

The World Bank
Investing in Health, 1993

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Overview

Over the past forty years life expectancy has improved more than during the entire previous span of human history. In 1950 life expectancy in developing countries was forty years; by 1990 it had increased to sixty-three years. In 1950 twenty-eight of every 100 children died before their fifth birthday; by 1990 the number had fallen to ten. Smallpox, which killed more than 5 million annually in the early 1950s, has been eradicated entirely. Vaccines have drastically reduced the occurrence of measles and polio. Not only do these improvements translate into direct and significant gains in well-being, but they also reduce the economic burden imposed by unhealthy workers and sick or absent schoolchildren. These successes have come about in part because of growing incomes and increasing education around the globe and in part because of governments' efforts to expand health services, which, moreover, have been enriched by technological progress.

Despite these remarkable improvements, enormous health problems remain. Absolute levels of mortality in developing countries remain unacceptably high: child mortality rates are about ten times higher than those in the established market economies. If death rates among children in poor countries were reduced to those prevailing in the rich countries, 11 million fewer children would die each year. Almost half of these preventable deaths are a result of diarrheal and respiratory illness, exacerbated by malnutrition. In addition, every year 7 million adults die of conditions that could be inexpensively prevented or cured; tuberculosis alone causes 2 million of these deaths. About 400,000 women die from the direct complications of pregnancy and childbirth. Maternal mortality

ratios are, on average, thirty times as high in developing countries as in high-income countries.

Although health has improved even in the poorest countries, the pace of progress has been uneven. In 1960 in Ghana and Indonesia about one child in five died before reaching age 5—a child mortality rate typical of many developing countries. By 1990 Indonesia's rate had dropped to about one-half the 1960 level, but Ghana's had fallen only slightly. Table 1 provides a summary of regional progress in mortality reduction between 1975 and 1990. (Figure 1 illustrates the demographic regions used in Table 1 and frequently throughout this Report.)

In addition to premature mortality, a substantial portion of the burden of disease consists of disability, ranging from polio-related paralysis to blindness to the suffering brought about by severe psychosis. To measure the burden of disease, this Report uses the disability-adjusted life year (DALY), a measure that combines healthy life years lost because of premature mortality with those lost as a result of disability.

There is huge variation in per person loss of DALYs across regions, mainly because of differences in premature mortality; regional differences in loss of DALYs as a result of disability are much smaller (Figure 2). The total loss of DALYs is referred to as the global burden of disease.

The world is facing serious new health challenges. By 2000 the growing toll from acquired immune deficiency syndrome (AIDS) in developing countries could easily rise to more than 1.8 million deaths annually, erasing decades of hard-won reductions in mortality. The malaria parasite's increased resistance to available drugs could lead to

The first six regions named in the key are at intermediate stages of the demographic transition.

Figure 1 Demographic regions used in this Report

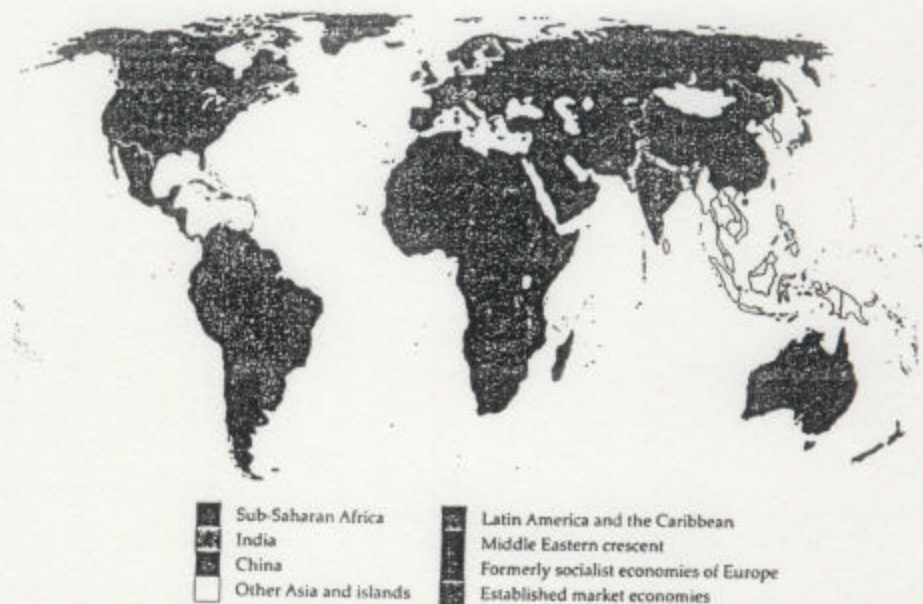


Table 1 Population, economic indicators, and progress in health by demographic region, 1975-90

Region	Population, 1990 (millions)	Deaths, 1990 (millions)	Income per capita		Child mortality		Life expectancy at birth (years)	
			Dollars, 1990	Growth rate, 1975-90 (percent per year)	1975	1990	1975	1990
Sub-Saharan Africa	510	7.9	510	-1.0	212	175	48	52
India	850	9.3	360	2.5	195	127	53	58
China	1,134	8.9	370	7.4	85	43	56	69
Other Asia and islands	683	5.5	1,320	4.6	135	97	56	62
Latin America and the Caribbean	444	3.0	2,190	-0.1	104	60	62	70
Middle Eastern crescent	503	4.4	1,720	-1.3	174	111	52	61
Formerly socialist economies of Europe (FSE)	346	3.8	2,850	0.5	36	22	70	72
Established market economies (EME)	798	7.1	19,900	2.2	21	11	73	76
Demographically developing group ^a	4,123	39.1	900	3.0	152	106	56	63
FSE and EME	1,144	10.9	14,690	1.7	25	15	72	75
World	5,267	50.0	4,000	1.2	135	96	60	65

Note: Child mortality is the probability of dying between birth and age 5, expressed per 1,000 live births; life expectancy at birth is the average number of years that a person would expect to live at the prevailing age-specific mortality rates.

a. The countries of the demographic regions Sub-Saharan Africa, India, China, Other Asia and islands, Latin America and the Caribbean, and Middle Eastern crescent.

Source: For income per capita, World Bank data; for other items, Appendix A.

a doubling of malaria deaths, to nearly 2 million a year within a decade. Rapid progress in reducing child mortality and fertility rates will create new demands on health care systems as the aging of populations brings to the fore costly noncommunicable diseases of adults and the elderly. Tobacco-related deaths from heart disease and cancers alone are likely to double by the first decade of the next century, to 2 million a year, and, if present smoking patterns continue, they will grow to more than 12 million a year in developing countries in the second quarter of the next century.

Health systems and their problems

Although health services are only one factor in explaining past successes, the importance of their

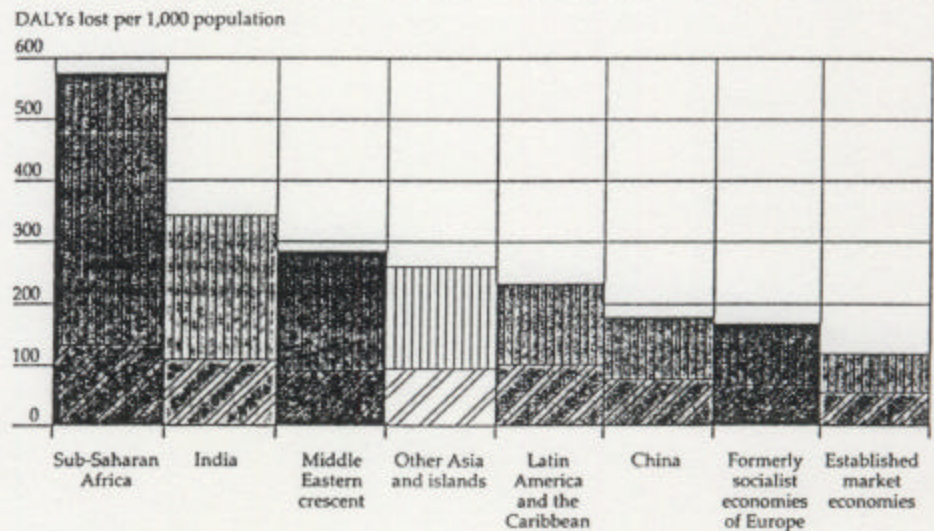
role in the developing world is not in doubt. Public health measures brought about the eradication of smallpox and have been central to the reduction in deaths caused by vaccine-preventable childhood diseases. Expanded and improved clinical care has saved millions of lives from infectious diseases and injuries. But there are also major problems with health systems that, if not resolved, will hamper progress in reducing the burden of premature mortality and disability and frustrate efforts to respond to new health challenges and emerging disease threats.

• *Misallocation.* Public money is spent on health interventions of low cost-effectiveness, such as surgery for most cancers, at the same time that critical and highly cost-effective interventions, such as treatment of tuberculosis and sexually

The disease burden is highest in poor countries, but disability remains a problem in all regions.

Figure 2 Burden of disease attributable to premature mortality and disability, by demographic region, 1990

▨ Premature mortality
▤ Disability



Source: Appendix B.

transmitted diseases (STDs), remain underfunded. In some countries a single teaching hospital can absorb 20 percent or more of the budget of the ministry of health, even though almost all cost-effective interventions are best delivered at lower-level facilities.

- *Inequity.* The poor lack access to basic health services and receive low-quality care. Government spending for health goes disproportionately to the affluent in the form of free or below-cost care in sophisticated public tertiary care hospitals and subsidies to private and public insurance.

- *Inefficiency.* Much of the money spent on health is wasted: brand-name pharmaceuticals are purchased instead of generic drugs, health workers are badly deployed and supervised, and hospital beds are underutilized.

- *Exploding costs.* In some middle-income developing countries health care expenditures are growing much faster than income. Increasing numbers of general physicians and specialists, the availability of new medical technologies, and expanding health insurance linked to fee-for-service payments together generate a rapidly growing demand for costly tests, procedures, and treatments.

World health spending—and thus also the potential for misallocation, waste, and inequitable distribution of resources—is huge. For the world as a whole in 1990, public and private expenditure on health services was about \$1,700 billion, or 8 percent of total world product. High-income countries spent almost 90 percent of this amount, for an average of \$1,500 per person. The United States alone consumed 41 percent of the global total—more than 12 percent of its gross national product (GNP). Developing countries spent about \$170 billion, or 4 percent of their GNP, for an average of \$41 per person—less than one-thirtieth the amount spent by rich countries.

