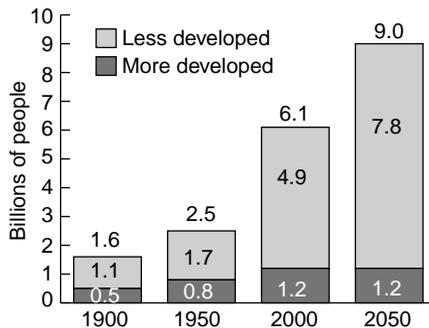
The mortality declines of the 20th century set off an unprecedented increase in population size. World population surged from 1.6 billion to 6.1 billion between 1900 and 2000. For most of human history, population grew slowly because the high birth rates were matched by high death rates. But as mortality fell, the population numbers began to swell from the excess of births over deaths. This demographic transition had already begun in the United States and many European countries by the beginning of the 20th century. Population growth in Europe helped fuel the transatlantic migration to the United States in the 19th and early 20th centuries.¹³ But fertility rates began to fall after the 1920s in more developed countries and population growth slowed.

In the United States, women had about four children, on average, in 1900. The total fertility rate (TFR), or the average total number of births a woman will have, fell below 3.0 children per woman by the 1930s before rising temporarily during the baby boom of the 1950s and early 1960s. From 1972 to 1997, the published TFR for American women was 2.1 or less.¹⁴

Fertility fell further in much of Europe over the last century. In 1999, the TFR was just 1.5 in Western Europe and 1.3 in Eastern and Southern Europe. Europe's population increased from about 408 million in 1900 to 547 million in 1950 and to

Figure 3

Population in More Developed and Less Developed Regions, 1900 to 2050



Source: Alene Gelbard, et al. *Population Bulletin* 54, no. 1 (1999): Tables 1 and 4. Based on United Nations projections.

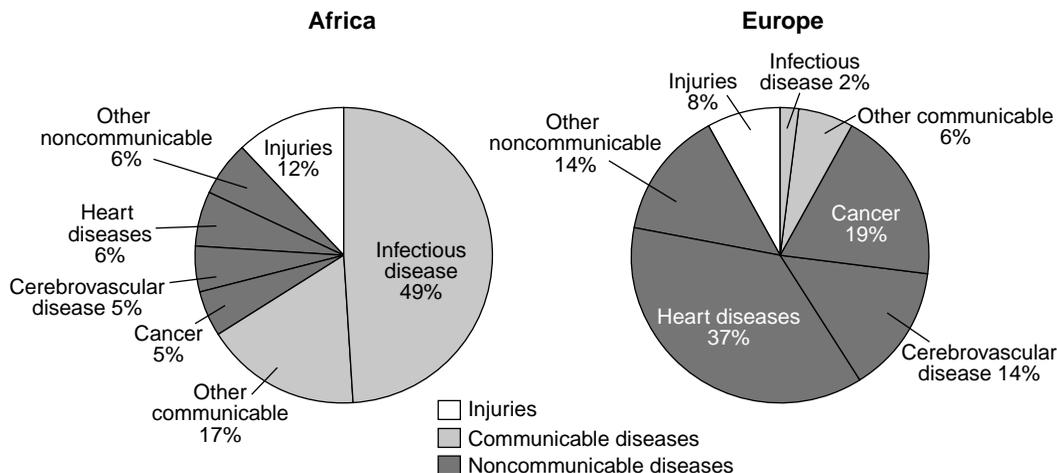
728 million in 1999. In the 21st century, continued low fertility will bring many of these countries to a new phase of demographic transition—population decline—as deaths begin to outnumber births. Several European countries, including Germany, Italy, and Russia, already had natural decrease in 1999 because of an excess of deaths over births.¹⁵

The fertility patterns were very different in the less developed countries. The average TFR in these countries was nearly 6.0 until the 1970s. In sub-Saharan Africa, it was 6.5 or higher until the late 1980s. Because this extremely high fertility was accompanied by declining mortality rates, the combined populations of Africa, Latin America, and Asia (less Japan) rose from 1.1 billion in 1900 to 1.7 billion by 1950, and then nearly tripled—to 4.9 billion—between 1950 and 2000 (see Figure 3). This rapid population growth, along with slower growth in the more developed countries, increased the less developed countries' share of world population from about 67 percent in 1900 to 80 percent in 2000.

The demographic changes altered the age structure of populations. Decades of declining fertility in the more developed world reduced the

Figure 4

Leading Causes of Death in Africa and Europe, 1998



Note: Infectious diseases causing most deaths include tuberculosis, HIV/AIDS, diarrheal diseases, malaria, and measles and other childhood diseases. Other communicable diseases include such diseases as pneumonia, bronchitis, and other lower respiratory diseases. Other noncommunicable diseases include such diseases as diabetes, mental disorders, chronic lung diseases, and cirrhosis of the liver. Injuries include intentional as well as unintentional injuries.

Source: WHO, *World Health Report, 1999* (1999): 102-3.

relative number of children in these populations. Youths ages 15 and younger made up about 34 percent of the U.S. population in 1900, for example, but just 22 percent by 1997.¹⁶ In contrast, the percentage of elderly increased fairly constantly over the century. Persons ages 65 and older made up just 4 percent of the U.S. population in 1900 and nearly 13 percent in 1997.

Epidemiologic Transition

The mortality transition in more developed countries involved a shift in the major causes of death from such communicable diseases as measles, influenza, and smallpox, to chronic and degenerative diseases such as heart disease, cancer, and emphysema. This fundamental change reflected a broader change in health status and health threats that is described as the epidemiologic transition.¹⁷

Scholars define the transition in various ways, but most identify several stages of transition as mortality rates fall.¹⁸ The pretransition stage—which encompasses most of human history—is the age of pestilence and famine.

Death rates are high, but spike even higher during health crises. This stage is followed by the age of receding pandemics. Death rates fall rapidly during this stage as infectious diseases are controlled. Next is the age of degenerative and man-made diseases, during which the death rates typically fall slowly to very low levels. Some researchers identify additional stages, including the age of delayed degenerative diseases and a re-emergence of infectious disease (such as AIDS).

Countries around the world occupy different stages in this transition. In Europe, for example, the major causes of death in the 1990s were heart disease, cancer, and cerebrovascular disease (strokes). Communicable diseases accounted for less than 10 percent of deaths (see Figure 4). In contrast, infectious and parasitic diseases such as HIV/AIDS, measles, and malaria caused more than 60 percent of the deaths in Africa. One reason that noncommunicable diseases such as cancer and heart disease cause a smaller percentage of deaths in areas in the early stages of transition is that a smaller proportion of the population is in the older ages, where the

risk of death from these degenerative diseases is greatest. Just 3 percent of Africans were age 65 or older in the late 1990s, while 14 percent of Europeans were age 65 or older. This difference in age structure primarily reflects the higher fertility in Africa than in Europe. The estimated TFR was 5.4 children per woman in Africa in 1999, compared with 1.4 children per woman in Europe. Africa's lower average life expectancy (about 52 years in 1999, while it was 73 years in Europe) also helps explain why degenerative diseases are not as prevalent there as they are in Europe—a smaller percentage of Africans live long enough to develop these diseases.

The mortality transition also brings a shift in the ages when most deaths occur. In countries at the beginning of the transition, most deaths occur in the youngest age groups because the health of babies and young children can deteriorate quickly from infectious diseases. In 1995, more than one-half of the deaths in less developed countries occurred among those under age 20; 40 percent of deaths were among children under age 5. Just 16 percent of deaths were among the elderly population (ages 65 or older). In more developed countries, only about 2 percent of all deaths occurred among those under age 20 in 1995; 68 percent were among the elderly.¹⁹

Why Did Health Improve?

The mortality transition in the more developed countries began in an era of exciting breakthroughs in the understanding of disease. The most far-reaching discoveries came in the latter half of the 19th century. The discovery that microorganisms caused infectious diseases (the “germ theory”) and that the transmission of such diseases could be avoided by cleansing hands and medical instruments revolutionized medical practice—once the theories were accepted by the medical establishment.²⁰ Vaccines to prevent cholera and typhoid were developed in the 1890s (a smallpox

vaccine was developed much earlier, in 1798). Penicillin was developed in the 1930s, although it was not widely available until after World War II.²¹

Many analyses of the health transition highlight the health benefits brought by higher incomes, better nutrition, and public sanitation measures, especially waste disposal systems and water treatment.²² There is also evidence that knowledge of the germ theory and of the benefits of antiseptics was widely disseminated, especially among urban populations. This knowledge prompted changes in household practices that probably helped reduce the spread of infection.²³ Washing hands before handling food, cleaning cooking utensils, sterilizing milk, and preventing food contamination, for example, were important changes in household behavior in the United States in the early 1900s. Likewise, the practice of isolating children from ill family members and ventilating the household slowed the spread of contagious diseases. Other aspects of modern life, such as refrigeration and expanded transportation systems, allowed more people access to fresh meat, fruits, and vegetables, and nutrition levels improved.

Medical advances also brought better health. Tuberculosis (TB) was a leading cause of death in the United States and many European countries in the early 1900s, but new medical treatments and the isolation of active TB carriers helped reduce TB mortality and morbidity.²⁴

Vaccines against common diseases and the use of antibiotics to cure persistent infections probably were the medical interventions with the most far-reaching effects on public health. Many of these medicines became widely available only after World War II, however, when mortality had already improved substantially in the more developed countries. These vaccines and drugs helped accelerate the mortality transition in the less developed countries.

Since the 1950s, several large-scale international public health projects

The mortality transition brings a shift in the ages when most deaths occur.

Preventable diseases still claim a high death toll in less developed countries.

have focused on reducing or eliminating specific diseases. The campaign against smallpox was the greatest success story. Smallpox was a major cause of death for much of human history. In the early 20th century, this disease still affected 10 million to 15 million people worldwide. In 1967, WHO launched a systematic international smallpox eradication program with immunization campaigns that reached even remote populations all over the world. Once inoculated, people did not transmit or catch the disease, and smallpox started to die out. The last case of smallpox was reported in 1977. The success of this effort led public health officials to target other infectious diseases for eradication, including malaria, measles, and polio.²⁵ WHO predicts that polio may be eliminated by the end of 2001.

Public health projects, including the draining of swamps and spraying against malaria-transmitting mosquitoes, have helped reduce exposure to health risks in less developed countries. Still, preventable diseases claim a high death toll in less developed countries. Mosquitoes have become resistant to common insecticides in some areas and international efforts to develop an effective vaccine against malaria have not yielded success.

Several international public health initiatives in recent decades have focused on children. Many childhood diseases are preventable, and infant and childhood mortality can fall rapidly in a population once health initiatives that target these diseases are introduced.

In 1973, WHO initiated the Expanded Programme on Immunization (EPI) with the goal of immunizing the world's children against six diseases: tuberculosis, measles, diphtheria, whooping cough, tetanus, and polio. The percentage of children immunized against these six diseases increased from 20 percent in 1981 to about 80 percent by 1995.

Another major advancement in child health in less developed countries was a low-cost, low-technology intervention to control diarrhea—oral

rehydration therapy (ORT). Diarrhea is a leading health burden in many less developed countries. International health agencies coordinated the training of health workers and mothers in how to administer ORT, which involves dissolving essential salts in clean water and feeding it to children suffering from diarrhea. ORT use was negligible in 1980, but it was used in an estimated 80 percent of diarrheal episodes by the 1990s, and had prevented millions of childhood deaths.²⁶

Infant and childhood mortality declined in many less developed countries between the 1970s and the 1990s. But diarrhea and the six target infectious diseases are still leading causes of disability and death in these countries. Immunization rates slipped in some countries during the late 1990s. WHO reports that the percentage of children worldwide who were immunized against the six EPI diseases was down to 74 percent in 1998. Childhood mortality could fall much further if these diseases were prevented or adequately treated.

In the 1990s, another major initiative—the Integrated Management of Childhood Illness (IMCI)—expanded this effort to improve child health, and is encouraging more cooperation between public and private organizations (see Box 1).

What Determines Health?

How can the world attain health for all? The search for ways to improve the health of the world's growing population must be rooted in a firm understanding of what determines health. In the last half of the 20th century, the concept of health has been transformed from a simple interaction between microbes and the body to a complex, multifaceted process. Strategies for promoting good health are becoming more sophisticated (see Box 2, page 14).

A better understanding of the determinants of health can guide the

type of interventions appropriate to attain or maintain health. At the most basic level, the “practice of good health” at the individual or community level involves acting on the following questions:

- How do we keep ourselves well? (primary prevention)
- If we are getting sick, how can we detect these conditions early? (secondary prevention)
- If we are sick, how do we get the best care? (tertiary prevention)

These questions outline the classic public health view of disease prevention. Primary prevention typically involves the interruption of transmission of infectious disease agents or exposure to environmental health hazards in the population through education. It also encompasses behavior modification, immunizations, and environmental measures. Practicing “safe sex” to prevent HIV transmission, enforcing automobile emissions standards, adding fluoride to water,

Box 1

Strategy for Improving Child Health: Integrated Management of Childhood Illness (IMCI)

By Mark Rasmuson

Despite the welcome declines in infant and childhood mortality, some 12 million children under age 5 in less developed countries died each year in the 1990s. About 70 percent of these deaths resulted from five diseases—acute respiratory infections, diarrhea, measles, malaria, or malnutrition—or from a combination of these conditions. Although most of these diseases are preventable or manageable, this burden of disease is projected to continue to 2020 unless greater control measures are taken.¹

To reduce these unnecessary child deaths, the World Health Organization and UNICEF implemented a new approach for improving child health in the mid-1990s—the Integrated Management of Childhood Illness (IMCI) strategy. The IMCI strategy combines better management of childhood illness with nutrition, immunization, maternal health, and other health programs. The core of IMCI is training health staff for integrated case management, but it also strives to improve the management of childhood illness throughout the health system and to enable communities and families to practice better health.² To accomplish its goals, IMCI is trying alternative training methods to accelerate the improvement of health workers’ case management skills and is seeking innovative ways to get communities to participate in the project.