In the *low-income countries* government hospitals and clinics, which account for the greatest part of the modern medical care provided, are often inefficient, suffering from highly centralized decision-making, wide fluctuations in budgetary allocations, and poor motivation of facility managers and health care workers. Private providers—mainly religious nongovernmental organizations (NGOs) in Africa and private doctors and unlicensed practitioners in South Asia—are often more technically efficient than the public sector and offer a service that is perceived to be of higher quality, but they are not supported by government policies. In low-income countries the poor often

lose out in health because public spending in the sector is heavily skewed toward high-cost hospital services that disproportionately benefit better urban groups. In Indonesia, despite concerted government efforts in the 1980s to improve health services for the poor, government subsidies for the richest 10 percent of households in 1990 were still almost three times the subsidies going to the poorest 10 percent of Indonesians.

In *middle-income countries* governments frequently subsidize insurance that protects only the relatively wealthy—a small, affluent minority. In the case of private insurance in South Africa and Zimbabwe and, in Latin America, the larger industrial labor force covered by compulsory public insurance (so-called social insurance). The bulk of the population, especially the poor, relies heavily on out-of-pocket payments and on government services that may be largely inaccessible to them. In Peru, for example, more than 60 percent of the poor have to travel for more than an hour to obtain primary health care, as compared with less than 3 percent of the better-off. The quality of care is also low: drugs and equipment are in short supply; patient waiting times are long and medical consultations are short; and misdiagnoses and inappropriate treatment are common.

In the *formerly socialist economies*, where governments have historically been responsible for both the financing and the delivery of health care, health care is free in principle, and wide coverage of the population has been achieved. This has led to greater apparent equity. But in reality, better-off consumers make informal out-of-pocket payments to get better care: about 25 percent of health costs in Romania and 20 percent in Hungary, for example, are under-the-table payments for pharmaceuticals and gratuities to health care providers. Inefficiency is also widespread because the government-run health system is highly centralized, bureaucratic, and unresponsive to citizens. Governments have been slow to regulate workplace safety and environmental pollution and have failed to mount effective campaigns against unhealthy personal behaviors—especially alcohol consumption and cigarette smoking. In recent years real government spending for health has fallen dramatically in the course of the transition to more market-oriented economies. The public sector has suffered from serious shortages of drugs and equipment and a lack of skills to manage changing health institutions. The consequences have been declining staff morale and falling quality of care.

The roles of the government and of the market in health

Three rationales for a major government role in the health sector should guide the reform of health systems.

- Many health-related services such as information and control of contagious disease are *public goods*. One person's use of health information does not leave less available for others to consume; one person cannot benefit from control of malaria-carrying mosquitoes while another person in the same area is excluded. Because private markets alone provide too little of the public goods crucial for health, government involvement is necessary to increase the supply of these goods. Other health services have large *externalities*: consumption by one individual affects others. Immunizing a child slows transmission of measles and other diseases, conferring a positive externality. Polluters and drunk drivers create negative health externalities. Governments need to encourage behaviors that carry positive externalities and to discourage those with negative externalities.

- Provision of cost-effective health services to the poor is an effective and socially acceptable approach to *poverty reduction*. Most countries view access to basic health care as a human right. This perspective is embodied in the goal, "Health for All by the Year 2000," of the conference held by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) at Alma-Ata in 1978, which launched today's primary health care movement. Private markets will not give the poor adequate access to essential clinical services or the insurance often needed to pay for such services. Public finance of essential clinical care is thus justified to alleviate poverty. Such public funding can take several forms: subsidies to private providers and NGOs that serve the poor; vouchers that the poor can take to a provider of their choice; and free or below-cost delivery of public services to the poor.

- Government action may be needed to compensate for problems generated by *uncertainty and insurance market failure*. The great uncertainties surrounding the probability of illness and the efficacy of care give rise both to strong demand for insurance and to shortcomings in the operation of private markets. One reason why markets may work poorly is that variations in health risk create incentives for insurance companies to refuse to insure the very people who most need health insurance—those who are already sick or are likely to become

ill. A second has to do with "moral hazard": insurance reduces the incentives for individuals to avoid risk and expense by prudent behavior and can create both incentives and opportunities for doctors and hospitals to give patients more care than they need. A third has to do with the asymmetry in information between provider and patient concerning the outcomes of intervention; providers advise patients on choice of treatment, and when the providers' income is linked to this advice, excessive treatment can result. As a consequence of these last two considerations, in unregulated private markets costs escalate without appreciable health gains to the patient. Governments have an important role to play in regulating privately provided health insurance, or in mandating alternatives such as social insurance, in order to ensure widespread coverage and hold down costs.

If governments do intervene, they must do so intelligently, or they risk exacerbating the very problems they are trying to solve. When governments become directly involved in the health sector—by providing public health programs or financing essential clinical services for the poor—policymakers face difficult decisions concerning the allocation of public resources. For any given amount of total spending, taxpayers and, in some countries, donors want to see maximum health gain for the money spent. An important source of guidance for achieving value for money in health spending is a measure of the cost-effectiveness of different health interventions and medical procedures—that is, the ratio of costs to health benefits (DALYs gained).

Until recently, little has been done to apply cost-effectiveness analysis to health. This is, in part, because it is difficult. Cost and effectiveness data on health interventions are often weak. Costs vary between countries and can rise or fall sharply as a service is expanded. Some groups of interventions are provided jointly, and their costs are shared. Nonetheless, cost-effectiveness analysis is already demonstrating its usefulness as a tool for choosing among possible health interventions in individual countries and for addressing specific health problems such as the spread of AIDS.

Just because a particular intervention is cost-effective does not mean that public funds should be spent on it. Households can buy health care with their own money and, when well informed, may do this better than governments can do it for them. But households also seek value for money, and governments, by making information about cost-effectiveness available, can often help im-

Box 1 Investing in health: key messages of this Report

This Report proposes a three-pronged approach to government policies for improving health.

Foster an environment that enables households to improve health

Household decisions shape health, but these decisions are constrained by the income and education of household members. In addition to promoting overall economic growth, governments can help to improve those decisions if they:

- Pursue economic growth policies that will benefit the poor (including, where necessary, adjustment policies that preserve cost-effective health expenditures)
- Expand investment in schooling, particularly for girls
- Promote the rights and status of women through political and economic empowerment and legal protection against abuse.

Improve government spending on health

The challenge for most governments is to concentrate resources on compensating for market failures and efficiently financing services that will particularly benefit the poor. Several directions for policy respond to this challenge:

- Reduce government expenditures on tertiary facilities, specialist training, and interventions that provide little health gain for the money spent.
- Finance and implement a package of public health interventions to deal with the substantial externalities surrounding infectious disease control, prevention of AIDS, environmental pollution, and behaviors (such as drunk driving) that put others at risk.
- Finance and ensure delivery of a package of essential clinical services. The comprehensiveness and composition of such a package can only be defined by each country, taking into account epidemiological conditions, local preferences, and income. In most countries public finance, or publicly mandated finance, of the essential clinical package would provide a politically acceptable mechanism for distributing both welfare im-

provements and a productive asset—better health—to the poor.

- Improve management of government health services through such measures as decentralization of administrative and budgetary authority and contracting out of services.

Promote diversity and competition

Government finance of public health and of a nationally defined package of essential clinical services would leave the remaining clinical services to be financed privately or by social insurance within the context of a policy framework established by the government. Governments can promote diversity and competition in provision of health services and insurance by adopting policies that:

- Encourage social or private insurance (with regulatory incentives for equitable access and cost containment) for clinical services outside the essential package.
- Encourage suppliers (both public and private) to compete both to deliver clinical services and to provide inputs, such as drugs, to publicly and privately financed health services. Domestic suppliers should not be protected from international competition.
- Generate and disseminate information on provider performance, on essential equipment and drugs, on the costs and effectiveness of interventions, and on the accreditation status of institutions and providers.

Increased scientific knowledge has accounted for much of the dramatic improvement in health that has occurred in this century—by providing information that forms the basis of household and government action and by underpinning the development of preventive, curative, and diagnostic technologies. Investment in continued scientific advance will amplify the effectiveness of each element of the three-pronged approach proposed in this Report. Because the fruits of science benefit all countries, internationally collaborative efforts, of which there are several excellent examples, will often be the right way to proceed.

prove the decisions of private consumers, providers, and insurers.

Government policies for achieving health for all

This Report focuses primarily on the relation between policy choices, both inside and outside the health sector, and health outcomes, especially for the poor. Box 1 summarizes the Report's three key messages for government policy and notes the im-

portance of continued investment in scientific advance.

- Since overall economic growth—particularly poverty-reducing growth—and education are central to good health, governments need to pursue sound macroeconomic policies that emphasize reduction of poverty. They also need to expand basic schooling, especially for girls, because the way in which households, particularly mothers, use information and financial resources to shape their

dietary, fertility, health care, and other life-style choices has a powerful influence on the health of household members.

- Governments in developing countries should spend far less—on average, about 50 percent less—than they now do on less cost-effective interventions and instead double or triple spending on basic public health programs such as immunizations and AIDS prevention and on essential clinical services. A minimum package of essential clinical services would include sick-child care, family planning, prenatal and delivery care, and treatment for tuberculosis and STDs. Low-income countries would have to redirect current public spending for health and increase expenditures (by government, donors, and patients) to meet needs for public health and the minimum package of essential clinical services for their populations; less reallocation would be needed in middle-income countries. Tertiary care and less cost-effective services will continue, but public subsidies to them, if they mainly benefit the wealthy, should be phased out during a transitional period.

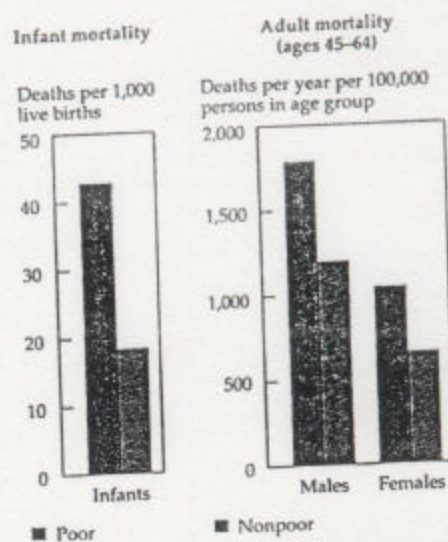
- Because competition can improve quality and drive down costs, governments should foster competition and diversity in the supply of health services and inputs, particularly drugs, supplies, and equipment. This could include, where feasible, private supply of health care services paid for by governments or social insurance. There is also considerable scope for improving the quality and efficiency of government health services through a combination of decentralization, performance-based incentives for managers and clinicians, and related training and development of management systems. Exposing the public sector to competition with private suppliers can help to spur such improvements. Strong government regulation is also crucial, including regulation of privately delivered health services to ensure safety and quality and of private insurance to encourage universal access to coverage and to discourage practices—such as fee-for-service payment to providers reimbursed by a “third-party” insurer—that lead to overuse of services and escalation of costs.