By August 1998, 51 countries had introduced or implemented the IMCI strategy; seven countries had entered an advanced expansion phase (Bolivia, Dominican Republic, Ecuador, Peru, Tanzania, Uganda, and Zambia). Many are optimistic that the IMCI approach will improve basic health status in areas, but the program is still new and unproven. WHO (with financial and technical support from USAID and the Johns Hopkins University) is planning a series of studies to document the costs of IMCI and to gauge its impact on child morbidity and mortality. IMCI may become a model for future health intervention projects.

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and vaccination campaigns are examples of primary prevention.

Secondary prevention is the interruption of clinical disease after exposure to an infectious agent or environmental hazard. In the case of HIV, secondary prevention entails preventing or delaying the onset of AIDS by using drugs and other medical, nutritional, and psychosocial measures. Tertiary prevention usually involves the prevention of complications of the health problem after it occurs.²⁷ The factors involved at each level of prevention work together to determine health.

The conceptual framework for health in this *Population Bulletin* is adapted from the framework initially developed by Robert Evans and G.L. Stoddart—the health field model—which describes the relationships among the factors that influence health. The 21st-century field model discussed here incorporates new ideas with selected observations from other researchers.²⁸

This comprehensive model specifies important variables that influence the relationships among the global factors, the health care system, disease and injury, and individual health status. The model demonstrates the role of the healthy individual in determining his or her health. It also incorporates the ideals of primary, secondary, and tertiary prevention of health problems (see Figure 5). This new model is illustrated in succeeding pages with descriptions of selected aspects of global health.

The top of the model shows global factors (structural variables)—community and social environment, physical environment, and family and individual environment—that directly affect the prevalence and incidence of disease and injury and indirectly affect the health and well-being of individuals. These global factors are the major determinants of morbidity and mortality levels in a population.²⁹

The model reinforces the interrelated nature of the factors that influence health. The **community and social environment** includes social sta-

tus or class, social networks, and government policies that directly or indirectly affect health and the kind of government. The **physical environment** includes physical hazards (in the home, community, and workplace), natural health threats (related to climate, physical location, or risk of natural disaster), and biological and chemical agents to which individuals might be exposed as well as the work environment (social structure and job demands).

The **family and individual environment** includes individual behaviors and lifestyles, personal health and hygiene (including mental health), support from family members, and access to and use of medical care. Physical variables—housing conditions and overcrowding—also can be considered part of the family and individual environment.

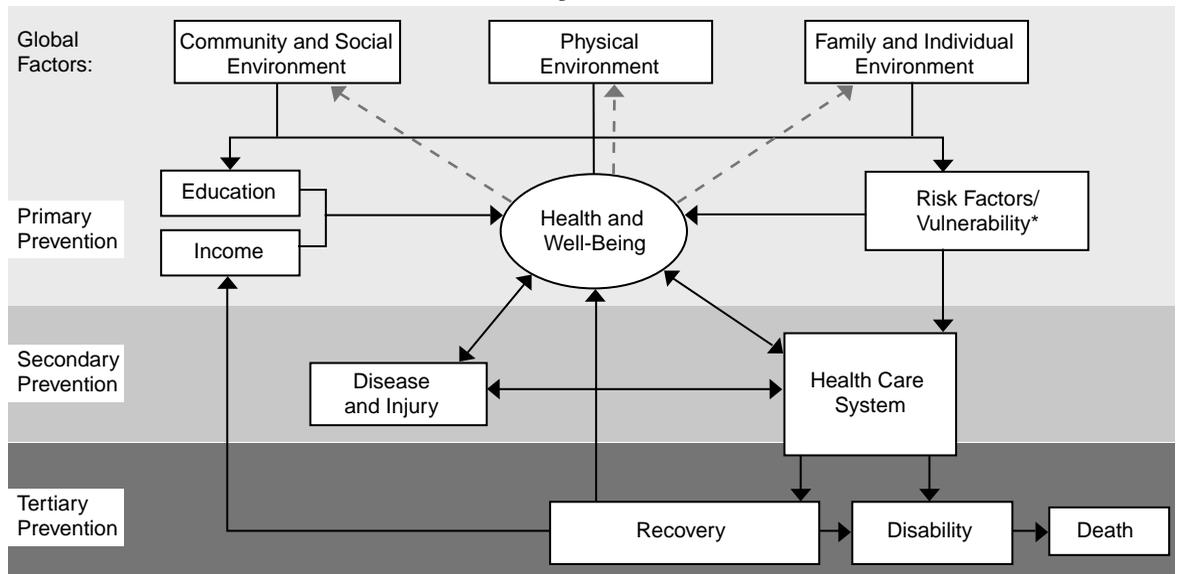
The next level includes variables that also directly influence **health and well-being—risk factors** (or **vulnerability**) and **education and income**. Risk factors include age, exposure to health risks (such as asbestos or malaria-transmitting mosquitoes), nutrition, and genetic makeup. Education and income influence health directly and indirectly.³⁰ The **health care system** affects **disease and injury** and contributes to **recovery** (or **death and disability**), which in turn affects **health and well-being**.

The circle in the center signals that health and well-being are related to all of the factors in the model. The colored arrows represent pathways through which individuals and communities can take action to affect their health.

What can an individual or community do to influence health? Many avenues already exist, as will be discussed later. On the global level, they include enacting and enforcing policies that affect health—such as regulation of workplace safety, air pollution, or health insurance. On the individual or family level, they can include personal decisions such as whether to smoke cigarettes or use family planning.

Figure 5

Determinants of Health: The 21st-Century Field Model



← - - Potential pathway for individual and community action to influence global factors.

*Risk factors include age, nutritional status, and genetic makeup, among other factors.

Source: Adapted from Robert G. Evans and G.L. Stoddart, "Producing Health, Consuming Health Care," in *Why Are Some People Healthy and Others Not?* eds. R.G. Evans, M.L. Barer, and T.R. Marmor (1994): 53.

There are three broad levels on which health can be promoted: primary, secondary, and tertiary, as indicated in Figure 5. The environment variables described above principally relate to **primary prevention** ("How do we keep ourselves well?"). **Secondary prevention** ("If we are getting sick, how can we detect these conditions early?") involves activating the health care system to reduce the prevalence of disease and injury. Disease and injury can lead to recovery, disability, or death through the health care system, or disease and injury can be resolved outside the health care system—with appropriate self-care and good decisionmaking.

The final level focuses on **tertiary prevention** ("If we are sick, how do we get the best care?"). The health care box extends into this region. Recovery from an illness or injury can return an individual to productive pursuits, which feed back to the global factors at the top of the model.

How can the world attain better health in the 21st century? As the model demonstrates, there are many paths of influence. Each presents its own challenges for the future. The components of the model that offer opportunities for improvement through communications and public health strategies are discussed below.

Physical Environment

WHO has estimated that a poor physical environment is responsible for about one-fourth of all preventable disease. Environmental conditions are especially critical for some diseases; for example, they account for an estimated 90 percent of health problems caused by malaria.³¹

Some of the environmental effect emanates from geography. Tropical regions, for example, are ideal environments for the transmission of many deadly diseases, including malaria, schistosomiasis, and diarrheal

diseases. Earthquakes, floods, and hurricanes are more likely in some geographic regions than others—and can pose major threats to public health. In 1999, at least 17,000 thousand people died in earthquakes in Turkey and at least 25,000 perished in floods in Venezuela. It is likely that many more people suffered from these natural disasters because of related injuries, disease, or the loss of their homes and incomes.³²

But the physical environment encompasses all aspects of the areas where people work and live. The death toll from the natural disasters in Turkey and Venezuela might have been much lower if the populations affected had better housing and a more developed infrastructure.

Environmental threats to human health can be divided into “traditional hazards” associated with a low level of economic development, and “modern hazards” associated with industrialization. Traditional hazards related to poverty and a low level of economic development include a lack of access to safe drinking water; inadequate sanitation in the household and in the community; indoor air pollution from cooking and heating with coal or biomass fuel; and inadequate solid waste disposal.

Modern hazards are related to economic development without adequate health and environmental safeguards and increased consumption of natural resources. These hazards include water pollution; intensive agriculture; air

Box 2

Health Promotion at the Crossroads

By Pamela Hartigan

The concept of health promotion is a relatively recent one. It first appeared in public health parlance in the latter part of the 20th century. Throughout its development, health promotion has been marked by tensions between two approaches: one more individually and medically focused; the other more socially oriented. The first approach has targeted people’s lifestyles. In particular, it sought ways to modify the unhealthy diets, low physical activity levels, and tobacco and alcohol use that were largely responsible for the chronic disease epidemic that emerged in industrialized countries and is spreading throughout the world. Health promotion within this context became synonymous with behavior modification. It emphasized personal motivation and individual responsibility.

The Ottawa Charter for Health Promotion, sponsored by the World Health Organization (WHO) in 1987, expanded this individualistic emphasis and created the second, socially oriented approach. The charter maintains that health reflects broad social conditions as well as individual behavior. The charter stated that these fun-

damental preconditions and resources for health include peace, shelter, education, food, income, a stable ecosystem, sustainable resources, justice, and equity.

This second approach has been avidly pursued by European nations, Canada, and Australia, with the support of WHO. It advocates the use of “settings” where people live, work, learn, and play as entry points for bringing together the people and organizations that have a stake in attaining good health. A plethora of settings approaches have emerged, including healthy schools, healthy cities, healthy markets, healthy hospitals, healthy islands, healthy prisons, and the like.

Critics of the socially oriented approach, particularly those from the medical sciences, voiced exasperation with what they saw as lofty, holistic, and inexact methods. They particularly decried the lack of baseline data and process or outcome assessments against which progress on key health and quality of life indicators might be evaluated. Moreover, because the health promotion agenda was driven largely by industrialized countries, it quickly became viewed as a strategy to

pollution from motor vehicles and coal-powered industry; climate change; and ozone depletion.

The changing pattern of environmental health hazards and associated health risks as countries develop economically is known as the “risk transition.” This transition will continue in the 21st century. Air and water pollution associated with industrialization are already a major health problem in Mexico City, Shanghai, and many other cities in less developed countries. Motor vehicle crashes have become a leading cause of death in Thailand, Mexico, and Ethiopia as the numbers of automobiles and other vehicles have increased.³³

There are many ways to reduce environmental health risks, which range

in scope from international treaties to lower carbon emissions to individual decisions about taking mass transit rather than driving an automobile. Occupational safety laws, building codes, and child labor laws can all be viewed as health interventions.

Water Supply and Sanitation

The availability of safe drinking water and sanitary human waste disposal are among the aspects of the physical environment most crucial for attaining health. Sanitary waste disposal requires keeping human wastes from coming into contact with drinking water, food, or people. Ensuring safe drinking water requires protecting water sources and having means of sanitary transportation and storage within

ensure that already healthy people remain healthy through proper nutrition, physical activity, moderate use of alcohol, and a tobacco-free lifestyle.

Health promotion is at a critical crossroad as a new century begins. There is growing acceptance of the idea that human health potential can only be attained by pursuing strategies that help individuals and communities gain a sense of control over the way they choose to live. At the same time, medical practitioners have begun to acknowledge that being healthy is a complex equation of many factors.

The challenge for health promotion is for social scientists to work together with medical professionals to understand how the social environment affects health and to use this knowledge to create more effective programs and policies. Taking up this challenge becomes all the more critical because income disparities are growing in many parts of the world. The UN Development Programme reports that the income gap between the top 20 percent and bottom 20 percent of incomes is now 150 to 1. This is twice the income gap measured in 1970.¹

WHO’s member countries are turning to health promotion for practical tools and methods to address increasing social complexity and urgent health problems. But “health promotion practitioners” need to recognize that their discipline’s greatest potential lies in bringing together the knowledge and methods of many related disciplines. Such cooperation will enhance our understanding of the ways that individuals and populations draw upon health “as a resource for living.”²

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Brazilian children retrieve water from a public well. Unprotected water sources and unsanitary storage of drinking water bring major health risks.

the home. To maintain a healthy household environment, clean water must also be available for washing hands (especially after defecation), bathing, and washing clothes and kitchen utensils.

Much of the world does not have access to safe water and adequate sanitation facilities. Expanding the supply of safe drinking water in cities, towns, and villages has been hampered by poverty, poor infrastructure, and increasing pollution of waterways and groundwater. Nearly \$100 billion was invested worldwide from 1981 to 1990 to introduce water services in poor regions, but population growth hampered this progress, especially in urban areas. In 1994, about 1.2 billion people in less developed countries still lacked safe water supplies and about 3 billion—more than half of the world's population—lacked access to sanitation services.³⁴

Urbanization

Place of residence is another element of the physical environment that influences health. People living in cities have better health and lower death rates than people living in rural areas, even though the urban poor often live in unsanitary and crowded conditions.

Compared with rural residents, urban residents have better access to medical services, are more easily reached by immunization and educational campaigns, and are more likely to benefit from such public health services as sanitation and water treatment. In Kenya, the 1998 mortality rate for children under age 5 was 109 deaths per 1,000 births in rural areas and 88 deaths per 1,000 births in urban areas. In Bolivia, the childhood mortality rate was 134 in rural areas in 1998, compared with 72 in urban areas.³⁵

This urban advantage is important for the goal of attaining global health because increasing percentages of people live in urban areas. Global health will increasingly be determined by the health of our cities. While less than 15 percent of the world's population lived in urban areas in 1900, nearly 50 percent is expected to live in urban areas by 2005. By 2030, the percentage urban is projected to be 61 percent.³⁶ Population growth combined with continued migration from rural to urban areas will increase the size of the global urban populations from 2.3 billion to 5.1 billion between 1990 and 2030. Eighty percent of urbanites will live in less developed countries in 2030.

There are likely to be more large cities in the future. The UN projects there will be 527 cities with populations of 1 million or greater by 2015, compared with 291 such cities in 1990. In 1950, just 83 cities around the world had 1 million or more inhabitants, and most of these were in more developed countries.³⁷

Many large cities in low-income countries are unable to provide adequate housing, jobs, and health services for their populations. Yet rural migrants continue to arrive in these cities, and often live in makeshift housing on undeveloped land. Air and water pollution are at unhealthy levels in many cities in less developed countries.³⁸

Rapid urbanization and the plight of urban populations in low-income countries have spurred international concern and action. Several interna-

tional conferences on these issues have attempted to define the major problems associated with urbanization and set priorities for action. Health problems and disparities in health within cities were major topics at a conference on human settlements in Istanbul, Turkey, in 1996. The conference documents declared that healthy living conditions were a prerequisite for reducing poverty.³⁹

Family and Individual Environment

The family environment exists within and is affected by the physical environment, but the family has an enormous independent effect on health and prosperity. Mothers are the primary “producers” of health for their children.

The timing and number of births a mother has during her lifetime affect her children’s health and life chances. Numerous studies have found that infants have an increased risk of death or chronic health problems if they are born to mothers who are adolescents or over age 40, or when the interval between births is less than two years.

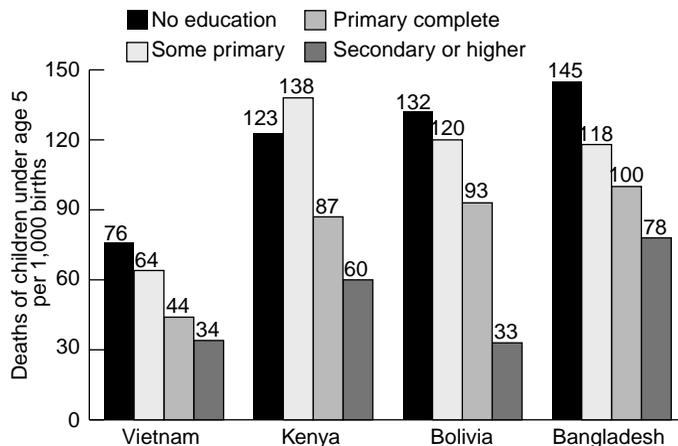
Having children poses risks for mothers as well, especially among populations in the early stages of the demographic and epidemiologic transition. WHO estimates that complications during pregnancy and childbirth cause the deaths of at least 585,000 women every year, primarily in the less developed world. In some African countries, the lifetime risk of dying from complications related to pregnancy and childbirth is as high as one in 16; in others it is as low as one in 1,000.

Most of the 4 million deaths of newborn babies each year result from poorly managed pregnancies and deliveries. Conditions related to pregnancy and childbirth—in particular, obstructed labor, infection, and unsafe abortion—are among the top three causes of disease burden among adults in less developed countries.⁴⁰

Maternal mortality has fallen in many countries as more women have

Figure 6

Child Mortality by Mother’s Education, 1997–1998



Sources: Macro International, Inc., Country Final Reports, Demographic and Health Surveys. Information available at www.macroit/dhs.

postponed or avoided risky pregnancies by using contraceptives. Worldwide, the percentage of women of reproductive age using a family planning method rose from about 14 percent in the 1960s to about 60 percent in the 1990s. The average world birth rate fell from about 16 births per 1,000 population to about 9 births per 1,000 over the same period. Maternal mortality rates also fell in part because women are having their first birth at an older age, are waiting longer between pregnancies, and are having fewer pregnancies.⁴¹

Family planning continues to be the most effective way to improve the health of mothers and children and is an important factor in the demographic transition to lower fertility and mortality rates. Many countries consider family planning to be a basic human right because it allows couples to decide the number and spacing of their children.⁴²

Breastfeeding is one way in which mothers contribute to a child’s healthy development. Breast milk enhances a baby’s growth and brain development. In one study, breastfed children performed better than bottle-fed children in mental development tests at 18 months and 7 years of age. Other evidence shows that breast

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More than two-thirds of girls were enrolled in secondary school in Botswana in 1996, several times higher than the percentages in most other sub-Saharan African countries.

milk may enhance the long-term development of a baby's immune and endocrine systems.⁴³ There is an active international movement to educate women about the benefits of breastfeeding and to encourage women to breastfeed their babies.

There are potential health problems from breast milk that warrant close monitoring in the future. HIV infection, for example, can be transmitted from mother to infant through breast milk. This is of particular concern in southern Africa, where women of reproductive age have a high prevalence of HIV/AIDS. On average, one in seven children born to and breastfed by mothers who are HIV-positive acquire the virus. This transmission rate is much lower for babies who consume only breast milk, however.⁴⁴

Millions of women still lack access to safe and effective family planning methods and to other reproductive health services such as prenatal and postnatal care. Ensuring this access emerged as a major goal of many governmental and nongovernmental organizations in the 1990s.⁴⁵ Carrying out the ambitious goals established by these organizations will require strong political commitment and funding, but the benefits of better health for

women would extend to their families and communities, and contribute to the goal of global health.

Mothers' Education and Child Survival

A mother's educational level also influences her child's health. Although the relationship is not always straightforward, children's chances of surviving usually improve as their mothers' education increases. In the late 1990s, the mortality rate for children under age 5 in Bangladesh was 145 deaths per 1,000 births for children whose mothers had no education, compared with 118 for children with mothers who completed some primary education, and 78 for children whose mothers completed a secondary or higher-level education (see Figure 6, page 17). In Bolivia, the rates were 132 for mothers with no education, and 33 for mothers with a secondary or higher education.

Women's education is interrelated with many other health determinants. Compared with less educated women, the educated mother is likely to marry at an older age and consequently to have her first birth later. She is more likely to use family planning and to want and have fewer children—all factors associated with better maternal and child health.⁴⁶

A more educated mother is also likely to have a higher income and to live in better housing than a less educated mother. Educated mothers often have been taught good nutrition and hygiene in school or by their own educated parents. A more educated mother also may have enough status and power in her family to take appropriate action when her child needs health care. The more educated a mother is, the more likely she is to use maternal and child health services.

This strong and consistent link between maternal education and child survival has important implications for health policy and investment in government programs. Educating women and girls is a daunting but crucial challenge for the future. Com-

pared with the early 1900s, when most women and men around the world could not read or write, women made great progress in education over the century.

In more developed countries, literacy is nearly universal, and the vast majority of young girls and boys attend school through the secondary level. In less developed countries, levels of literacy and educational attainment have increased at the primary level, but the majority of girls in this region do not complete secondary school. Between 1980 and 1996, the percentage of girls enrolled in secondary school in less developed countries rose from 28 percent to 45 percent. For boys, the increase was from 42 percent to 55 percent over the period.

Some countries offer greater educational opportunities than others, and some cultures value education more highly for boys than for girls. Among southern African countries, an average of 72 percent of boys and 87 percent of girls attended secondary school in 1995, for example. But in Middle Africa, just 30 percent of boys and 18 percent of girls were in secondary school in 1995; the average was even lower in East Africa. In India, 59 percent of boys were in secondary school in 1995, compared with 38 percent of girls.⁴⁷

The struggle to expand educational opportunities for children is often stymied by low national income levels, rapid population growth, and competing budget priorities. In Angola, Benin, and Togo, economic problems and burgeoning numbers of young people caused school enrollment figures to stagnate or decline in the 1980s and 1990s.⁴⁸

Enhancing female education is seen as an effective way for less developed countries to help improve women's status, lower fertility rates, foster economic development, reduce poverty, and improve maternal and child health. Narrowing the gender gap in educational levels was identified as a major goal in a number of international conferences in the 1990s,

including the 1994 International Conference on Population and Development in Cairo, and the 1995 World Conference on Women in Beijing.⁴⁹

Community and Social Environment

Social networks—social ties and contacts with groups of individuals—can contribute to good health.⁵⁰ These interpersonal networks, along with social norms and social and political institutions, form the social capital that helps shape social interactions within a society. People rely on social capital for information and access to new disease treatments, for example, and to family planning methods. Social capital enables groups to cooperate effectively to achieve a common goal, such as controlling unsafe substances or ensuring equal access to health services.

Violence is an aspect of the social environment that threatens individual and community health. Physical violence caused an estimated 2 million deaths worldwide in 1990. In many countries homicide, suicide, and acts of war account for 20 percent to 40 percent of the deaths of men ages 15 to 34.⁵¹

Levels of violence vary among and within populations. And violence sometimes increases in response to political instability, economic hardship, or social changes. Violence increased in the United States after crack cocaine was introduced in the 1980s, for example.⁵²

Youths who turn to violence may be reflecting social norms that tolerate physical domination. But a tendency toward violence is often associated with other factors, including poverty, lower levels of educational attainment, lower socioeconomic status, and unemployment. Depression and other psychological problems can also lead people to violent acts directed at themselves or others.

Access to handguns and other weapons can also affect the rates of death and serious injuries from violence. Firearms are more easily avail-

Social networks can contribute to good health.

able in the United States than in most other more developed countries, for example, and they cause a higher percentage of injuries and deaths in the United States than in many other countries. Between 1990 and 1995, the overall firearm-related death rate among U.S. children younger than 15 was nearly 12 times higher than among children in 25 other industrialized countries combined.⁵³

Violence often exacerbates other health problems. Elderly or infirm people living in communities with high rates of violent crime sometimes avoid obtaining needed medical care because they are afraid to leave their homes. Domestic violence is associated with psychological disorders and it can prevent the victims from seeking care for any health problem.

Organized political violence is another threat to public and individual health in many areas of the world. Wars cause death or serious injury to thousands each year. Political turmoil also forces people to leave their homes and communities, which puts them at risk for many health problems. In 1997, some 14 million refugees and asylees were forced from their home countries. The vast majority were in the less developed countries of Africa, Asia, and the Middle East in which health care and public health infrastructures are weak.

Refugees often suffer from malnutrition, exposure to new viruses, and poor living conditions. Many are victims of civil violence as well.⁵⁴ Mass movements of refugees and armies in central Africa in the 1990s have been tied to an expansion of malaria and HIV/AIDS, for example.⁵⁵

Children are especially vulnerable in times of political instability and war. In the 1990s, at least 2 million children died and millions more were displaced because of war and political violence. WHO estimates that 4 million children worldwide were disabled because of landmines and other war-related injuries in 1998.

Violence cannot be addressed as an isolated behavior problem. It requires interventions that begin in ear-

ly childhood, continue throughout adolescence, and are reinforced by the community. In the United States and many other countries, violence has been recognized as a public health issue as well as a legal and criminal matter. This recognition broadens the range of interventions communities can use to stem violence.⁵⁶ Successful efforts at reducing community violence could involve the educational, recreational, mental health, and social service systems at state and local levels, as well as the law enforcement community. The broader problem of political violence requires international efforts and a commitment to aid refugees and victims of war, and, ideally, to reduce armed conflict.

Individual Risk Factors

The risk factors that determine an individual's or community's vulnerability to health problems include such demographic characteristics as age and sex as well as genetics. Aging is associated with an increased risk of such health problems as cardiovascular disease, diabetes, osteoporosis, dementia, and cancer. With the impending boom in the number of older people around the world, there is an urgent need to learn more about the health of the elderly. Medical research is yielding new information about the aging process and the role of diet and exercise in delaying many age-related health problems. Other individual behaviors, including smoking and alcohol use, also influence an individual's health.