Improving the economic environment for healthy households

Advances in income and education have allowed households almost everywhere to improve their health. In the 1980s, even in countries in which average incomes fell, death rates of children under age 5 declined by almost 30 percent. But the child mortality rate fell more than twice as much in

The poor suffer far higher levels of mortality at all ages than do the rich

Figure 3 Infant and adult mortality in poor and nonpoor neighborhoods of Porto Alegre, Brazil, 1980



Note: Poor neighborhoods were defined according to specific criteria. They are, broadly, squatter settlements with substandard housing and infrastructure.
Source: Barcellos and others 1986.

countries in which average incomes rose by more than 1 percent a year. Economic policies conducive to sustained growth are thus among the most important measures governments can take to improve their citizens' health.

Of these economic policies, increasing the income of those in poverty is the most efficacious for improving health. The reason is that the poor are most likely to spend additional income in ways that enhance their health: improving their diet, obtaining safe water, and upgrading sanitation and housing. And the poor have the greatest remaining health needs, as Figure 3 illustrates for Porto Alegre, Brazil. Government policies that promote equity and growth together will therefore be better for health than those that promote growth alone.

In the 1980s many countries undertook macro-economic stabilization and adjustment programs

designed to deal with severe economic imbalances and move the countries onto sustainable growth paths. Such adjustment is clearly needed for long-run health gains. But during the transitional period, and especially in the earliest adjustment programs, recession and cuts in public spending slowed improvements in health. This effect was less than originally feared, however—in part because earlier expenditures for improving health and education had enduring effects. As a result of this experience, most countries' adjustment programs today try to rationalize overall government spending while maintaining cost-effective expenditures in health and education. Despite these improvements, much is still to be learned about more efficient ways of carrying out stabilization and adjustment programs while protecting the poor.

Policies to expand schooling are also crucial for promoting health. People who have had more schooling seek and utilize health information more effectively than those with little or no schooling. This means that rapid expansion of educational opportunities—in part by setting a high minimum standard of schooling (say, six full years) for all—is a cost-effective way of improving health. Education of girls and women is particularly beneficial to household health because it is largely women who buy and prepare food, maintain a clean home, care for children and the elderly, and initiate contacts with the health system. Beyond education, government policies that support the rights and economic opportunities of women also contribute to overall household well-being and better health.

Investing in public health and essential clinical services

The health gain per dollar spent varies enormously across the range of interventions currently financed by governments. Redirecting resources from interventions that have high costs per DALY gained to those that cost little could dramatically reduce the burden of disease without increasing expenditures. A limited package of public health measures and essential clinical interventions is a top priority for government finance; some governments may wish, after covering that minimum for everyone, to define their national essential package more broadly.

Public health

Government action in many areas of public health has already had an important payoff. Immuniza-

tions are currently saving an estimated 3 million lives a year. Social marketing of condoms to prevent transmission of human immunodeficiency virus (HIV) has proved highly successful in Uganda, Zaire, and elsewhere. Information on the risks of smoking, and taxes on both tobacco and alcohol are changing behavior in some countries—although mostly, so far, in the richer countries.

Governments need to expand these efforts and to move forward with other promising public health initiatives. Several activities stand out because they are highly cost-effective: the cost of gaining one DALY can be remarkably low—some times less than \$25 and often between \$50 and \$150. Activities in this category include:

- Immunizations
- School-based health services
- Information and selected services for family planning and nutrition
- Programs to reduce tobacco and alcohol consumption
- Regulatory action, information, and limited public investments to improve the household environment
- AIDS prevention.

Intensified government support is required to extend the Expanded Programme on Immunization (EPI), which currently protects about 80 percent of the children in the developing world against six major diseases at a cost of about \$1.4 billion a year. Expanding EPI coverage to 95 percent of all children would have a significant impact on children in poor households, who make up a disproportionately large share of those not yet reached by the EPI. Other vaccines, particularly those for hepatitis B and yellow fever, could be added to the six currently included in the EPI, as could vitamin A and iodine supplements. In most developing countries such an "EPI Plus" cluster of interventions in the first year of life would have the highest cost-effectiveness of any health measure available in the world today.

A second high priority for governments should be to provide inexpensive and highly efficacious medications to treat school-age children afflicted with schistosomiasis, intestinal worm infections, and micronutrient deficiencies. Treatment of these conditions through distribution of medications and micronutrient supplements in schools would greatly improve the health, school attendance, and learning achievement of hundreds of millions of children, at a cost of \$1 to \$2 per child per year. In addition to treatment, schoolchildren can be taught by their teachers or by radio about the hu-

man body and about avoiding risks to health—for example, from smoking or unsafe sex.

Governments need to encourage healthier behaviors on the part of individuals and households by providing information on the benefits of breast-feeding and on how to improve children's diets. Programs in Colombia, Indonesia, and elsewhere show the potential for success. Information on the benefits of family planning and on the availability of family planning services is also critical. Government dissemination of this information can take a number of creative forms, as the effective use of radio drama and folk theater in Kenya and Zimbabwe demonstrates.

Measures to control the use of tobacco, alcohol, and other addictive substances—through information campaigns, taxes, bans on advertising, and, in certain cases, import controls—can help substantially to reduce chronic lung disease, heart disease, cancer, and injuries. Unless smoking behavior changes, three decades from now premature deaths caused by tobacco in the developing world will exceed the expected deaths from AIDS, tuberculosis, and complications of childbirth combined.

Governments must do more to promote a healthier environment, especially for the poor, who face greatly increased health risks from poor sanitation, insufficient and unsafe water supplies, poor personal and food hygiene, inadequate garbage disposal, indoor air pollution, and crowded and inferior housing. Collectively, these risks are associated with nearly 30 percent of the global burden of disease. To help the poor improve their household environments, governments can provide a regulatory and administrative framework within which efficient and accountable providers (often in the private sector) have an incentive to offer households the services they want and are willing to pay for, including water supply, sanitation, garbage collection, clean-burning stoves, and housing. The government has a vital role in disseminating information about hygienic practices. It can also improve the use of public resources by eliminating widespread subsidies for water and sanitation that benefit the middle class. Government legislation and regulations to increase security of land tenure for the poor would encourage low-income families to invest more in safer, healthier housing.

A special challenge for concerted public health action is to reduce the spread of AIDS. The AIDS epidemic has already become a dominant public health concern in many countries. Although HIV, the virus that causes AIDS, has only recently be-

gun to spread through human populations, it has so far caused 2 million deaths and infected about 13 million individuals. Some parts of the developing world are already heavily infected: in Sub-Saharan Africa an average of one in forty adults has the virus, and in certain cities the rate is one in three. In Thailand one adult in fifty is infected. More than 90 percent of the infected individuals are in their economically most productive years, ages 15–40. They will be developing AIDS and dying over the next decade. Projections of the future course of the epidemic are gloomy: conservative estimates from WHO are that by 2000, 26 million individuals will be HIV-infected and 1.8 million a year will die of AIDS. By destroying individuals' immune systems, HIV will also vastly worsen the spread of other diseases, especially tuberculosis. In highly affected areas demand for AIDS treatment will overwhelm capacity for clinical treatment and cause a deterioration of care for other illnesses.

What governments need to do is clear: intervene early, before a major epidemic gets under way. Countries as diverse as Bangladesh, Ghana, and Indonesia share the preconditions for rapid transmission of HIV—substantial numbers of prostitutes and high rates of prevalence of other STDs, such as syphilis, gonorrhea, and chancroid, which facilitate the spread of the AIDS virus. Strong public action is required to reduce HIV transmission. Particularly important are efforts targeted to high-risk groups: information to promote change in sexual behavior; distribution of condoms; and treatment for other STDs. Early reduction in HIV transmission by high-risk individuals is very cost-effective, but later in an AIDS epidemic the cost-effectiveness of interventions declines substantially. Current expenditures on AIDS prevention in developing countries—totaling less than \$200 million a year—are woefully inadequate. Five to ten times this level of spending is needed to deal with the emerging epidemic.

Essential clinical services

The components of a package of essential clinical services of high cost-effectiveness will vary from country to country, depending on local health needs and the level of income. At a minimum, the package should include five groups of interventions each of which addresses very large disease burdens. The five groups are:

- * Services to ensure pregnancy-related (prenatal, childbirth, and postpartum) care; strength-

ened efforts could prevent most of the almost half-million maternal deaths that occur each year in developing countries.

- Family planning services; improved access to these services could save as many as 850,000 children from dying every year and eliminate as many as 100,000 of the maternal deaths that occur annually.

- Tuberculosis control, mainly through drug therapy, to combat a disease that kills more than 2 million people annually, making it the leading cause of death among adults.

- Control of STDs, which account for more than 250 million new cases of debilitating and sometimes fatal illness each year.

- Care for the common serious illnesses of young children—diarrheal disease, acute respiratory infection, measles, malaria, and acute malnutrition—which account for nearly 7 million child deaths annually.

These clinical interventions are all highly cost-effective—often costing substantially less than \$50 per DALY gained.

A minimal package of essential clinical services would also include some treatment for minor infection and trauma and, for health problems that cannot be fully resolved with existing resources, advice and alleviation of pain. The provision of hospital-based emergency care other than the interventions mentioned above would depend on day-to-day capacity and availability of resources. This emergency care includes, for example, treatment of most fractures, as well as appendectomies. Depending on resource availability and social values, some countries may define their essential clinical package to include a much

broader range of interventions than this minimum. At modest increases in spending, relatively cost-effective measures for the treatment of some common noncommunicable conditions could be included. Examples are low-cost protocols for treatment of heart disease using aspirin and a hypertensive drugs; treatment for cervical cancer; drug treatment of some psychoses; and removal of cataracts.

Many health services have such low cost-effectiveness that governments will need to consider excluding them from the essential clinical package. In low-income countries these might include heart surgery; treatment (other than pain relief) of highly fatal cancers of the lung, liver, and stomach; expensive drug therapies for HIV infection; and intensive care for severely premature babies. It is hard to justify using government funds for these medical treatments at the same time if much more cost-effective services which benefit mainly the poor are not adequately financed.