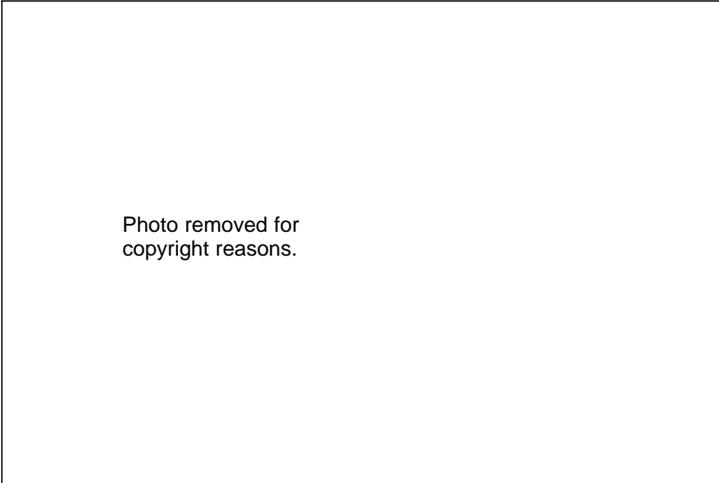
Genetics

Genes play an important role in the etiology of most human diseases, including such major killers as cancer and coronary heart disease. The relationship between genes and disease is not fully understood, but current knowledge suggests that some genes act alone to cause disease while other genes interact with other risk factors to cause disease. "Disease genes" are single genes that directly cause a spe-

cific disease, such as hemophilia. “Susceptibility genes” contribute to the development of diseases such as cancer or heart disease through interaction with other genes and environmental factors. These genetic risk factors include the numerous systems involved in the body’s ability to metabolize drugs and cancer-causing substances.

There have been tremendous advances in molecular genetic technology—particularly in the 20th century’s closing decade. But the explosion of information about genes and the growing sophistication of technology to study and manipulate genes has just begun to show results. Major advances are expected from the Human Genome Project, an international program launched in 1990. The entire human genome—contained in the 23 pairs of chromosomes that lie in the nucleus of every cell in the body—is projected to be mapped and sequenced by 2003. Scientists hope to use this knowledge to learn how genes interact and how outside influences, such as diet, infections, and prenatal exposure to health risks, influence health. Genetic tests to predict an individual’s susceptibility to disease and gene therapy for some diseases may become common in the next 50 years, according to geneticists.⁵⁷

Relatively simple technology—including the polymerase chain reaction—is already available to examine genetic variation by using small amounts of human tissue, such as blood spots and cells collected from cheek swabs. And molecular technology is helping researchers identify disease and susceptibility genes by studying families whose members are at a high risk of developing a specific disease. A notable example is the intense search for breast cancer genes in high-risk families. Investigators have identified a gene on human chromosome 17—BRCA1—that is associated with breast and ovarian cancer. Women who inherit BRCA1 mutation(s) have more than a 90 percent lifetime risk of developing either breast or ovarian cancer. Patients



A Cambodian mother feeds her child in a Thai refugee camp. Refugees often have inadequate nutrition and are exposed to violence and infectious diseases.

from high-risk families who are found to carry this gene can seek genetic counseling and preventive medical care. But currently, the only means of prevention available has been prophylactic mastectomy. Even this may not provide full protection against the development of breast cancer.

The gene tends to be clustered in specific population groups, which calls into question the cost-effectiveness of widespread testing for BRCA1. In addition, the contribution of the apparently numerous BRCA1 mutation(s) to the overall risk of breast and ovarian cancer in the population is not yet clearly understood.

The emergence of genetic technology is accompanied by increasing concern regarding the use and misuse of genetic information in society.⁵⁸ In the United States, the availability and use of genetic tests are more common, but the appropriateness of their use in a public health setting is controversial. Ultimately, advancement in genetics may be determined by policy and politics, rather than science.

Gene research also promises new types of vaccines, treatments, and cures for diseases. Its impact on global health will depend on who will have access to these new medical breakthroughs. If the populations of only

Malnutrition worldwide includes a spectrum of nutrient-related disorders, deficiencies, and conditions.

wealthy countries will benefit from them, the global effect will be small, especially in relation to the cost. If genetic research furthers the fundamental understanding of disease and of the determinants of health, it will have a much wider application.

Nutrition

Access to a healthy diet is key to health. Under- and overnutrition cause many types of health problems, as does overconsumption of alcohol. Most food experts agree that there is more than enough food produced to feed the world's 6 billion inhabitants, and that hunger occurs because of the unequal distribution of food among and within countries. Hunger and malnutrition are devastating problems worldwide, particularly for the poor and underprivileged. In the mid-1990s, an estimated 843 million people in less developed countries, including 200 million children, did not receive enough calories to ensure physical health and development.⁵⁹

Malnutrition worldwide includes a spectrum of nutrient-related disorders, deficiencies, and conditions such as intrauterine growth retardation, protein-energy malnutrition, iodine deficiency disorders, vitamin A deficiency, iron-deficiency anemia, and obesity and other diet-related, noncommunicable diseases. A range of other specific nutritional deficiency diseases often related to distinct population groups are folate deficiency, zinc deficiency, calcium deficiency and osteoporosis, scurvy, and selenium deficiencies.

The UN Food and Agriculture Organization estimates that approximately 43 percent of the population in sub-Saharan Africa and 22 percent of the population in South Asia were malnourished in the mid-1990s. Protein-energy malnutrition was an associated and causative factor in nearly one-half of the estimated 10.4 million deaths among children under age 5 years in less developed countries in 1995.⁶⁰

Rapid population growth exacerbates malnutrition, especially in coun-

tries that already must import food. Globally, food production is keeping pace with population growth, but the food is not being produced where it is needed most. Food-deficit countries turn to international trade or assistance to procure enough food for their populations. This imbalance is likely to increase because world population continues to grow more rapidly in the least developed countries. While many food experts are optimistic that the world's farmers can produce enough to feed the expected 9 billion to 10 billion people living on Earth in 2050, other experts expect food shortages in the future.⁶¹

Genetic research has led to the development of crops that not only offer higher yields and ward off pests, but also deliver more nutrients and potentially could contain vaccines (so called "functional foods"). But there are many questions about the safety of genetically modified foods, which are defined in various ways. These questions will be addressed at the political as well as scientific level in the future as new innovations in food production are introduced.⁶²

Agricultural research, poverty reduction, economic development, and international development aid can all work toward ensuring adequate food supplies in all countries, and therefore, better global health.

Obesity

While undernutrition is a major contributor to disease and other health disabilities, especially in some world regions, overnutrition is also a growing problem. Overconsumption of fats and sugar, combined with a sedentary lifestyle and lack of exercise, are increasing the proportion of people who are overweight or obese.⁶³

Obesity is a significant risk factor for a number of serious diseases, including cardiovascular disease, hypertension and stroke, diabetes mellitus (noninsulin dependent), various forms of cancer, gastrointestinal and liver diseases, gall-bladder disease, and accidents. Among the elderly, osteoporosis and bone fractures are

more debilitating in obese or overweight adults. WHO estimates that about 1 million unnecessary deaths of adults resulted from health problems exacerbated by overnutrition in 1995. In comparison, about one-half million adult deaths were associated with undernutrition in 1995.⁶⁴

WHO estimates there were about 22 million overweight children under age 5 in the late 1990s. Nearly 10 percent of school children are overweight in more developed countries like the United States, Japan, and some European countries. High rates are also evident in such rapidly industrializing countries as Argentina, Egypt, Indonesia, Iran, Morocco, Peru, South Africa, Thailand, and many Caribbean countries. Being overweight or obese during childhood is one of the major risk factors for obesity in adulthood. Up to 30 percent of obese children become obese adults.

As countries develop economically and personal incomes rise, the risk of obesity is likely to increase. Education will be key to controlling obesity because weight levels are regulated at an individual level. Individuals will need to learn the health dangers of obesity and to know how and when to seek help to prevent excessive weight gain. Public policies regulating school curricula, food processing, and other factors can also influence nutrition.

Education and Income

Education is closely associated with an individual's health status—and high average educational levels are closely associated with higher average life expectancy. A recent World Bank study credits increases in women's education with 38 percent of the reduction in child mortality between 1960 and 1990.⁶⁵

Education interacts with the health process on many levels. But a special type of education—health literacy—is key to the ability of mothers to enhance the health of their families, of individuals to obtain the best health for themselves, and of health profes-

Table 1

Life Expectancy Relative to GNP Per Capita, Selected Countries, 1997

Country	GNP/capita (US\$) 1997	Life Expectancy at Birth in Years, 1997	
		Males	Females
Male life expectancy 70+ years; GNP per capita less than US\$2,000 annually			
Armenia	\$480	70	77
Jamaica	\$1,680	72	77
Macedonia	\$1,290	70	75
Sri Lanka	\$810	71	75
Male life expectancy under 70 years; GNP per capita US\$2,000 or higher annually			
Botswana	\$3,600	46	48
Colombia	\$2,600	67	73
Russia	\$2,300	61	73
Thailand	\$2,200	66	72

GNP (gross national product) is a measure of national income.

Source: World Bank, *World Development Report 1999/2000* (1999).

sionals and policymakers to make the most appropriate health services available to the public.

Health Literacy

Health literacy refers to the ability to obtain, process, and understand basic health information and services needed to make appropriate health decisions. Health literacy skills are essential for addressing the question: "How do we keep ourselves well?"

A person's level of basic education is an important determinant of health literacy. Even in more developed countries, many people cannot read and understand the information and instructions contained on prescriptions, medicine bottles, appointment slips, informed consent documents, insurance forms, and health educational materials.

Their low reading skills translate to low health-literacy skills. Ineffective communication between health providers and patients can lead to medication errors, poorer health, and higher health care costs. When self-reported health status is taken into account, patients with low literacy skills use substantially more hospital resources than other patients.⁶⁶

There are many avenues for enhancing health literacy around the

world. Low literacy levels in many less developed countries are a barrier to increasing health literacy. But literacy has been increasing rapidly among young people throughout the world, which should raise health literacy as well. Much can be done now to make patient information brochures, consent forms, and other print materials more comprehensible to individuals with limited reading skills and health

literacy. Health professionals and media campaigns can, for example, gear their messages toward people with lower educational levels.

New information technology will also enhance health literacy. Educational multimedia products, electronic communication, and advanced networking technologies are expanding and show promise for increasing health literacy (see Box 3).

Box 3

Entertainment-Education to Improve Health

By Everett M. Rogers

“Entertainment-education” is a promising strategy for improving health in many countries. This approach relies on specially crafted media messages to entertain and to educate audiences about an educational issue, to create favorable attitudes, and to change behavior. Radio and television soap operas, popular music, street theater, and comic books have all been used to educate the public about such health issues as family planning, HIV/AIDS prevention, environmental health, female equality, improved sanitation, and female genital mutilation.¹

Entertainment-education typically provides positive and negative role models for health-related behaviors. A popular radio soap opera in Tanzania, “*Twende na Wakati*” (Let’s Go with the Times), features a truck driver, Mkwaju, who has unprotected sex with multiple sex partners, including commercial sex workers. His behavior puts him at risk of contracting and spreading HIV/AIDS and of producing unwanted pregnancies. Mkwaju also exhibits other negative traits: he has strong son-preference and is an alcoholic. His behavior leads to the loss of his family, his job, and eventually his life.²

In contrast to Mkwaju’s irresponsible behavior and male bias, Fundi Mitundu, a tailor in the soap opera, adopts a contraceptive method and has one child. He and his wife are financially successful. This program

has influenced about one-fourth of its listeners to adopt family planning methods and HIV/AIDS prevention, primarily by getting people to discuss the issues.

In the late 1990s, South Africa used entertainment-education successfully in annual Soul City campaigns. Each campaign is organized around a particular health issue, such as AIDS or family planning.

More than 75 entertainment-education projects have been carried out in Latin America, Africa, and Asia, and such projects could be used to influence audiences in more developed countries as well.

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Income and Poverty

Measures of national income, such as gross domestic product (GDP) and gross national product (GNP) are strongly related to such health indicators as infant mortality and average life expectancy at birth. But wealth does not necessarily bring health. Sub-Saharan Africa, with a per capita GNP of US\$480 in 1997, had a life expectancy of 49 years for males in the late 1990s, while North America (excluding Mexico) and Western Europe, with 1997 per capita GNP exceeding US\$27,000 had a life expectancy of 74 years for males.

A number of less developed countries have raised their average life expectancies closer to the levels of wealthier countries without a major increase in the GNP per capita. Conversely, some countries with high per capita incomes still rank relatively low on measures of health and survival.

Table 1 (see page 23) lists four examples of countries with low incomes but relatively high life expectancies. Armenia and Sri Lanka stand out in this list with male life expectancies of 70 years and 71 years, despite relatively low per capita GNPs of US\$480 and US\$810, respectively. All of these countries demonstrate high levels of literacy for women and men. The literacy rate in Sri Lanka is 88 percent for women and 94 percent for men.⁶⁷

In contrast, Botswana has a life expectancy of just 46 years for males and 48 years for females despite a per capita income greater than US\$2,000 in 1997. Botswana has suffered an epidemic of HIV/AIDS cases in recent years—25 percent of the adult population is presumed to be HIV-positive—which caused average life expectancy to decline.⁶⁸

The relationship between GNP and health is also affected by the distribution of wealth within countries. Extreme poverty exists even within wealthy countries. The poor tend to have poor nutrition, limited access to medical care, and inadequate housing and sanitation. They fare worse than the general population on most health indicators. Within the same

country, children living in absolute poverty are five times more likely than nonpoor children to die before they reach age 5.⁶⁹

These examples suggest that raising national income levels is not sufficient for improving health and that reducing income inequality and increasing access to education will promote better health. Eliminating poverty and ensuring equal access to education are common goals delineated in international conferences in the 1990s. Achieving these goals will help the world attain better health.

Disease and Injury

Environmental factors, genetic characteristics, and other factors in the field model either promote good health or contribute to poor health. They determine an individual's risk of contracting a disease or sustaining an injury. Many of the leading health threats for the 21st century—such as malaria, tuberculosis (TB), and heart disease—were also major killers in past centuries. Others have recently emerged as global problems—such as HIV/AIDS and hepatitis C. The incidence and prevalence of infectious diseases are likely to recede because of economic development and advances in health policies and health services (for example, protecting the blood supply and developing new vaccines and drug treatments).

Infectious diseases will remain a major cause of death and disability, especially among poor populations. Noncommunicable diseases such as cancer and heart disease are likely to account for an increasing proportion of the health burden as populations age and as countries control preventable infectious diseases. The health burden of psychoneurologic disorders such as depression, dementia, and schizophrenia is also growing. Each type of problem calls for a different strategy of prevention and treatment.

Communicable Diseases

Malaria, TB, and hepatitis are among the leading communicable diseases re-

sponsible for compromised health and premature death (see Table 2). New forms of TB and hepatitis are particularly deadly and pose a growing threat to world health. In addition, at least 20 new disease-causing organisms have been identified

throughout the world since the 1970s.⁷⁰ These include HIV/AIDS, leishmaniasis, and Ebola hemorrhagic fever. Despite remarkable inroads into the control of infectious disease, many have no effective treatment. Some scientists assert that hu-

Table 2
Selected Causes of Death and Disease Burden in High-Income and Low-Income Countries, 1998

	World		High-income		Low-income	
	Number (millions)	Percent	Number (millions)	Percent	Number (millions)	Percent
Deaths						
Total	53.9	100	8.0	100	45.9	100
Communicable diseases	16.4	30	0.5	6	15.9	35
Respiratory infection	3.5	7	0.3	4	3.2	7
Tuberculosis	1.5	3	—	—	1.5	3
Malaria	1.1	2	—	—	1.1	2
Hepatitis	0.1	0	—	—	0.1	0
HIV/AIDS	2.3	4	—	—	2.2	5
Measles/childhood diseases	1.7	3	—	—	1.6	4
Diarrheal diseases	2.2	4	—	—	2.2	5
Noncommunicable diseases	31.7	59	7.2	90	24.7	54
Cardiovascular	16.7	31	3.6	45	13.1	29
Ischemic heart disease	7.4	14	1.9	23	5.5	12
Cerebrovascular	5.1	9	0.0	11	4.2	9
Cancers	7.2	13	2.0	25	5.2	11
Mental disorders	0.7	1	0.2	3	0.5	1
Injuries	5.8	11	0.5	6	5.3	11
Homicide/violence	—	—	—	—	—	—
Suicide	—	—	—	—	—	—
Disease burden						
Total DALYs	1,382.6	100	108.3	100	1,274.3	100
Communicable diseases	565.5	41	7.8	7	557.7	44
Respiratory infection	85.1	6	1.5	1	83.6	7
Tuberculosis	28.2	2	0.1	0	28.1	2
Malaria	39.3	3	—	—	39.3	3
Hepatitis	1.7	0	—	0	1.7	0
HIV/AIDS	70.9	5	1.0	1	69.9	5
Measles/childhood diseases	56.9	4	0.4	0	56.5	4
Diarrheal diseases	73.1	5	0.4	0	72.7	6
Noncommunicable diseases	595.4	43	87.7	81	507.6	40
Cardiovascular	143.0	10	19.5	18	123.5	10
Ischemic heart disease	51.9	4	9.5	9	42.5	3
Cerebrovascular	41.6	3	5.2	5	36.4	3
Cancers	80.8	6	16.3	15	64.6	5
Mental disorders	159.5	12	25.4	23	134.1	11
Unipolar major depression	58.2	4	7.0	6	51.2	4
Alcohol dependence	18.3	1	4.7	4	13.6	1
Injuries	221.7	16	12.7	12	208.9	16
Homicide/violence	21.6	2	1.2	1	20.4	2
Suicide	21.5	2	2.4	2	19.1	1

— Less than 0.1 million cases or less than 0.1 percent.

Notes: Childhood diseases include measles, pertussis, polio, diphtheria, and tetanus. All are preventable through immunization.

Source: WHO, *World Health Report 1999* (1999): Annex Tables 2, 3.

mans will always be plagued by infectious diseases because the microbes that cause them will continue to evolve. Others say that many aspects of modern life favor a resurgence of health threats from infectious diseases.⁷¹

Malaria

Malaria long has been a major health problem from Africa and the Middle East to the Indian subcontinent and the western Pacific. The disease claimed more than 2 million lives annually during the first half of the 20th century, when world population was one-third its present size. In some at-risk areas, epidemics of malaria occurred periodically. In others, malaria was endemic. In endemic areas, children who survived the disease developed immunity. People moving in from other areas—for example, agricultural workers, gold and gem miners, and settlers entering new colonization areas—were at risk of contracting the disease.

After World War II, the incidence of malaria was reduced through international efforts to eradicate the mosquito that transmits malaria. Widespread use of the insecticide DDT helped cut the annual number of malaria cases in Sri Lanka from 1 million in the 1950s to less than 20 cases in the 1960s.⁷² But malaria is still endemic in many parts of the world. In the 1990s, more than 40 percent of the world's population was at risk of exposure to malaria. Almost 300 million cases of malaria occur each year, and more than 1 million people die of the disease. About 80 percent of malaria deaths occur in sub-Saharan Africa.

When malaria does not result in death, it contributes to debilitating health problems and exacerbates the effects of malnutrition and infections. Some mosquito populations have become immune to DDT, and the malarial parasites have evolved drug-resistant strains that require the development of new drugs. New anti-malarial drugs are increasingly expensive, and are unaffordable for the

people at greatest risk of the disease. A long and costly search for a vaccine against malaria has not been successful, but in the 1990s, several promising vaccines are being tested for human use.⁷³

Several control programs have reduced the burden of malaria. Bednets impregnated with insecticide have proven to be a low-cost, effective method for reducing malaria infection. Prophylactic drug treatment can help prevent infection for people traveling in malaria endemic areas. In 1998, WHO, the World Bank, UNICEF, and the UN Development Programme launched a new global initiative to fight malaria: the Roll Back Malaria Program. The program aims to halve the number of malaria deaths worldwide by 2010 by controlling the transmission of the disease through insecticide treated bednets and medication.

Tuberculosis

TB is a leading cause of death among adults in less developed countries. TB was a major health problem in more developed countries at the beginning of the 20th century, but improved treatment, and more important, better living conditions and hygiene, led to a dramatic decline in its prevalence. TB was ranked just below pneumonia as the leading cause of death in the United States in 1900; it caused about 194 deaths per 100,000 population that year. The number of TB cases in the United States dropped from 122,000 to 28,000 between 1900 and 1980. The 1980 TB death rate was 0.6 per 100,000 in the United States. But the decline slowed in the past two decades. In 1997, 20,000 new TB cases were reported in the United States.⁷⁴

TB-infected immigrants from less developed regions and the HIV epidemic are two reasons for the persistence of TB in the United States and other more developed regions. Persons infected with HIV are 100 times more likely to develop active TB than are people with healthy immune systems. Unfortunately, the strains of TB that have re-emerged in the more de-

veloped countries are resistant to many of the drugs used to treat TB in the previous decades.

Worldwide, more than 8 million people were infected with TB in 1998. The overwhelming majority were in Africa and Asia. India had an estimated 1.8 million TB cases, and China had 1.4 million cases in 1998.⁷⁵

Most TB cases occur in countries where patients cannot afford, or lack access to, the strict six-month regimen of chemotherapy required to treat it. Many patients who begin treatment do not complete it, and that has several negative consequences. An incomplete course of treatment not only fails to cure the disease, it favors the evolution of multidrug-resistant TB strains (see Box 4).

In the 1990s, WHO achieved some success with TB monitoring and control in less developed countries through a new treatment strategy

called DOTS (directly observed treatment, short course). DOTS has been introduced in more than 100 countries and applied to more than 1 million TB patients. Progress has been slow, but this and other interventions could significantly reduce the incidence of TB around the world, given adequate political and financial support.⁷⁶

Viral Hepatitis

Viral hepatitis, which causes inflammation of the liver, is a leading disease burden in less developed countries. Of the five hepatitis virus that have been identified, hepatitis A, hepatitis B, and hepatitis C, are the most prevalent. Hepatitis A, which generally does not lead to chronic liver disease, could be greatly reduced through inoculation and better sanitation and personal hygiene.

Hepatitis B and C (HBV and HCV) lead to debilitating liver diseases and

Box 4

Use and Misuse of Antibiotics

For more than five decades, the world has relied on a vast array of antibiotics to conquer infectious diseases like pneumonia and meningitis. But antibiotics are losing their efficiency against a growing number of diseases because they are being over-prescribed by health practitioners and misused by patients.

With larger numbers of people traveling faster and farther, disease-causing microbes are spread to new populations, which gives the disease agents more opportunities to evolve new strains that can resist standard treatments. The ever-increasing volume of international travel has hastened transfer to the United States of multidrug-resistant tuberculosis from other countries. Strains of multidrug-resistant *Streptococcus pneumoniae* have migrated from Spain to Great Britain, the United States, South Africa, and elsewhere.¹

Antibiotics are also widely used in livestock production, which increases exposure and therefore encourages the evolution of bacteria and viruses that are resistant. Antibiotics are used

to boost growth and limit disease among cattle, chickens, and other animals.

Most antibiotics are available only by prescription in the industrialized world, but their use is not controlled. Many patients do not finish the full course of treatment. They “save or stockpile” leftover doses and then medicate themselves or others in the future in insufficient amounts. This improper dosing fails to eliminate the infectious agent and encourages growth of more resistant strains.

In the less developed countries, antibiotic use is even less regulated. Antibiotics and other medicines often are dispensed without prescriptions by unlicensed health care providers.

Since the introduction of antibiotics in the early 20th century, bacteria have evolved new strains that can resist the antibiotics used to suppress them. This resistance created the need to develop alternative antibiotics. Penicillin remains effective for many diseases, but as early as 1967, a penicillin-resistant pneumococcal strain was reported in New Guinea. By 1992, about 5 per-

cancer. Both are transmitted by contact with contaminated blood and by sexual contact. About 350 million people carry the hepatitis B virus and more than 2 billion have been infected at some time. An effective vaccine against hepatitis B is available, but it is not yet widely available in many less developed countries. WHO estimates that widespread use of the vaccine could prevent any new cases of HBV by 2025.

Hepatitis C is a growing health problem throughout the world. Researchers have a rudimentary knowledge about the prevalence and course of HCV, which was identified in 1989. WHO recently published the first global estimate of HCV prevalence, which suggests that up to 3 percent of the world's population—more than 170 million people—have been infected with HCV. Less than 2.5 percent of the population in Africa, the Americ-

as, Europe, and Southeast Asia are infected with HCV. But prevalence rates are as high as 12 percent in some Middle Eastern countries and 4 percent in some countries of the western Pacific.

Between 50 percent and 80 percent of those infected with HCV develop chronic liver disease that can lead to death. HCV has become a leading reason for liver transplants in the United States.⁷⁷ But transplants are not a permanent cure and are available only to a small fraction of those infected. There is no vaccine to prevent infection, and there is no cure once infection has occurred, although many promising new medicines are being tested.

HIV/AIDS

HIV/AIDS is another challenge for the 21st century. HIV, recognized in 1981, spread throughout the world

cent of U.S. pneumococcal samples tested by the Centers for Disease Control and Prevention (CDC) were resistant to penicillin. In 1999, 25 percent of cases were resistant and in some areas of the United States the rate tops 40 percent.²

Antimicrobial resistance is a major concern for public health officials. Some analysts have estimated the financial burden for the United States alone at \$30 billion yearly. But consumption of these medicines has begun to rise dramatically. In the United States, more than 150 million courses of antibiotics are prescribed by doctors each year to nonhospitalized patients, while 190 million doses a day are administered in hospitals. Physicians often over-prescribe antibiotics, sometimes to assure an ill patient that something can be done to hasten recovery. Researchers at the CDC have estimated about one-third of the outpatient prescriptions for antibiotics every year are unneeded.³

The development of disease-causing microbes that can resist antibiotics will continue and will require faster

development of new drugs. To slow the development of resistance, many health advocates are calling for physicians to refrain from prescribing antibiotics unless truly necessary, and for patients to use antibiotics exactly as prescribed.

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Future Directions in HIV/AIDS Prevention, Care, and Support

By Collins O. Airhihenbuwa and Bunmi Makinwa

In the early days of the HIV/AIDS epidemic, the public and health communities focused on slowing the spread of HIV by changing individual behavior—primarily by convincing individuals to limit the number of sex partners and to use condoms consistently. In the late 1990s, the focus of medical care has broadened to encompass the care and treatment of persons with AIDS and opportunistic infections, and the prevention of secondary infection through prophylactic use of medicines. Antiretroviral drugs have reduced HIV to undetectable levels in some persons infected with the virus. Yet, hopes for a vaccine to prevent HIV infection have not been realized, and a cure has not been found.