Widespread adoption of an essential clinical package would have a tremendous positive impact on the health of people in developing countries: 80 percent of the population were reached, 24 percent of the current burden of disease in low-income countries and 11 percent of that in middle-income countries could be averted (Table 2). The estimated impact of implementing the minimum clinical services is more than twice that for the public health package outlined above; when combined with the public health package, the share of current illness that could be eliminated rises to perhaps 32 percent for low-income countries and 15 percent for middle-income countries. This reduction in disease is equivalent, in terms of DALYs

Table 2 Estimated costs and health benefits of the minimum package of public health and essential clinical services in low- and middle-income countries, 1990

Group	Cost (dollars per capita per year) ^a	Cost as a percentage of income per capita	Approximate reduction in burden of disease (percent)
<i>Low-income countries</i> (Income per capita = \$350)			
Public health	4.2	1.2	8
Essential clinical services ^a	7.8	2.2	24
Total	12.0	3.4	32
<i>Middle-income countries</i> (Income per capita = \$2,500)			
Public health	6.8	0.3	4
Essential clinical services ^a	14.7	0.6	11
Total	21.5	0.9	15

a. The estimated costs and benefits are for a minimum essential package of clinical services, as defined in the text. Many countries may wish, if they have the resources, to define their essential clinical package more broadly.
Source: World Bank calculations.

gained, to saving the lives of more than 9 million infants each year.

Paying for the package

The most sophisticated facility required to deliver the minimum elements of the essential clinical package is a district hospital. Providing services in lower-level facilities allows costs to be contained at modest levels for minimal versions of the essential clinical package. The cost is about \$8 per person each year in low-income countries and \$15 in middle-income countries. The cost differences are the result of distinct demographic structures, epidemiological conditions, and labor costs in the two settings. When the cost of the public health interventions described above is added, total costs rise to \$12 per capita in low-income countries and \$22 per capita in middle-income countries.

Adoption of the package in all developing countries would require a quadrupling of expenditures on public health, from \$5 billion at present to \$20 billion a year, and an increase from about \$20 billion to \$40 billion in spending on essential clinical services. In the poorest countries governments typically spend about \$6 per person for health and total health expenditures are about \$14 per person. There, paying for an essential package will require a combination of increased expenditures by governments, donor agencies, and patients and some reorientation of current public spending for health. In middle-income countries, where public spending for health averages \$62 per person, the \$22 cost of the package is financially feasible if the political commitment exists for shifting existing resources away from discretionary services with lower cost-effectiveness toward public health programs and essential clinical care. These major changes cannot be made overnight, but it is important to start and complete them as swiftly as possible, before interest groups and bureaucratic inertia undermine reform.

A critical question in designing an essential clinical package is the extent of government financing. Should governments pay for everyone, or only for the poor? The main problem with universal government financing is that it subsidizes the wealthy, who could afford to pay for their own services, and thus leaves fewer government resources for the poor. A policy requiring those who can pay all or part of their own costs to do so may make sense on equity grounds, but it also has disadvantages. Often, the administrative costs of targeting are high, and exclusion of wealthy and middle-income

groups can lead to erosion of political support for the essential package and to decreased funding and lower quality of care. Furthermore, problems of cost escalation and access to insurance on the part of high-risk groups can complicate private finance. For these reasons, in most member countries of the Organization for Economic Cooperation and Development (OECD), governments finance (or mandate the financing of) comprehensively defined essential packages for virtually all their citizens.

In low-income countries, where current public spending for health is less than the cost of an essential package, some degree of targeting is inevitable. If the wealthy are already opting out of government-financed services because of the higher quality and convenience of privately financed services, targeting is fairly easy. Community-financing schemes, whereby patients at local health centers and pharmacies pay modest fees, are another option that can help both to improve the quality of care and, when fees are retained and managed locally, to sustain services. A large number of countries in Africa have had some early success with community financing as part of the Bamako Initiative led by UNICEF and WHO. Nonetheless, experience to date suggests that introduction of user fees at levels that do not discourage the poor is likely to be more useful for improving technical efficiency (for example, by facilitating drug supply) than for raising substantial revenues on a nationwide basis.

Reforming health systems: promoting diversity and competition

Ensuring basic public health services and essential clinical care while the rest of the health system becomes self-financed will require substantial health system reforms and reallocations of public spending. Only by reducing or eliminating spending on discretionary clinical services can governments concentrate on ensuring cost-effective clinical care for the poor. One way to do so is by charging fees to affluent patients who use government hospitals and services. In Chile, Kenya, Lesotho, and other countries governments are increasing user fees for the wealthy and for those covered by insurance and are strengthening the legal and administrative systems for billing patients and collecting revenues.

Promoting self-financed insurance, thus eliminating large and inequitable subsidies to the more affluent groups who are covered by insurance,

would also help to free government funds for public health programs and essential clinical care. Subsidies in the form of tax relief for contributions to private insurance are equal to nearly a fifth of total government spending for health in South Africa. In Latin America subsidies to the social insurance systems are widespread and include tax relief, direct transfers to cover the operating deficits of social security health funds, and matching government funds for employee payroll contributions. Where these subsidies benefit only the better-off in society, they need to be scaled back.

Reforms entail shifting new government spending for health away from specialized personnel, equipment, and facilities at the apex of health systems and "down the pyramid" toward the broad base of widely accessible care in community facilities and health centers. Very few cost-effective interventions depend on sophisticated hospitals and specialized physicians—all the services contained in the minimum essential clinical package proposed in this Report can be provided by health centers and district hospitals. Yet specialized facilities everywhere absorb a large amount of public resources, a problem that has frequently been exacerbated by donor investments in tertiary care facilities. In the 1980s Papua New Guinea, to correct overconcentration of resources on higher-level facilities, limited public spending on hospitals to 40 percent of the recurrent budget of the Ministry of Health—well below the level in most developing countries.

Governments need to use more effective policies for financing training (including use of national service mechanisms) to help meet the need for primary care providers, particularly nurses and midwives, and for public health, health policy, and management personnel. At the same time, governments should limit or eliminate subsidies for specialist training. Increased government support for health information systems and operations research would help to guide public policies for health. Estimates of the national burden of disease along the lines of the global burden of disease methodology used in this Report, and local information on the cost-effectiveness of different interventions, would enable governments to establish health priorities.

In every developing country decisive steps are needed to correct the pervasive inefficiency of clinical health programs and facilities and especially of government services. Clinics and outreach programs operate poorly because of shortages of drugs, transport, and maintenance. Hospitals

keep patients longer than necessary and poorly organized and managed. Countries pay much for drugs of low efficacy, and drugs and supplies are stolen or go to waste in government warehouses and hospitals.

In the short term, reforms in pharmaceuticals offer the greatest gains in efficiency. Governments that have introduced competition in procurement of drugs have typically achieved savings of 40 to 60 percent. Governments can develop national essential drug lists, consisting of a limited number of inexpensive drugs that address the important health problems of the population. Many countries have such lists, but not use them to guide the selection and procurement of drugs for the public sector. New treatment protocols and alternative uses of facilities can also raise efficiency. Outpatient surgery can replace some procedures customarily performed on an inpatient basis, at considerable savings.

In the long run, decentralization can help to increase efficiency when there is adequate capacity and accountability at lower levels of the national health system. Some countries, such as Botswana and Ghana, have delegated a wide range of management responsibilities to regional and district level offices of the ministry of health; other countries, including Chile and Poland, have devolved authority and resources to local government agencies. Their experience provides evidence that success is possible—but also that hasty and unplanned decentralization, sometimes purely in response to political pressures, can create new problems.

Greater reliance on the private sector to deliver clinical services, both those that are included by a country in its essential package and those that are discretionary, can help raise efficiency. The private sector already serves a large and diverse clientele in developing countries and often delivers services of higher quality without the long lines and inadequate supplies frequently found in government facilities. In many countries private doctors and pharmacies face unnecessary legal and administrative barriers, and these need to be removed. But the tendency for profit-making providers to overprescribe drugs, procedures, and diagnostics needs to be countered; encouraging the for-profit sector to move away from fee-for-service to prepaid coverage (through, for example, encouraging health maintenance organizations) is one feasible approach.

Governments could also subsidize private health care providers who deliver essential clinical

services to the poor. This is already beginning to happen and needs to go further. In many African countries, including Malawi, Uganda, and Zambia, governments subsidize the operating expenditures of church hospitals and clinics in rural areas and the training of their health personnel. In Bangladesh, Kenya, Thailand, and other countries, governments, with assistance from donors, are supporting the work of traditional birth attendants in safe pregnancy and delivery care and of traditional healers in controlling infectious diseases such as malaria, diarrhea, and AIDS.

Regulation is an essential element of government efforts to encourage private health care suppliers. In most countries, governments have an important role to play in ensuring the quality of private sector health care—through accreditation of hospitals and laboratories, licensing of medical schools and physicians, regulation of drugs, and reviews of medical practices. Some countries in which the government's ability to regulate is particularly weak could explore self-regulation for health care providers, while building up government capacity. In Brazil experiments with self-regulation for local hospital associations and medical ethics boards are now under way.

Government regulation of insurance is equally important. In some countries part of the population is denied insurance because of selection bias under private voluntary insurance. In the United States millions of people with high health risks—and thus high need for health insurance—are unable to obtain affordable coverage. Some types of insurance schemes also seem to contribute to pushing up health care costs; this is particularly true of third-party systems and of systems that reimburse hospitals and physicians item by item for any and all services performed. In both the Republic of Korea, which relies on universal social insurance, and the United States, which uses mostly private insurance, health care already absorbs an unusually high share of GNP—and costs are still rising. During the 1980s, for example, health expenditures in Korea increased from 3.7 to almost 7 percent of GNP, in large part because of expansion of third-party insurance coverage combined with fee-for-service provider compensation.

To eliminate selection bias and expand insurance coverage, governments can require insurers to pool risks across large numbers of people. To control costs, governments have a number of options for limiting payments to health providers. One approach is to encourage prepayment of a fixed amount for each person, as is now done in

private health maintenance organizations and in the British National Health Service. Another is for insurers jointly to negotiate uniform fees with doctors and hospitals, as is done in Japan's social insurance system and Zimbabwe's private medical aid insurance system; or insurers themselves can set fixed payments for specified medical diagnoses, as in Brazil. Yet a third approach, which has been tested on a limited scale in the United States, is "managed competition." This scheme pursues the three objectives of cost-effective health spending, universal insurance coverage, and cost containment simultaneously through tightly regulated competition among companies that provide a specified package of health care for a fixed annual fee. Each of these approaches has proved workable, but each also has its limits and disadvantages. There are no simple answers for health policymakers.

An agenda for action

Adoption of the main policy recommendations of this Report by developing country governments would enormously improve the health status of their people, especially poor households, and would also help to control health care spending (Table 3). Millions of lives and billions of dollars could be saved. Implementation of the public health and essential clinical care packages, pursuit of economic growth strategies that reduce poverty, and increased investment in schooling for girls would have the largest payoffs in averting deaths and reducing disability. Scaling back public spending for tertiary care facilities, specialist training, and clinical care with lower cost-effectiveness would help to increase the effectiveness of health spending. So would encouragement of competition in delivery of health services and regulation of insurance and of provider payment systems.

These recommendations will facilitate progress toward the goal contained in the declaration from the historic 1978 Alma-Ata conference: "The attainment of all peoples of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life." Continued momentum toward this goal was provided by the 1990 World Summit for Children. Almost 150 countries have now signed commitments to specific goals for their countries to improve the health of children and women (Box 2). These goals include reduction of child mortality rates by one-third (or to 70 per 1,000 births, whichever would be less) over the course of the decade of the 1990s,

Table 3 Contribution of policy change to objectives for the health sector

Government objectives and policies	Contribution to goals		
	Improving health outcomes	Reaching the disadvantaged	Containing costs
<i>Foster an enabling environment for households to improve health</i>			
Pursue economic growth policies that benefit the poor	■	■	□
Expand investment in education, particularly for females	■	■	□
Promote the rights and status of women through political and economic empowerment and legal protection against abuse	■	■	□
<i>Improve government investments in health</i>			
Reduce government expenditures for tertiary care facilities, specialist training, and discretionary services	□	■	■
Finance and ensure delivery of a public health package, including AIDS prevention	■	■	■
Finance and ensure delivery of essential clinical services, at least to the poor	■	■	■
Improve the management of public health services	■	■	■
<i>Facilitate involvement by the private sector</i>			
Encourage private finance and provision of insurance (with incentives to contain costs) for all discretionary clinical services	□	□	■
Encourage private sector delivery of clinical services (including those that are publicly financed)	□	□	■
Provide information on performance and cost	□	□	□

Very favorable
 Favorable
 Somewhat favorable
 No impact expected

reduction of maternal mortality rates by half, eradication of polio, and major reductions in morbidity and mortality from several other diseases. Commitments to specific improvements in education, nutrition, water supply, and sanitation were also made. These commitments underscore the political potential of action agendas for improving health.

The relevance of the main recommendations of this Report varies from one setting to another. In low-income countries renewed emphasis on basic schooling for girls, strengthening of public health programs, and support for expanded public fi-

nancing of essential clinical services should be at the top of the policy agenda. In most middle-income countries these policies are still germane, but reducing public subsidies for insurance and discretionary care would also yield large benefits and should therefore be a key element of policy change. In the formerly socialist economies there are two particularly crucial policy areas—improving the management of government health services and developing sustainable health-financing systems that maintain universal coverage while encouraging competition among cost-conscious suppliers.

Box 2 The World Summit for Children

The declaration and plan of action adopted at the World Summit for Children, held in New York in 1990, incorporate a politically salient agenda for health. The summit focused, in particular, on the needs of children and women but was set in the broader context of human and community goals. The seventy-one heads of state who attended and the seventy-seven more who subsequently signed the declaration committed their countries to developing national programs of action (NPAs) for achieving these goals. To date, about eighty-five countries have drawn up NPAs, and another sixty are in the process of preparing them.

NPAs typically cover, among other concerns, primary health care, family planning, safe water, environmental sanitation, nutrition, and basic education. Because of their concentration on the welfare of children, NPAs are able to transcend political differences. They offer a means of mobilizing the whole of civil society—neighborhood and civic associations, religious groups and professional bodies, businesses, voluntary agencies, organized labor, and universities—in the cause of investment for health.

NPAs are being integrated into national development planning. They set forth measurable, attainable goals—to be met by 2000 or earlier—that are adapted to the realities of the country. By quantifying the resources required to achieve these goals, NPAs help to identify the changes that are needed in national bud-

gets and external aid if priorities for human development are to be met. The health goals of the summit's plan of action include:

- The eradication of polio by 2000
- The elimination of neonatal tetanus by 1995
- A 90 percent reduction in measles cases and a 95 percent reduction in measles deaths
- Achievement (by 2000) and maintenance of at least 90 percent immunization coverage of one-year-old children, as well as universal tetanus immunization for women of childbearing age
- A halving of child deaths caused by diarrhea and a one-quarter reduction in the incidence of diarrheal disease
- A reduction by one-third in child deaths caused by acute respiratory infections
- Virtual elimination of vitamin A deficiency and iodine deficiency disorders
- A reduction in the incidence of low birth weight (2.5 kilograms or less) to no more than 10 percent
- A one-third reduction from 1990 levels in iron deficiency anemia among women
- Access for all women to prenatal care, trained attendants during childbirth, and referral for high-risk pregnancies and obstetric emergencies.

The agenda for action of the children's health summit is broadly consistent with the messages of this Report.

At first glance, it might appear that adoption of this Report's major recommendations will be easy. To reach most people living in the developing world with the minimum package of cost-effective public health and essential clinical services, about half of current government expenditures on other, more discretionary care would have to be redirected. But in reality, change will be difficult, since an array of interest groups may stand to lose—from suppliers of medical services to rich beneficiaries of public subsidies to protected drug companies. Many of the changes will take years to implement because they mean a major redirection of public resources and require the development of new institutional capabilities.

A number of developing countries have already shown in recent years that broad reforms in the health sector are possible when there is sufficient political will and when changes to the health system are designed and implemented by capable planners and managers. Zimbabwe has imposed a decade-long moratorium on new investments in

central hospitals and has concentrated on improving health centers and other district-level infrastructure. Tunisia has converted eleven large government hospitals to semiautonomous institutions with strong incentives for improved performance. During the 1980s Chile delegated responsibility for its entire primary clinical care system to local governments and fostered more public and private competition in health service delivery and in insurance. Costa Rica and Korea achieved universal health coverage through social insurance.

The international community can do more to support health policy reforms. In 1990 donors disbursed about \$4.8 billion of assistance for health, or about 2.5 percent of all health spending in developing countries. The share of total development aid for health declined slightly in the 1980s, from 7 to 6 percent, despite widespread calls for increased investment in human resource development, including health. As an immediate first step, donors need to restore this share to its former level. A more substantial increase can be easily

justified, given the importance of health in reducing poverty and the large gap between current and needed spending for public health programs and minimum clinical services. An additional \$2 billion a year from donors would meet about one-quarter of the costs of stabilizing the AIDS epidemic (\$500 million) and one-sixth of the extra resources needed to provide the public health and clinical care package for low-income countries (\$1.5 billion of the \$10 billion required).

Increased external assistance for health research that focuses on the major health problems of developing countries—such as the search for new antimalarial drugs and new or improved vaccines—could have a very high payoff and would build on the comparative advantage of donor countries in conducting scientific research. That most health research benefits many countries further justifies donor support, particularly through such effective internationally collaborative mechanisms as the Special Programme for Research and Training in Tropical Diseases.

Donors and developing country governments can also do much to improve the effectiveness of aid for health. This is especially important in low-income Africa, where aid already accounts for an average 20 percent of health spending—and for over half in Burundi, Chad, Guinea-Bissau, Mozambique, and Tanzania. Even in other developing regions, where aid amounts to 2 percent or less of health expenditures, better targeting and management of this assistance can catalyze policy change.

Redirecting donor money from hospitals and specialist training to public health programs and

essential clinical care—especially for tuberculosis control, the EPI Plus program, AIDS prevention and reduction of tobacco consumption—would be a significant contribution to policy reform. Donors would support for capacity-building. Countries that are willing to undertake major changes in health policy should be strong candidates for increased aid, including donor financing of recurrent costs. An increasing number of donors, among them the World Bank, are now supporting this kind of broad sectoral reform. Stronger donor coordination, especially at the level of individual developing country clients, would improve the positive impact of aid on health, as shown by the experience of Bangladesh, Senegal, and Zimbabwe.

The benefits to the developing world from adopting sound policies for health are enormous. There is great potential for change during the closing years of this decade as more countries encourage broad political participation and public accountability, as levels of education and knowledge improve, and as understanding of human biology, public health, and health care systems increases. If the right policy choices are made, the payoff will be high. The momentum of past reductions in the burden of infectious disease in developing countries can be maintained and accelerated. The AIDS epidemic can be slowed or reversed. The emerging problems of noncommunicable disease in agricultural populations can be managed without rapid increases in health expenditures. In the end, this will translate into longer, healthier, and more productive lives for people around the world, especially the more than 1 billion now living in poverty.



Health in developing countries: successes and challenges

On October 22, 1977, Ali Maow Maalin, a twenty-three-year-old cook living in the town of Merca, Somalia, developed a fever and rash that was subsequently diagnosed as smallpox. Vaccination teams immediately descended on Merca and within three weeks had vaccinated more than 50,000 people. They also began an intensive search for other cases in Merca and along the road and footpaths leading to it. By December 29 the World Health Organization (WHO) had removed Merca from its list of potential outbreaks of smallpox and had initiated a two-year surveillance for the disease throughout the Horn of Africa. It turned out, however, that Mr. Maalin had experienced the world's last case of smallpox. He survived, and WHO's twelve-year-long Intensified Smallpox Eradication Programme was brought to a triumphant end.

In 1967, the year when the program began, somewhere between 1.5 million and 2 million people died from smallpox. Perhaps half a million more were blinded, and more than 10 million were seriously and permanently disfigured. In the early 1950s the toll from smallpox had been three or four times greater. Then more and more countries undertook vaccination programs, and by the time the global program began, the disease had been virtually eradicated in 125 countries. Even so, the cost of smallpox vaccination, quarantine programs, and treatment totaled more than \$300 million in 1968 alone. The eradication program, by contrast, cost \$300 million over the whole of its twelve-year life and has therefore saved hundreds of millions of dollars a year in direct, measurable costs, as well as unquantifiable amounts of human suffering.

Few investments of any kind generate human and financial benefits on that scale. Yet in many ways the Intensified Smallpox Eradication Programme exemplifies the potential of today's medicine. Around the world, the past half century has seen startling improvements in health. Progress in drugs, vaccines, epidemiological knowledge, and organizational experience continually expands the range of options for tomorrow. Tools and methods for combating and eliminating much of the remaining burden of disease are now affordable, even by the poorest countries. Good policy, however, is essential for achieving good health. Some countries have made full use of the potential of medicine; others have barely tapped it, despite heavy spending. This Report draws from this varied experience lessons that will assist policymakers in realizing the enormous potential returns from their countries' investments in health.