Prevention will remain the primary way to stem the HIV/AIDS epidemic in the near future, but control efforts are expanding from offering medical treatment and changing individual behavior to altering the socioeconomic and cultural context in which individuals live. New research suggests that HIV/AIDS prevention, care, and support efforts should encompass government policy, socioeconomic status, culture, gender relations, and spirituality.¹ Government policy and political will were major factors in slowing the spread of HIV in Uganda and Senegal, initiating a 100 percent condom-use policy in Thailand, and guaranteeing antiretroviral drugs for HIV-positive persons in Brazil. Conversely, HIV/AIDS is an increasing problem in countries where governments failed to provide leadership in and resources for HIV/AIDS prevention, care, and support.²

The epidemic has prompted a reappraisal of social norms in many countries, especially norms

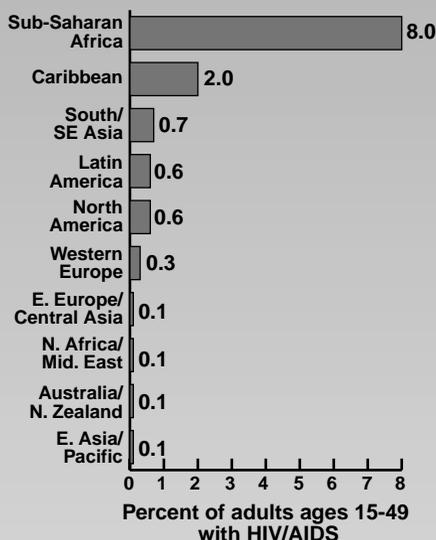
governing sexual behavior. Many HIV/AIDS control experts agree that efforts to promote safe sex practices must be culturally sensitive to be successful. In cultures that allow early sexual initiation and multiple sex partners, for example, traditional rights of passage can incorporate lessons about sexual responsibility.³ Cultural attitudes about community and family responsibilities to care for the infirm are also important in the management of HIV/AIDS.

The status of women in relation to men in society and the community, and women's role in sexual negotiation and health care decisionmaking pose additional challenges to the management of HIV/AIDS.⁴ Women's decisionmaking power in the family and community has an important bearing on whether women protect themselves from HIV infection and on the resources available to care and support HIV-positive members of the family or community.

Spiritual values (which include religious values) play an important part in health behavior. In recognition of this role, the World Council of Churches has asked spiritual leaders to join health professionals in a unified effort to fight HIV/AIDS.⁵

While there are successful models for controlling the HIV/AIDS epidemic, economic disparities and lack of political leadership hampers HIV/AIDS control in many low-income countries. At the same time, the epidemic threatens economic development in some countries because it is depleting the labor

Adult HIV/AIDS Prevalence by Region, 1998



Source: UNAIDS, *AIDS Epidemic Update—December 1998*: 5. Accessed online at www.unaids.org, on Feb. 25, 1999.

force and sapping resources that could be invested in education or development. Policymakers and business leaders in some countries are beginning to consider the effect of HIV/AIDS in their economic planning and forecasts.⁶

The economic imbalance between rich and poor countries is mirrored in the disparity in the gains in HIV/AIDS prevention, care, and support. In many less developed countries, access to condoms, treatment drugs, and health facilities is rare. Many children are born with preventable HIV infection because their mothers were served by inadequate health facilities that lacked even relatively inexpensive treatment drugs. Many low-income countries cannot afford to import antiretroviral drugs. More important, many governments fail to address the HIV/AIDS epidemic with appro-

priate policies and resources. Meanwhile, AIDS is slowly taking the back-stage to other major health problems in several more developed countries because of the growing arsenal of prevention policies, products, and drugs, which could offer hope to other countries grappling with the epidemic.

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A billboard in Zambia promotes safe sex to combat the HIV/AIDS epidemic. In 1999, at least 23 million people were living with HIV/AIDS in sub-Saharan Africa.

and devastated specific population groups in even the wealthiest countries in the closing decades of the 20th century. In the United States, HIV/AIDS was one of the 15 leading causes of death between 1987 and 1997.⁷⁸

Many industrialized countries have reduced deaths from AIDS significantly, thanks to the wide availability and use of antiretroviral drugs. The rate of new infections has slowed, primarily because of the practice of safe sex among high-risk populations in these countries. But, HIV infections are likely to increase throughout the less developed world. In sub-Saharan Africa, more than 23 million adults and children were infected with HIV in 1999—accounting for more than two-thirds of the global total.⁷⁹ Countries in Asia and Latin America are recording increases in HIV infections, AIDS cases, and AIDS deaths.

The success in slowing AIDS in more developed countries and in some less developed countries suggests that the epidemic can be stemmed (see Box 5). But in the near term, millions more will become infected with the virus and the epidemic will bring major health, social, political, and economic costs to many countries around the world.

Unusual weather patterns can affect animal habitats and cause a clustering of new diseases.

Emerging and Re-Emerging Infectious Diseases

As the battle to control known infectious diseases continues, new threats have emerged. Many of them are neither preventable nor treatable. More than 20 emerging diseases have been identified in humans since 1970. At the same time, old foes such as plague, diphtheria, yellow fever, dengue, meningitis, influenza, and cholera have been reported in new geographic areas.⁸⁰

Migration within and among countries, international travel and commerce, including the transport of live animals and animal products, all carry diseases into new areas. In some cases, environmental change—deforestation, for example—has brought people into closer contact with animals and insects that harbor disease.

In Africa, outbreaks of meningitis affected 300,000 people and caused 35,000 deaths between 1996 and 1998. East Africa was hit by major cholera epidemics in the 1990s that affected tens of thousands of people in more than 10 countries.⁸¹

Unusual weather patterns can affect animal habitats and cause a clustering of new diseases that affect humans. In 1993, an outbreak in the United States of a previously unknown disease, Hantavirus pulmonary syndrome, was sparked by a weather change that brought disease-carrying rodents into closer contact with humans in the American Southwest. More than 50 cases of the disease occurred in and around New Mexico. More than two-thirds of those infected died.

Meanwhile, changes in food production, handling, and processing have increased the incidence of food-borne diseases such as salmonella, which comes from infected eggs, or a potentially fatal form of *E. coli* (*E. coli* 0157).

An outbreak of Ebola hemorrhagic fever in the former Zaire in 1995 was a dramatic reminder of the need for constant vigilance of emerging diseases. Although only 316 cases were identified, more than three-quarters

of those who became ill died. About one-third of the victims were health care workers who came into contact with blood or body fluids infected with the virus. Two years later, 58 cases and 43 deaths occurred in Gabon. No treatment or vaccine for Ebola is available, and 50 percent to 90 percent of those infected with the virus die.

Other emerging diseases will challenge humankind in the coming decades, including Lassa fever, legionnaires' disease, Lyme disease, Marburg disease, and a new variant of Creutzfeldt-Jakob disease (or nvCJD), purported to be related to mad cow disease.⁸²

Noncommunicable Diseases

While communicable diseases are a continuing threat to public health, some researchers predict an "epidemic" of noncommunicable diseases in the 21st century.⁸³ The aging of the world population and extension of life expectancy at older ages mean that more people will be in the ages when degenerative diseases take their greatest toll. In addition, higher incomes and higher living standards associated with economic development are likely to place increasing percentages of people at risk of developing the "lifestyle" diseases common in the industrialized countries. The leading causes of death in the more developed countries today—cardiovascular diseases (including heart diseases and strokes) and cancer—are likely to be the major health problems of the next 50 years. In addition, mental illnesses and injuries will bring increasing disability to people all over the world.

Cardiovascular Disease

Cardiovascular diseases (CVD) have been a leading cause of death in industrialized countries for more than half a century. They have more recently emerged as a major health burden in less developed countries. In the 1990s, deaths from CVD ranked a close second behind lower respiratory infections as the leading cause of death in less developed countries.

The type of CVD tends to vary according to the level of economic development. For countries at a low stage of economic development, the predominant circulatory diseases are rheumatic heart disease, infections, and heart problems resulting from malnutrition.⁸⁴ Sub-Saharan Africa and the rural areas of South America and Asia are in this early phase.

In the newly developing, or “emerging” economies (including China and some industrialized Asian countries), infectious disease burdens decline, nutrition improves, and diseases related to hypertension become more common. For countries in the more advanced stage of economic development, the health effects of consuming more fat, widespread tobacco use, and a more sedentary lifestyle begin to emerge. In these countries, the incidence of ischemic heart disease rises, especially for people under age 50. Urban India and the former socialist republics, including Russia, are in this stage. In areas with more developed economies—including Western Europe, North America, Australia, and New Zealand—increased efforts to prevent, diagnose, and treat ischemic heart disease and stroke delay the impact of these diseases to more advanced ages.⁸⁵

CVD remains a leading cause of the health burden and of death in the United States and most other countries, but the CVD mortality rates declined significantly in the United States in the past 25 years. These declines, which the U.S. Centers for Disease Control and Prevention call “one of the most important public health developments of the 20th century,” demonstrate the potential effectiveness of health interventions at the primary, secondary, and tertiary levels. U.S. death rates for heart disease declined 56 percent between 1950 and 1996, after adjusting for changes in the age structure. Age-adjusted death rates from stroke fell 70 percent between 1950 and 1996. The primary reasons for the decline in the United States include a reduction in smoking (from 42 percent of adults in 1965 to

25 percent in 1995); less consumption of saturated fats and cholesterol; increased screening of cholesterol levels and blood pressure; and better medical treatment for people with high blood pressure and for heart attack and stroke victims.⁸⁶

Exercise played an important role in the change by helping people control their blood pressure. By changing their lifestyles, people were able to lower their risk of death from CVD. The health care industry also responded to the challenge with information campaigns, screening for risk factors, increases in medical personnel trained in CVD treatment, and new drugs to control blood pressure.

Yet some U.S. population groups did not enjoy large declines in CVD, including the poor and ethnic and racial minorities. Smoking, for example, is more prevalent among less-educated Americans. Obesity is more common among blacks and Mexican Americans than among non-Hispanic whites.⁸⁷ These discrepancies point out the importance of an equitable distribution of information and resources for improving a population’s health.

Because CVD is affected by lifestyle behaviors such as smoking and eating high cholesterol foods, it is poised for a dramatic increase worldwide as more countries import or produce cigarettes and adopt a western diet high in animal fats. A World Bank study estimates that by the year 2020, almost 4 percent of all deaths worldwide will result from tobacco-related CVD. In India, where cardiovascular mortality rates are already fairly high, tobacco-attributable mortality is expected to increase from 1 percent to 13 percent of total mortality between 1990 and 2020.⁸⁸

Cancer

Cancers of all types are the second leading cause of death in high-income, industrialized countries, and are rapidly increasing in importance in lower-income countries.

There have been important changes in mortality rates for some

CVD is poised for a dramatic increase worldwide.

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Although smoking has declined among U.S. adults, it increased among U.S. high school students in the 1990s. Tobacco use has been linked to cancer, heart disease, stroke, respiratory disease, and many other health problems.

types of cancers. In the United States, lung cancer mortality (85 percent of which results from smoking) more than tripled between 1950 and 1997, but there is evidence the rate will decline. Lung cancer mortality declines began among U.S. men ages 30 to 34 in 1963 and were evident in progressively older age groups as these men aged. Rates declined among the 35-to-39 age group in 1969, the 40-to-44 age group in 1971, and the 45-to-49 age group in 1976. By 1980, small declines were detectable for men in their early 50s and early 60s.

Lung cancer surpassed breast cancer as the leading cause of cancer mortality for U.S. women in the late 1980s. Breast cancer occurs more than twice as often as lung cancer among women in the United States; however, with early diagnosis, women have a better chance of surviving breast cancer than lung cancer. A decline in lung cancer mortality for women under age 45 began after 1979.⁸⁹

The causes of cancer appear to involve a complex interplay of genetic, environmental, and lifestyle variables. One promising approach to preventing cancer involves vaccines that provide “immunity” to factors that can trigger cancer growth, such as viruses or bacteria. And, a large body of evi-

dence shows that individuals can reduce their risk of developing cancer with lifestyle changes, such as adopting healthy diets and getting regular exercise.⁹⁰

Tobacco-Related Illness

CVD and cancer are just two diseases linked to long-term tobacco use. Chronic lung disease, respiratory infections, and low birth weight are among many other health problems that are exacerbated by smoking. Tobacco-related illnesses constitute a special health challenge for the 21st century because the incidence of smoking is increasing worldwide. Although the percentage of the population that smokes has declined in the United States and some other countries, it is increasing in less developed countries, where more than 80 percent of the world population lives. The number of people who smoke is projected to rise from about 1.1 billion in the late 1990s to more than 1.6 billion by 2025. Tobacco-attributable mortality is expected to increase from 14 percent of total mortality worldwide in 1990 to 23 percent in 2020.⁹¹

Many policymakers fear potential losses of tax revenues and jobs if they impose controls on the tobacco industry. A recent World Bank study concluded, however, that restrictions on tobacco production and sales would not cause economic difficulties; in fact, economies would benefit from reducing tobacco-related health problems.⁹² The World Bank study estimated that a tobacco tax increase of 10 percent would prevent 7 million deaths, including deaths of people in their productive middle ages, in low-income countries.