Why health matters

Good health, as people know from their own experience, is a crucial part of well-being, but spending on health can also be justified on purely economic grounds. Improved health contributes to economic growth in four ways: it reduces production losses caused by worker illness; it permits the use of natural resources that had been totally or nearly inaccessible because of disease; it increases the enrollment of children in school and makes them better able to learn; and it frees for alternative uses resources that would otherwise have to be spent on treating illness. The economic gains are relatively greater for poor people, who are typ-

ically most handicapped by ill health and who stand to gain the most from the development of underutilized natural resources.

Gains in worker productivity

The most obvious sources of gain are fewer work days lost to illness, increased productivity, greater opportunities to obtain better-paying jobs, and longer working lives. To take a classic example, leprosy is a disease that affects people in the prime of life, with peak incidence rates among young adults. As many as 30 percent of those affected may be seriously deformed, and their working lives will be shortened as well. A study of lepers in urban Tamil Nadu, India, estimates that the elimination of deformity would more than triple the expected annual earnings of those with jobs. The prevention of deformity in all of India's 645,000 lepers would have added an estimated \$130 million to the country's 1985 GNP. This amount is the equivalent of almost 10 percent of all the official development assistance received by India in 1985. Yet leprosy accounted for only a small proportion of the country's disease burden, less than 1 percent in 1990.

Healthier workers earn more because (as research in Bangladesh has demonstrated) they are more productive and can get better-paying jobs. In Côte d'Ivoire daily wage rates are estimated to be 19 percent lower, on average, among men who are likely to lose a day of work per month because of illness than among healthier men.

When illness strikes, an individual's lost output and earnings often go undetected in economic statistics because they are borne by the household. In many developing countries unemployment (or disability) insurance is rare, and healthier members of the household work harder or longer to make up for the loss in income. In a sample of 250 Sudanese households, each of which lost, on average, forty working hours per year because of malaria alone, this extra work made up for 68 percent of the lost agricultural labor. Similar findings have come from research in Paraguay and Colombia.

In the long run, the benefits of improved health are also likely to influence the way work is organized and carried out. With a healthy work force, employers can reduce the costs of building slack into their production schedules, invest more in staff training, and exploit the benefits of specialization. Similar gains are likely among farmers, who often hedge against sickness by being risk-averse; they forgo higher output in return for less vari-

ability in their income. In Paraguay, for example farmers in malarious areas choose to grow crops that are of lower value but that can be worked outside the malaria season.

Improved utilization of natural resources

Some health investments raise the productivity of land. In Sri Lanka the near-eradication of malaria during 1947-77 is estimated to have raised national income by 9 percent in 1977. The cumulative cost was \$52 million, compared with a cumulative gain in national income over the thirty-one years of \$7.6 billion, implying a spectacular benefit-cost ratio of more than 140. Areas previously blighted by mosquitoes became attractive for settlement; migrants moved in, and output increased. In Uganda massive migration to fertile but underexploited land followed the partial control of river blindness (onchocerciasis) in the 1950s. The Onchocerciasis Control Programme, conducted in eleven countries of the Sahel, is a more recent example of the same benefits (see Box 1.1).

Benefits in the next generation through education

There is no question that schooling pays off in higher incomes. Four years of primary education boosts farmers' annual productivity by 9 percent on average, and workers who do better at school earn more. Studies in Ghana, Kenya, Pakistan, and Tanzania indicate that workers who scored 10 percent above the sample mean on various cognitive tests have a wage advantage ranging from 13 to 22 percent; in Nepal farmers with better mathematical skills are more likely to adopt profitable new crops.

Poor health and nutrition reduce the gains of schooling in three areas: enrollment, ability to learn, and participation by girls. Children who enjoy better health and nutrition during early childhood are more ready for school and more likely to enroll. A study in Nepal has found that the probability of attending school is only 5 percent for nutritionally stunted children, compared with 27 percent for those at the norm.

Health and nutrition problems affect a child's ability to learn. Nutritional deficiencies in early childhood can lead to lasting problems: iron deficiency anemia reduces cognitive function, iodine deficiency causes irreversible mental retardation, and vitamin A deficiency is the primary cause of blindness among children. Older children are subject to other kinds of disease. In a recent study in

Box 1.1 Controlling river blindness

Onchocerciasis, or river blindness as it is more commonly known, is caused by a parasitic worm which produces millions of larvae that move through the body, causing intense itching, debilitation, and eventually blindness. The disease is spread by a small, fiercely biting blackfly that transmits the larvae from infected to uninfected people.

The goals of the Onchocerciasis Control Programme (OCP), set up in 1974 and covering eleven Sahelian countries, are to control the blackfly by destroying its larvae with insecticides sprayed from the air. The environmental impact of the insecticides is continuously monitored by an independent ecological committee, in cooperation with the national governments. The committee has full authority to screen insecticides and to approve or reject their use. The program has also collaborated with the pharmaceutical industry to develop for human use a drug, ivermectin, that safely and effectively kills the larvae in the body. Ivermectin, however, has little impact on the adult worm and so must be supplemented with vector control by aerial spraying. The producer of ivermectin, Merck & Co., has committed itself to provide the drug free of charge as long as it is needed to combat river blindness.

The OCP's four sponsoring agencies—the Food and Agriculture Organization, the United Nations Development Programme (UNDP), the World Bank, and WHO—through a steering committee chaired by the World Bank, make broad policy decisions and oversee operations. WHO has executive responsibility through

a team of entomologists, epidemiologists, field staff, and pilots; 97 percent of the staff are nationals of the participating countries. The World Bank organizes the finances and manages them through a trust fund. It also supports socioeconomic development in the areas affected by the disease.

The program is widely regarded as a great success. It protects from river blindness about 30 million people, including more than 9 million children born since the OCP began, at an annual cost of less than \$1 per person. More than 1.5 million people who were once seriously infected have completely recovered. It is estimated that the program will have prevented at least 500,000 cases of blindness by the time it is wound up around the end of the century. And it is already freeing approximately 25 million hectares of previously blighted land for resettlement and cultivation, boosting agricultural production.

The estimated cost of the OCP during the whole of its existence, from 1974 to 2000, is about \$570 million. Its estimated internal rate of return is in the range of 16 to 28 percent (depending on the pace at which the newly available land is settled, the incremental output added by the new land, the income level of the OCP area, and the productivity growth rate that is projected). These estimated benefits do not include the program's favorable effects on income distribution; its main beneficiaries are subsistence farmers whose incomes are well below average.

Jamaica children with moderate whipworm infection scored 15 percent lower before treatment than uninfected children in the same school. When retested after treatment, those same children did almost as well as the uninfected children.

In a sample of children in a poverty-stricken area of northeast Brazil, inadequately nourished children lagged 20 percent behind the average gain in achievement score over a two-year period. The same study also shows the harm done by a simple and easily remedied handicap: children with bad eyesight lagged 27 percent behind the average gain over the two years. Both groups had below-average promotion rates and above-average drop-out rates. In China a child at the twentieth percentile in height-for-age (a sign of poor health) averages about one-third of a year behind the grade normally reached by children of that age. In Thailand children whose height-for-age is 10 percent below average are 14 percent lower in grade attainment.

Girls are particularly liable to suffer from iodine or iron deficiency—reasons why fewer of them complete primary school. Other health-related reasons include dropping out as a result of pregnancy and parental concern about sexual violence. In societies where girls' education is given lower priority than boys', girls miss school because they have to stay home to look after sick relatives.

Reduced costs of medical care

Spending that reduces the incidence of disease can produce big savings in treatment costs. For some diseases the expenditure pays for itself even when all the indirect benefits—such as higher labor productivity and reduced pain and suffering—are ignored. Polio is one example. Calculations for the Americas made prior to the eradication of polio in the region showed that investing \$220 million over fifteen years to eliminate the disease would prevent 220,000 cases and save between \$320 million

Box 1.2 The economic impact of AIDS

The AIDS epidemic, through its effects on savings and productivity, poses a threat to economic growth in many countries that are already in distress. World Bank simulations indicate a slowing of growth of income per capita by an average 0.6 percentage point a year in the ten worst-affected countries in Sub-Saharan Africa. In Tanzania, where income per capita has already fallen 0.2 percent a year in recent years, the estimated slowdown ranges between 0.1 and 0.8 percentage point, depending on the assumptions used. In Malawi, which has had a recent growth rate of 0.9 percent a year, the simulated reduction ranges from 0.3 to 0.5 percentage point. These calculations include the effect of the epidemic on population growth, which will slow slightly in severely affected countries.

The heavy macroeconomic impact of AIDS comes partly from the high costs of treatment, which divert resources from productive investments. Tanzanian clinicians estimate that, on average, an HIV-infected adult suffers 17 episodes of HIV-related illnesses prior to death and a child suffers 6.5 episodes. Depending on how much medical care a patient gets, in the typical developing country the total cost per adult death ranges from 8 to 400 percent of annual income per capita; the average is about 150 percent of annual income per capita.

That AIDS kills so many skilled adults adds to its economic impact. At a large hospital in Kinshasa, for example, more than 1 percent per year of the health personnel, including highly trained staff, become infected (through sexual rather than occupational contact). Among the (largely male) employees at a Kinshasa textile mill, managers had a higher infection rate than foremen, who in turn had a higher rate than workers. The cost of replacing skilled workers will be substantial. A study of Thailand estimates that through 2000 the cost of replacing long-haul truckers lost to AIDS will be \$8 million, and another study, of Tanzania, projects the cost of replacing teachers at \$40 million through 2010.

The death of an adult can tip vulnerable households into poverty. Even in Tanzania, where the government pays a large share of health costs, a World Bank study shows that affected rural households in 1991 spent \$60—roughly the equivalent of annual rural income per capita—on treatment and funerals. The study also showed that the effects of losing an adult persist into the next generation as children are withdrawn from school to help at home. School attendance of young people ages 15–20 is reduced by half if the household has lost an adult female member in the previous year.

and \$1.3 billion (depending on the number of people treated) in annual treatment costs. The program's net return, after discounting at even as much as 12 percent a year, was calculated to be between \$18 million and \$480 million.

AIDS is another example. Although it remains much less common in the developing world than diseases such as malaria, its economic impact per case is greater for two reasons: it mainly affects adults in their most productive years, and the infections resulting from it lead to heavy demand for expensive health care (Box 1.2). For example, because individuals with AIDS are typically more prone to pneumonia, diarrhea, and tuberculosis, the cost of medical care is high even though there is no effective treatment as yet for the disease itself. Research in nine developing and seven high-income countries suggests that preventing a case of AIDS saves, on average, about twice GNP per capita in discounted lifetime costs of medical care; in some urban areas the saving may be as much as five times GNP per capita. Calculations for India show that, given prevailing transmission patterns, each currently HIV-positive person infects one

previously uninfected person every four years. At this rate, there will be six HIV-positive persons in 2000 for every one today. If the transmission rate could be slowed to one every five years, that number could be reduced to only four infected persons in 2000 for every one today. The corresponding reduction in medical costs, after discounting at 3 percent a year, amounts to \$750 by 2000 for each currently HIV-positive person in India, for a total saving of \$750 million. Similar calculations for Thailand suggest savings of \$1,250 per currently HIV-positive person, for a potential total of \$560 million.

Health investments and poverty

The goal of reducing poverty provides a different but equally powerful case for health investments. The adverse effects of ill health are greatest for poor people, mainly because they are ill more often, but partly because their income depends exclusively on physical labor and they have no savings to cushion the blow. They may therefore find it impossible to recover from an illness with their human and financial capital intact.

The health consequences of poverty are severe: the poor die younger and suffer more from disability. In Porto Alegre, Brazil, adult mortality rates in poor areas in the late 1980s were 75 percent higher than in rich areas, and in São Paulo rates were two to three times higher for nonprofessionals than for professionals. In the late 1970s among Kenyan families in which the mother had no schooling, the probability of dying by age 2 averaged 184 per 1,000 in regions where half of the families lived below the poverty line but 100 per 1,000 in regions where only one-fifth of the families lived in poverty. The poor are exposed to greater risks from unhealthy and dangerous conditions, both at home and at work. Malnourishment and the legacy of past illness mean that they are more likely to fall ill and slower to recover, especially as they have little access to health care.

When a family's breadwinner becomes ill, other members of the household may at first cope by working harder themselves and by reducing consumption, perhaps even of food. Both adjustments can harm the health of the whole family. If free health care is not available, the costs of treatment may drive a household deeper into debt. Although ill health is only one of many factors that can cause financial distress, its potential for disaster means that it should be explicitly recognized in formulating policies. Investments to reduce health risks among the poor and provision of insurance against catastrophic health care costs are important elements in a strategy for reducing poverty.

Spending on health is a productive investment: it can raise incomes, particularly among the poor, and it reduces the toll of human suffering from ill health. Good health, however, is a fundamental goal of development as well as a means of accelerating it. Targeting health as part of development efforts is an effective way to improve welfare in low-income countries. Evidence gathered over the past thirty years indicates that in health, unlike income, the gap between poor and rich countries has been narrowing.

Putting the effects together

The detrimental effects of poor health on individuals and households and on the use of resources suggest that better health should lead to better economic performance at the national level. A number of analyses have found a positive relationship between growth of income per capita and the initial national educational stock. A similar analysis carried out for this Report examines the relation

of growth in income per capita between 1960 and 1990 in about seventy countries to the initial level of national income, the initial educational level, and an indicator of initial health status (the child mortality rate, used in this Report to mean the risk of dying by age 5 per 1,000 live births). The health status indicator is found to be a highly significant predictor of economic performance. For the average country in the sample, the annual growth rate of income per capita is 1.40 percent and the child mortality rate is 116 per 1,000. An otherwise average country with a child mortality rate of 106 would have a growth rate of income per capita of 1.55 percent, whereas one with a child mortality rate of 126 would have a growth rate of 1.26 percent.

Not surprisingly, the health status variable is strongly correlated with educational stock, but the significant association between income growth and health remains strong and of similar magnitude across time periods and for a range of model formulations. Although it is possible that unobserved factors such as government capacity to implement effective policies could explain the apparent association, the data do suggest that better health means more rapid growth.

The record of success

Mortality started to decline in Europe, North America, and Australasia about two centuries ago, but slowly at first. A century ago life expectancy in the United States, then the world's richest country, was only forty-nine years, and child mortality was about 180 per 1,000. The rate of improvement accelerated in the first half of this century; by 1950 life expectancy in the United States had increased to sixty-six years, and child mortality had fallen to 34 per 1,000. Progress was also being made in developing countries: in Chile, for example, life expectancy increased from thirty-seven years in 1930 to forty-nine in 1950, and child mortality fell from 350 to 209 per 1,000.

Mortality transitions since 1950

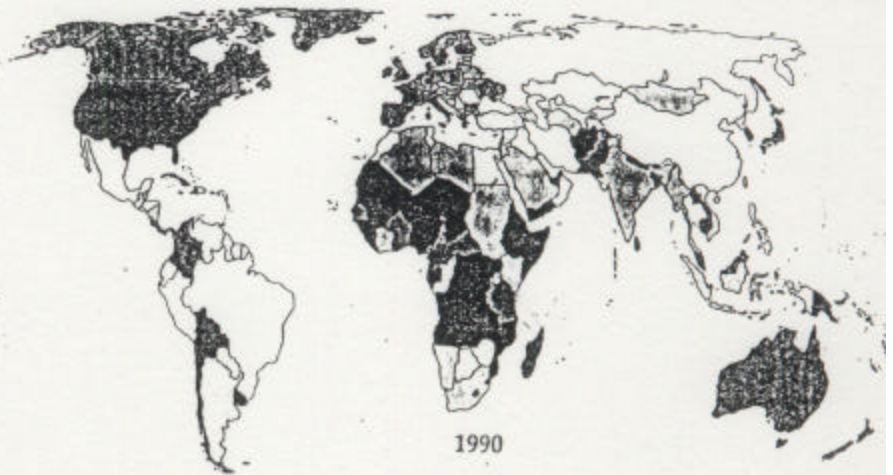
Health conditions around the world have improved more in the past forty years than in all previous human history. Life expectancy at birth in developing countries increased from forty to sixty-three years, and child mortality fell from 280 to 106 per 1,000. In a high-income country life expectancy is more than seventy-five years; in a low-mortality developing country it is seventy years or

Child mortality has fallen sharply in the past thirty years, with particularly rapid declines in parts of Asia and Latin America.

Figure 1.1 Child mortality by country, 1960 and 1990



Under-five mortality rate



Source: Appendix A.

more; and in Sub-Saharan Africa, the region where least progress has been made, it is about fifty years.

Much of what is known about the decline in mortality in the developing world since 1950 is limited to the mortality of children and has come from a series of standardized, internationally funded demographic surveys. Enormous reductions in child mortality occurred almost everywhere around the world between 1960 and 1990 (Figure 1.1). For example, child mortality in Chile dropped from 155 to 20 per 1,000, in Tunisia from 245 to 45, and in Sri Lanka from 140 to 22.

The statistics for adult mortality in the developing world are much less satisfactory than those for child mortality. Approximate estimates for all developing countries suggest that the adult mortality rate (defined as the probability of dying between ages 15 and 60 per 1,000 persons reaching age 15) fell from about 450 in 1950 to about 230 in 1990. In Chile, a country with excellent statistics, the rate dropped from 466 in 1930 to 152 in 1990.

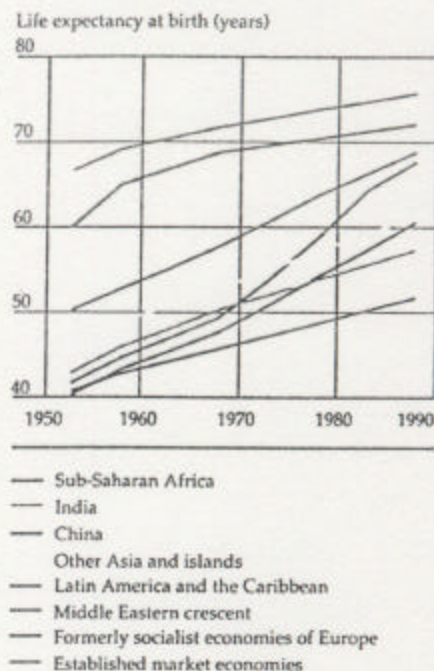
The decline in mortality has accelerated over the past thirty years. In the 1960s child mortality fell by approximately 2 percent a year in about seventy developing countries for which estimates are available. The annual decline increased to more than 3 percent in the 1970s and to more than 5 percent in the 1980s. This result could be skewed by changes in the mix of countries with reliable data; there were, however, twenty-one countries with a continuous series of acceptable estimates of child mortality from the early 1960s to the late 1980s, and for this group as a whole the fall in child mortality averaged 3 percent a year in the 1960s but 6 percent a year in the 1980s. In seventeen of the twenty-one the pace of decline increased over the period.

Regional patterns

The extent of success has varied significantly between regions. Between 1950 and 1990 all eight demographic regions used for this Report enjoyed increases in life expectancy at birth, but China and the Middle Eastern crescent did particularly well (see Figure 1.2). Sub-Saharan Africa showed the slowest improvement, with life expectancy increasing only from thirty-nine to fifty-two years—although even this compares well with European experience in the nineteenth century. (It took England and Wales more than half a century to raise life expectancy by a similar amount.) The formerly socialist economies of Europe showed a rapid improvement in the 1950s and 1960s, but the rise was much slower in the 1970s and 1980s.

Life expectancy has increased substantially everywhere over the past forty years.

Figure 1.2 Trends in life expectancy by demographic region, 1950–90

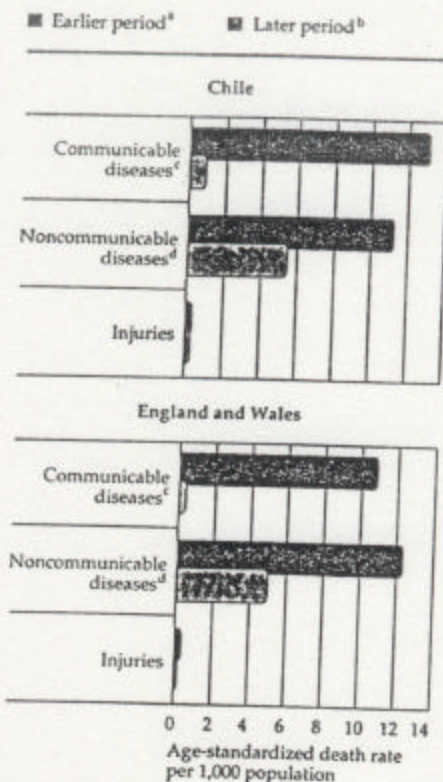


Source: Appendix A.

There are strong parallels between the pattern of mortality decline in the high-income countries and the accelerated progress of developing countries over the past forty years. In both groups the control of communicable diseases, particularly those of childhood, accounts for most of the gains. (The term "communicable diseases," in the analyses for this Report, includes deaths from maternal and perinatal causes.) Progress against noncommunicable diseases—primarily those of the circulatory and respiratory systems, which principally affect adults—has been much slower. In both Chile (from 1930 to 1987) and England and Wales (over the longer period 1891 to 1990) mortality from communicable disease fell to less than 5 percent of its initial level, whereas mortality from noncommuni-

Mortality from communicable diseases has fallen much faster than that from noncommunicable diseases or injuries.