Some low-income countries such as Thailand have introduced effective antismoking measures. Yet the health dangers of smoking are not widely acknowledged. In China, for example, 61 percent of smokers questioned in 1996 thought tobacco did them “little or no harm.”⁹³

Protecting children and nonsmokers from exposure to tobacco smoke and informing adult smokers about

the health dangers of smoking are key to improving public health in the future. These objectives are served by interventions that reduce the demand for and supply of tobacco products.

A new initiative spearheaded by WHO for the first decade of the 21st century—the Global Convention on Tobacco—intends to focus member states on activities and policies that limit tobacco use worldwide.⁹⁴

Mental Health

While physical health has improved throughout the world, raising average life expectancy and reducing disability, mental health remains a major health problem. Mental disorders result from complex and multiple biological, psychological, and social determinants. The most common mental disorders are depression, dementia, schizophrenia, epilepsy, and mental retardation.

Mental disorders have never been ranked in the top 10 priority lists of public health significance because they usually are not a major cause of death. But the Global Burden of Disease study included mental disorders as a “disability” in calculating DALYs because mental disorders adversely affect physical health, cognitive function, productivity, and social relationships. The disease burden of mental disorders ranks almost as high as that of cardiovascular diseases and respiratory diseases and surpasses HIV and all types of cancer.⁹⁵ Mental and neurological problems account for an estimated 11 percent of the global burden of disease (see Table 2, page 26). As the world’s population grows older, the burden of age-related mental disabilities such as Alzheimer’s disease will increase.

Depression is a leading health problem for adult men in high-income countries, and the disorder is increasing in lower-income countries. Dependence on alcohol and other drugs is another enormous health burden worldwide that incurs high social and economic costs.

Many mental disorders are long-term and recurrent conditions, but they can be effectively treated. Treat-

ment does not require sophisticated medical technology; however, it does require trained personnel and organized outpatient support services.⁹⁶

Health Care System

The term “health care system” usually refers to the varied health care resources available in most countries. Traditionally, people interact with the health care system only after they have a health condition that requires treatment. Health services help cure disease, deliver babies, and rehabilitate the injured. This emphasis on tertiary prevention explains why health care systems are placed below the primary level of intervention in the field model (see Figure 5, page 13). But these systems provide primary and secondary prevention as well; and the health care systems of the future will be better equipped to focus on proactive interventions. New developments in communication and health technologies offer expanding opportunities for health care systems to reach more people and to help them stay healthy.

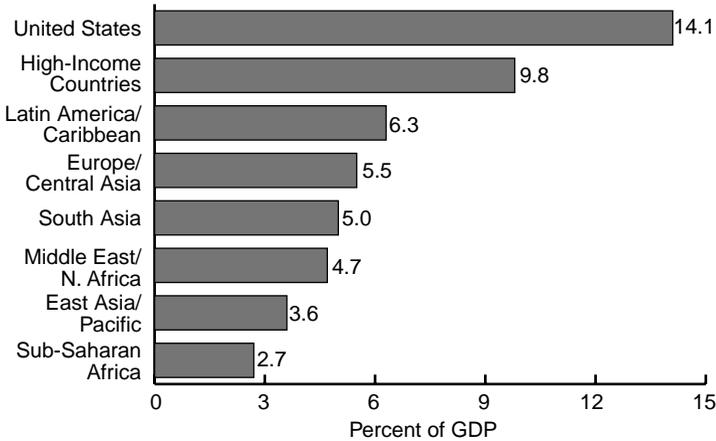
Health care systems can help people to avoid becoming sick by, for example, monitoring blood pressure and cholesterol levels, screening for the risk of developing a genetic disease, and educating new mothers about child care and nutrition. Such primary health care, in fact, is a more cost-effective way to improve general health status than sophisticated medical technology—such as magnetic resonance imagery—that may benefit relatively few people. Providing greater access to low-technology, primary health care could bring the greatest improvement in mortality and morbidity in countries in the earlier stages of the epidemiologic transition.

The impact of contemporary health care systems is often measured by their resources—the per capita number of hospitals and hospital beds, doctors and other health professionals, and schools offering degrees in the health professions. The expenditures on health—expenditures per

Increasing the emphasis on primary health care could bring the greatest improvement in mortality and morbidity.

Figure 7

Health Expenditures as Percent of GDP, 1990–1997



Note: GDP (gross domestic product) is a measure of national income. High-income countries include those with a 1997 gross national product per capita above US\$9,658. These include, among other countries, Australia, Canada, Japan, the United States, New Zealand, most of Europe. The other regions shown above include countries with a gnp/capita below that level.

Source: World Bank, *World Development Indicators, 1999* (1999): Table 2.13.

capita or as a percent of national income—also are commonly used indicators.

The proportion of GDP devoted to health differs dramatically among countries and regions of the world (see Figure 7). The percentage of GDP going to health expenditures in 1993 and 1994 was less than 2 percent in Nigeria and Indonesia, 4 percent to 5 percent in China, Russia, and Paraguay, 8 percent in South Africa, and 11 percent in Argentina.

These resources, however, usually do not adequately measure the effectiveness or availability of health services. In many less developed countries, for example, most hospitals and physicians are located in urban areas, while most of the population lives in rural areas. Within cities, families in poor neighborhoods may not have access to health services. The resources spent on health may reflect investment in sophisticated technology rather than primary care services that benefit more people. A more accurate measure of the effectiveness of a country's health care services might be the general level of a population's health.

Health care expenditures are escalating in most countries for a number

of reasons: the increasing costs of new technology and medicines, aging populations that use more health services, higher demands and expectations for cures and treatments for more health problems, and financing systems that tend to encourage higher costs.

The rising cost of health services and the distribution of funds within the health system are issues that will gain increasing attention from policymakers around the world. Policymakers and the public will need to grapple with who should pay for health care, what level of care should be provided, and for whom.

The type of health care systems available in the future will depend in part on the amount and source of financing available. Currently, health care systems may be owned by national or local governments, not-for-profit organizations, or for-profit organizations. One of the big sources of change in the financing and operating of health systems may evolve from new health communication strategies and opportunities.

Health Communication

Communication technology is a powerful intervention that could bring information about new health developments to people around the globe. It could bridge the digital divide between those who do and do not have access to information technologies—or it could widen the gap. The new media will be ubiquitous—accessed from television, land-linked and cellular phones, satellites, radio, kiosks, wristwatches, and other venues. The wearable Web, or “e-device,” will be a two-way monitoring device that can offer instant feedback, advice, and recommendations. The overarching goal will be getting the right message to the right people, at the right time, with the intended effect.

The medical information now used in many hospitals—instantaneous laboratory results, x-rays, oxygen levels,

and the like—may evolve into a handheld computer at the patient’s bedside. E-devices—wearable earring monitors or watches with microchips that measure certain blood levels—could be developed to help people with chronic diseases. Diabetics could wear monitors and devices that release the appropriate amount of insulin when needed, for example. A nano-implant device (a semiconductor chip smaller than a grain of rice) could monitor blood pressure, cholesterol, and other relevant data. The personal information could be transmitted to a device that interprets it and advises the individual to, for example, alter food or liquid intake or take a drug supplement.

New communication technologies will provide extensive opportunities for improving health around the world by managing information at various levels of the health care system. The health care provider will have benchmark data with guidelines for providing feedback and reminders to patients.

These new communication technologies will also provide information unmediated by human decisionmaking. Artificial intelligence and decision systems will offer diagnoses and treatment options based on large population databases, but which may not be appropriate for a given individual.

New and traditional media will educate the public without a clinician’s involvement. The 21st-century health provider will need to assert his or her influence by delivering accurate, personalized health and medical information. Hospitals and health care systems can create interactive channels with tailored information for a patient from “his” doctor in his own home. Ideally, the delivery of health information and services will move from hospital to home and from cure to self-care and prevention. Communicating health information accurately will require communication of the context—or what this will mean for the health of the individual (see Box 6, page 38).

Table 3

Challenges and Opportunities for Improving Health

Global Issues

Challenge: Build local and individual capacity to enact policies for ideal health

Opportunities:¹

- Improve public health infrastructure and research, surveillance, and communication systems
- Encourage and enforce international treaties that promote better health (for example, the Global Convention on Tobacco and the Kyoto Protocol on Climate Change)
- Enhance health training and education among the general public (health literacy) to enable them to advocate for better health
- Identify potential emerging diseases and craft international strategies to combat them.

Physical Environment

Challenge: Protect water, air, land, and food supply

Opportunities:¹

- Maintain and improve surveillance of environmental contaminants
- Integrate technological and medical advances to reduce exposure to health hazards.

Community and Social Environment

Challenge: Develop social structures to enhance health in the workplace and the community

Opportunities:¹

- Create safety-net programs to provide a baseline of services
- Enhance communication to strengthen social networks and participatory decisionmaking
- Motivate communities to advocate for policy changes (for example, tobacco sales, motorcycle helmet use)
- Promote health literacy programs
- Establish priorities for community health resources.

Family and Individual Environment

Challenge: Pursue a healthy lifestyle

Opportunities:¹

- Increase personal responsibility for health
- Encourage family cohesion and support
- Promote education and information that foster healthy individual decisions (for example, regarding smoking, hygiene, and communication with family members).

¹ Opportunities include technology, communication, services, and overall development.

Can the World Be Healthy?

At the 1893 World's Fair in New York, experts predicted humans would live to 150 years by the end of the 20th century. In this *Population Bulletin*, we do not make such predictions, but we will identify some roadblocks and some opportunities for action in the hope of moving each of us to actively pursue WHO's goal of "health for all" (see Table 3, page 37).

Many of the health successes of the past 100 years emanated from the work and discoveries of Louis Pasteur, Robert Koch, and others who identified germs as the agents that caused communicable diseases. Joseph Lister introduced antiseptic practices that helped prevent the transmission of disease. In the 20th century, life expectancy nearly doubled in the coun-

tries in which this knowledge was disseminated. The next great leaps in health will be with new ideas: ideas about what good health is and how it can best be promoted.

The future promises exciting developments in medical technology and knowledge. But we will not attain global health unless we are guided by the following points.

Pursue Health, Not Just Cures for Disease

The 21st-century field model focuses on vulnerability and risk factors as well as on educational and environmental factors that determine whether people become sick. By emphasizing primary prevention, individuals and communities can avoid health conditions that would require treatment or cause loss of productivity. An ideal health system would in-

Box 6

Emerging Information and Communication Technologies

By Thomas R. Eng

Information and communication technologies are permeating the workplace and the home in more developed countries, and they are becoming more common in many less developed countries. Because health care and public health are information-intensive sectors, it is not surprising that these technologies are beginning to have a substantial impact on health care systems.

The Internet in particular is an increasingly powerful channel for interactive health communication and for delivering health care services. Interactive media enable users to tailor health information to an individual's method and point of access, literacy and health status, and personal characteristics. These new technologies can promote self-care and healthy behaviors, provide access to peer and emotional support, and improve delivery of health care services. Better health and lower health costs are potential outcomes.

In more developed countries, Internet access is rapidly increasing as com-

puter equipment and service become more affordable. The situation is completely different in most of the rest of the world, however. About 80 percent of the world's population does not have access to basic telecommunications services. Most people have never made a telephone call and more than half of the world's population lives more than two hours from a telephone.¹ The "digital divide" among the world's wealthy and poor populations is growing wider.

There are two major barriers to ensuring global access to emerging technologies that can improve health: lack of access to technology infrastructure and hardware, and low educational levels. Several initiatives are underway to broaden access to the Internet and other emerging technologies in less developed countries, but making such service affordable for most residents is likely to be a long-term process. A short-term solution could be establishing public access points through land/terrestrial lines and satellite and radio connections.

clude primary prevention by incorporating better communication, education, vaccination, and screening for disease.

Another way to focus on attaining health rather than treating disease is to develop new ways to measure health. International surveillance systems could focus on health indicators rather than tracking the occurrence of diseases.

Strive for Ideal Health, Not “Best” Health

We need to broaden the definition of health. Health is measured by the quality of individuals’ lives rather than simply by the absence of disease. The health of an individual or population is best assessed within the relevant socioeconomic and environmental setting. The goal for the future should be ideal physical and mental health—

ideal for a specific community, ideal for given socioeconomic conditions. Ideal health requires a basic set of values and services; it is not equivalent to “free” health for all or “longest life” for all.

The surest way to attain ideal health is to focus on actions that will have the greatest impact: Increase economic development; reduce poverty; educate the public; deter poor individual health habits (such as smoking and unprotected sex); provide basic housing and clean water; and build an effective health sector.

Reduce Economic and Social Disparities

Reducing poverty is one of the toughest challenges of the new century, but it would bring the largest rewards. Globalization has created new opportunities for economic growth and

High illiteracy rates and low educational levels in many less developed countries are other barriers that require long-term solutions. In the interim, policymakers can promote policies and programs to enhance Internet access (or “connectivity”) and to develop health care and public health technologies that are appropriate for a given population’s situation. The most appropriate short-term strategy for less developed countries, for example, might be telemedicine and health professional and lay worker education rather than direct-to-consumer applications, because most residents lack telecommunications access.

Several major initiatives are now underway to use emerging communication technologies to improve health in areas where technology infrastructure are lacking. A notable example is “HealthNet,” which uses two low-Earth-orbit satellites to provide e-mail services to government agencies, medical schools, libraries, and other facilities, and to health workers in 28 developing countries.

Because it will cost billions of dollars to connect less developing countries to the global telecommunications network, business models and incentives need to encourage telecommunications companies to invest in infrastructure-poor areas. Providing universal access to emerging technologies will need to involve a wide variety of stakeholders on local, national, and international levels. Connectivity will require funding and partnerships from both the public and private sectors.

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A traditional Chinese physician reads a patient's pulse. Some traditional health practices provide valuable insight to links between behavior and disease.

spread wealth to new populations in the less developed world. But in some cases it has widened the income gaps between the lowest, middle, and highest income countries.⁹⁷ Governments at all levels must try to eliminate the disparities among and within population groups so that all people have an adequate standard of living, basic education, and equal access to health information and services. One successful model for achieving this goal is the WHO Healthy Cities project, which has reduced poverty in more than 1,000 cities in 27 countries since 1987. The Healthy Cities approach could be transferred to other population groups: villages, towns, and even “virtual communities” created through the Internet.

Rapid population growth often hinders poverty reduction in low-income countries. High fertility creates a large dependent child population that requires costly educational, social, and health services. In some African countries, food production has not kept pace with population growth and countries are forced to spend scarce resources importing food.

Population pressure and poverty can lead rural populations to waste and destroy natural resources—by overcutting woodlands and overplant-

ing cropland, for example—which can contribute to environmental, economic, and, eventually, health problems. Extreme poverty, especially in areas with marginal agricultural land, encourages migration to cities, which can compound the health burden in urban areas.⁹⁸ Slowing population growth in the low-income countries can help reduce poverty.

Acknowledge That Behavior, as well as Microbes, Spreads Disease

Human behavior, including the way we allocate our resources within our population and among institutions, determines the health status of a population. The virus that causes AIDS has assumed epidemic proportions primarily because of human behavior that spreads the disease through unprotected sex and use of contaminated needles. At least in the short-term, stemming the AIDS epidemic lies with changing human behavior, not medical research. It is unlikely that a vaccine or cure could reach the populations in low-income countries, which are those most affected by HIV/AIDS.

Health policies need to look beyond the causes of specific diseases and strengthen the health sector by mobilizing resources from international, private, national, or other sources. These resources can enhance the delivery and management of health services and can thwart the spread of disease by focusing on primary prevention.

Another promising approach to primary prevention involves developing indicators for the physical, occupational, intellectual, social, and emotional factors (or POISE factors) that determine health. These POISE indicators would help in designing policies for specific populations.⁹⁹

Seek Health Knowledge From Individuals and From Traditional Cultures, Not Just From Medical Research

Knowledge about what keeps people healthy can be gleaned from the experiences of people in their villages,

towns, cities, and with their families. The emphasis on scientific research can cause medical analysts to miss cultural, environmental, and personal factors that are not easily quantifiable, but are important to health. Exposure to a virus at birth, for example, may be a better predictor of heart disease than diet or cholesterol, but this information may not surface in a typical research situation.

Traditional and nonwestern healing practices can also reveal important links between disease and behavior and introduce effective treatments not found in Western familiar medicine.

Empower Individuals Through Health Literacy

The purpose of education, as described by Alfred North Whitehead, is “to provide life and wisdom to the information learned.”¹⁰⁰ Health literacy embodies the ideals of education and health. Health literacy is the capacity of individuals to obtain, interpret, and understand basic health information and services necessary for appropriate health decisionmaking. People might be more diligent about handwashing, for example, if they truly understood its role in preventing infectious disease.

Health literacy may involve developing the skills to care for others or to teach healthy behavior to other family members. Adult children caring for elderly parents may need to learn to monitor insulin levels or blood pressure, and they will also need to learn to navigate the health system to obtain appropriate care. Mothers of young children impart a wealth of health-related knowledge by example as well as through instruction. Personal hygiene, good nutrition, attitudes toward family planning—including safe sex practices—are all learned (or could be learned) within the family. In addition, people develop a sense for which kinds of health problems require medical care based on their parents’ actions and attitudes. Children also learn where to go to get information

about health matters. As parents become better informed about healthy behaviors, their children will develop a greater health literacy.

Health literacy not only arms individuals to enhance their own health and the health of family members, it also empowers them to advocate for a health-friendly environment with appropriate services and preventive care.

Make Health a Global and Multisectoral Issue

British scientist Sir Geoffrey Vickers suggested we need to stimulate the “world of the well” to mobilize private and public organizations to create living and working conditions and public attitudes that support health and well-being.¹⁰¹ WHO, the World Bank, UNICEF, and a number of nongovernmental organizations (NGOs) as well as the for-profit multinational pharmaceutical industry are the principal actors involved in the delivery of health services. As the field model shows (see Figure 5, page 13), economic, social, environmental, and genetic factors are as important as health services in affecting health.

Multinational and nongovernmental organizations promote health on many fronts: education, immunization campaigns, research and analysis, and policy formation (see Box 7, page 43). WHO, for example, is supporting a treaty that would standardize the marketing, production, and promotion of tobacco to limit the health hazards related to tobacco use. This is a promising first step toward reframing health as a global issue that people can influence through collective and individual actions.

Other multinational groups are also taking actions that affect health. The European Union is developing a directorate in health and consumer safety for its 18 member states. Such a unit might deal with economic and cultural considerations of genetically modified foods, hormone-treated beef, pharmaceuticals, and other issues.

Health is measured by the quality of individuals’ lives.

Health can be integrated into the activities and agreements of the growing number of organizations that govern trade. The World Trade Organization, and the World Intellectual Property Organization can promote the development of health delivery, provision of medicine and foodstuffs, advancement of health literacy in communications and management, and sanctions against the marketing of illegal drugs and other health hazards. NAFTA (the North American Free Trade Agreement), Mercosur (Southern Cone Common Market in Latin America), APEC (Asian Pacific Economic Cooperation), ASEAN (Association of Southeast Asian Nations), other international trade organizations, and the Andean Community could also put health on their agendas.

NGOs are also becoming important actors in the efforts to attain global health. They include relief and welfare agencies, technical innovation organizations, public service contractors, development agencies (such as Oxfam), grassroots development organizations, and advocacy groups and networks. In addition to administering their own programs, NGOs sometimes can influence the policy agenda at international conferences and in national legislatures.

Public and private organizations and national governments need to work together to advance global health. The most obvious areas that would benefit from cooperative effort are health service delivery and policies concerning treatment of diseases. Worldwide surveillance systems are another prime opportunity for international cooperation.

Other potential for cooperation include integration of activities that affect social, economic, and environmental factors important for health. Many international organizations support activities crucial to these other factors that determine health. The International Labour Organization and the United Nations Environmental Program, for example, provide guidance

on safe levels of chemicals in drinking water, pesticides, food additives, and in livestock feed.

The media can also promulgate health and equity by promoting civic responsibility, global citizenship, and environmental stewardship. The media are a powerful force in the global society.

Implement and Enforce Policies That Strengthen Health Systems and Encourage Health Literacy

While the WHO represents the interests of 191 member states in setting policies, it is up to each individual country to adopt and implement its policies, and many policies have not been implemented. For example, TB kills more young people and children than any infectious disease in the world today—more than malaria and HIV/AIDS combined. Yet TB treatment usually does not follow the best scientific policy. The DOTS strategy can detect and cure 95 percent of TB patients. As of 1999, however, WHO reports that only 102 of the 212 countries and territories in the world had adopted the DOTS strategy to control TB.

Environmental exposure is another policy challenge. In the workplace, over 500 million people annually suffer injury and occupational and respiratory diseases. Many of these health problems could be prevented by policies that enforce health and safety standards for employers and employees.

The creation and implementation of effective policies could include:

- Promoting public-private partnerships. Combining resources of soap manufacturers with governmental handwashing campaigns, for example, can decrease the spread of disease just as pesticide manufacturers can work with health workers on malaria eradication.
- Adopting best practice guidelines and incentives to adopt and evaluate health policies.
- Encouraging policy change at the local level to create healthier environments.

- Supporting global conventions that address health threats, such as the global convention on tobacco.
- Creating global surveillance systems and health indicators that reward reporting of disease and health.
- Linking economic policy and development with the goal of improving health.
- Developing ethical standards and moral leadership for media conglomerates.

Harness the Information Revolution to Improve Health Systems

New technologies are making health information available faster than it can be absorbed by health systems.

Box 7

Prevention Strategies

Prevention strategies include primary, secondary, or tertiary interventions. Primary prevention is the prevention of disease before it occurs (“How do we keep ourselves well?”). For potentially lethal genetic conditions and other chromosomal disorders that are passed from parent to child, medical and community-based interventions usually focus on carrier detection, premarital counseling, prenatal diagnosis, and pregnancy termination (the latter may not be considered primary prevention). Such approaches have been applied for several single-gene conditions such as Tay-Sachs disease and chromosomal disorders such as Down syndrome.¹

Primary prevention can also be used for other genetically influenced disorders. One example is an exciting opportunity for primary prevention of neural tube defects, such as spina bifida.² Maternal folate supplementation reduces the risk of recurrence of neural tube defects, and making food fortified with folic acid available to women of reproductive age may be the most cost-effective way to prevent this disorder.

Secondary prevention (“If we are getting sick, how can we detect these conditions early?”) targets clinical manifestations of disease through early detection and intervention during the preclinical phase of the disease. A classic example in public health genetics is newborn screening for metabolic disorders such as phenylketonuria—an abnormal excretion of amino acid.

Tertiary prevention minimizes the effects of disease by preventing complications and deterioration (“If we are sick, how do we get the best

care?”). One example of tertiary prevention for a genetic disease is antibiotic prophylaxis and immunization for individuals with sickle-cell anemia in order to prevent life-threatening bacterial infections.

But most chronic diseases are not caused by a single factor. No single gene accounts for a significant fraction of cases of a given disease, and not all persons with a susceptibility genotype for that disease will develop it. The use of genetic tests is, however, likely to improve the predictive value of environmental risk factors. Researchers might find, for example, that individuals with the genotype for a given type of cancer are more likely to develop the disease if they had worked with certain chemicals. In the future, primary prevention of many chronic diseases could involve identifying and removing environmental factors that lead to clinical disease among persons with susceptibility genotypes. But the additional knowledge about genetic susceptibility and risk factors will also create difficult dilemmas for families at a high risk for developing diseases. They will need to decide how much to change their aspirations for children, occupations, and lifestyles to avoid the risk of disease.

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Health care systems need help to capitalize on the wealth of information and new means of communicating.

Governments may not be the most efficient distributors of information. Global corporations have surpassed national governments in resources. In particular, they have the ability to reach millions of people through their products and their business operations. Corporations can use their considerable power to further social good—like good health—and thus be at the forefront of a revolution in health made possible through effective health communication. National governments and international organizations can provide incentives for corporations to use their power to promote general health.

New technologies and research promise exciting developments at all levels of health intervention. Passive public health delivery systems might include such primary prevention interventions as smart airbags for automobiles, food fortified with micronutrients, new vaccines for endemic regions, and flouridated water. More active interventions are being developed for cancer: chemotherapy to prevent cancer, earlier detection and treatment, cancer vaccines, and cancer-fighting viruses and antibodies.

Biologists are also developing new foods with potential health benefits. Cholesterol-busting margarine, cow's milk containing vaccines or medicines (in a process called "pharming") and genetically altered, vitamin A-enriched rice offer passive delivery of public health interventions. Primary prevention can also help control genetic diseases (see Box 7).

New indices and measures can be developed to capitalize on new technologies and allow individuals to take a more active role in their health. Data on an individual's blood pressure, body mass index, cholesterol, and other indices might be used by future public health interventions. The development of comprehensive global health indicators could also help focus society on prevention. Ideally,

health indicators could be established by credible international organizations (such as WHO), could receive publicity in the news media, and could be adapted locally so that every citizen could compare their individual and community health.

Summary

As 6 billion people begin a new century and millennium, global health and resources are strained. Yet we have the ability, unlike other generations, to navigate within an environment and global marketplace unparalleled in history. The question "Can the world be healthy?" is not answered simply. If we marshaled all of our resources to overcome poverty, we would still have infectious and noncommunicable diseases, albeit at lower levels. We can still aim for health for all, but this will require a commitment and investment of scientific know-how to the idea of creating "ideal health." If we strive to integrate health into all sectors of society and generate the same level of enthusiasm as we have for economic growth, we will move into a new health age.

The future will challenge us to use our knowledge to fight disease. We can use our wisdom to prevent disease, build a society with healthy economic and environmental development, and offer scientific progress to support our behavioral commitment to quality of life and health. With such wisdom, we can embark on a new age in the 21st century: a postmodern industrial age, a communication age.

Global health is not simplistic or stochastic. There is no single intervention that can establish trusted health leadership to advance health. It is our hope, however, that we can strive to create health with realistic expectations for the future. We can all be healthy; it begins at home, at work, at school, in government, and in our environment. But most important, health begins with ourselves.

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