Figure 1.3 Age-standardized female death rates in Chile and in England and Wales, selected years

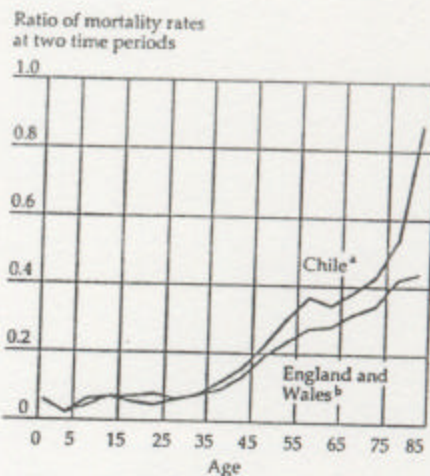


a. For Chile, 1930; for England and Wales, 1891.
 b. For Chile, 1987; for England and Wales, 1990.
 c. Includes maternal and neonatal mortality.
 d. For earlier period, includes "other and unknown" category.
 Source: For Chile 1930 and England and Wales 1891, Preston, Keyfitz, and Schoen 1972; for 1987 and 1990, WHO, *World Health Statistics Annual*, 1989 and 1991.

cable disease fell much less rapidly (Figure 1.3). One result of this change is that mortality risks have fallen much faster for children than for

Similar patterns in Chile and in England and Wales show how mortality rates have declined much more sharply for the young than for the old.

Figure 1.4 Change in female age-specific mortality rates in Chile and in England and Wales, selected years



a. Ratio of 1990 rates to 1930 rates.
 b. Ratio of 1981 rates to 1891 rates.
 Source: For Chile 1930 and England and Wales 1891, Preston, Keyfitz, and Schoen 1972; for Chile 1990, World Health Organization data; for England and Wales 1990, United Nations, *Demographic Yearbook*, 1991.

adults. In Chile, for example, mortality risks up to age 30 fell by more than 90 percent between 1930 and 1990; the decline was at least 60 percent at ages 30-70, but above age 70 the gains were much smaller (Figure 1.4). The age pattern of mortality decline in Chile over sixty years is strikingly similar to the pattern in England and Wales during the ninety years from 1891 to 1981.

The only exception to this broad similarity between industrial and developing countries has been in the formerly socialist economies. In these countries child mortality has continued to decline, as has the mortality of women, albeit more slowly. The mortality of adult men, on the other hand, has stopped declining in the past two decades and has actually started to increase. This excess male mor-

tality is largely the result of extremely high death rates from cardiovascular disease, associated with heavy smoking and drinking.

Measuring the burden of disease

The health improvements of the past few decades have done much to enhance human welfare, both directly and indirectly. But much more remains to be done. Communicable (and largely preventable) diseases are still common. Health systems also have to cope with the aging of populations, which leads to an increased burden of the more expensive noncommunicable diseases. New illnesses, such as AIDS, have emerged. One simple statistic gives a sense of the remaining burden of disease: about 12.4 million children under age 5 died in 1990 in the developing world. Had those children faced the mortality risks of children in the established market economies, the number of deaths would have been cut by more than 90 percent, to 1.1 million.

Any discussion of health policy must start with a sense of the scale of health problems. These problems are often assessed in terms of mortality, but that indicator fails to account for the losses that occur this side of death because of handicap, pain, or other disability. A background study for this Report, undertaken jointly with the World Health Organization, measures the global burden of disease (GBD) by combining (a) losses from premature death, which is defined as the difference between actual age at death and life expectancy at that age in a low-mortality population, and (b) loss of healthy life resulting from disability. The GBD is measured in units of disability-adjusted life years (DALYs). Worldwide, 1.36 billion DALYs were lost in 1990, the equivalent of 42 million deaths of newborn children or of 80 million deaths at age 50. Premature deaths were responsible for 66 percent of all DALYs lost and disabilities for 34 percent. In the developing world 67 percent of all DALY loss was a result of premature death; in the established market economies and the formerly socialist economies of Europe the figure was only 55 percent. Table 1.1 shows the GBD broken down by sex, category of disease, and type of loss (premature death or disability). The three categories of disease used are the group of communicable diseases, noncommunicable diseases, and injuries.

The derivation and interpretation of the GBD are explained in Box 1.3. The results of research on the GBD challenge the belief that the war against infectious and parasitic diseases has been won. Di-

Table 1.1 Burden of disease by sex, cause, and type of loss, 1990 (billions of DALYs)

Sex and outcome	Disease category		
	Communicable ^a	Noncommunicable	Injuries
<i>Male</i>			
Premature death	259	152	70
Disability	47	146	39
<i>Female</i>			
Premature death	244	135	33
Disability	74	142	20

Note: DALY, disability-adjusted life year.
a. Includes maternal and perinatal causes.
Source: Appendix B.

arrhea, childhood diseases such as measles, respiratory infections, worm infections, and malaria account for one-quarter of the GBD. The burden of these largely preventable or inexpensively curable diseases of children is far larger in Sub-Saharan Africa (43 percent of all DALYs lost) than anywhere else, although it is still substantial in India (28 percent), Other Asia and islands (29 percent), and the Middle Eastern crescent (29 percent). For adults too, communicable diseases are far from trivial: sexually transmitted diseases (STDs) and tuberculosis together contribute 7 percent of the GBD.

Even as broad a measure as the GBD does not capture all the consequences of disease or injury. It excludes the social costs of disfigurement, such as that arising from river blindness or leprosy, and of dysfunction—for example, marital breakups resulting from obstetric fistula (permanent damage to the reproductive tract incurred during delivery). And some health-related factors are likely to be underreported. A clear example is violence against women, much of which goes undetected—but not unsuffered.

Comparisons of absolute numbers of DALYs lost may be misleading because the sizes and age structures of the populations at risk are not the same. The effects of population size can be allowed for by expressing the 1990 burden per 1,000 population. Figure 1.5 shows the resulting rates by sex and regional group. This index is 259 for the world as a whole, but it varies widely among regions. Sub-Saharan Africa loses 574 DALYs for every 1,000 population, more than twice the global average. India, the Middle Eastern crescent, and Other Asia and islands all have values between 250 and 350. For China, the formerly socialist economies of Europe, and Latin America and the Caribbean, the figures are between 150 and 250. The burden per

Box 1.3 Measuring the burden of disease

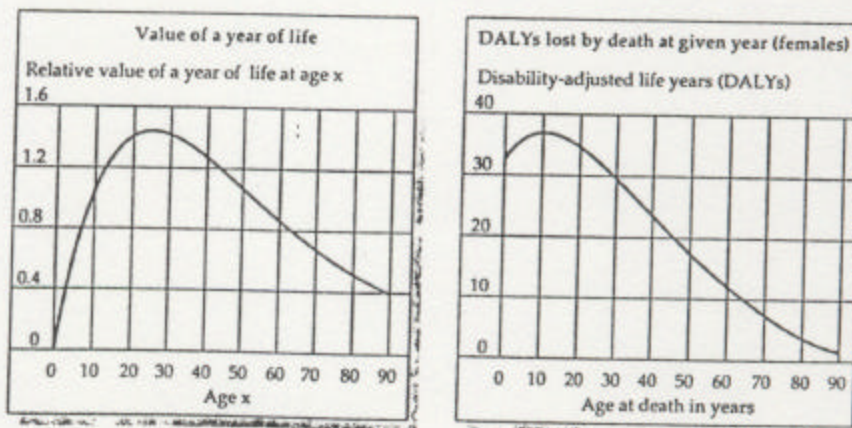
Most assessments of the relative importance of different diseases are based on how many deaths they cause. This convention has certain merits: death is an unambiguous event, and the statistical systems of many countries routinely produce the data required. There are, however, many diseases or conditions that are not fatal but that are responsible for great loss of healthy life: examples are chronic depression and paralysis caused by polio. These conditions are common, can last a long time, and frequently lead to significant demands on health systems.

To quantify the full loss of healthy life, the World Bank and the World Health Organization undertook a joint exercise for this Report. Diseases were classified into 109 categories on the basis of the *International Classification of Diseases* (ninth revision). These categories cover all possible causes of death and about 95 percent of the possible causes of disability. Using the recorded cause of death where available, and expert judgment when records were not available, the study assigned all deaths in 1990 to these categories by age, sex, and demographic region. For each death, the number of years of life lost was defined as the difference between the actual age at death and the expectation of life at that age in a low-mortality population. For disability, the incidence of cases by age, sex, and demographic region was estimated on the basis of community surveys or, failing that, expert opinion; the number of years of

healthy life lost was then obtained by multiplying the expected duration of the condition (to remission or to death) by a severity weight that measured the severity of the disability in comparison with loss of life. Diseases were grouped into six classes of severity of disability; for example, class 2, which includes most cases of leprosy and half the cases of pelvic inflammatory disease, was given a severity weight of 0.22, and class 4, which includes 30 percent of cases of dementia and 50 percent of those of blindness, was assigned a severity weight of 0.6. The death and disability losses were then combined, and allowance was made for a discount rate of 3 percent (so that future years of healthy life were valued at progressively lower levels) and for age weights (so that years of life lost at different ages were given different relative values). The value for each year of life lost, shown in the left-hand panel of Box figure 1.3, rises steeply from zero at birth to a peak at age 25 and then declines gradually with increasing age. These age weights reflect a consensus judgment, but other patterns could be used—for example, uniform age weights, with each year of life having the same value, which would increase the relative importance of childhood diseases.

The combination of discounting and age weights produces the pattern of DALYs (disability-adjusted life years) lost by a death at each age. As the right-hand panel of Box figure 1.3 shows, the death of a newborn

Box figure 1.3 Age patterns of age weights and DALY losses



Source: World Bank data.

Box table 1.3 Distribution of DALY loss by cause and demographic region, 1990
(percent)

Cause	World	Suh-Saharan Africa	India	China	Other Asia and islands	Latin America and the Caribbean	Middle Eastern crescent	Formerly socialist economies of Europe	Established market economies
Population (millions)	5,267	510	850	1,134	683	444	503	346	798
Communicable diseases	45.8	71.3	50.5	25.3	48.5	42.2	51.0	8.6	9.7
Tuberculosis	3.4	4.7	3.7	2.9	5.1	2.5	2.8	0.6	0.2
STDs and HIV	3.8	8.8	2.7	1.7	1.5	6.6	0.7	1.2	3.4
Diarrhea	7.3	10.4	9.6	2.1	8.3	5.7	10.7	0.4	0.3
Vaccine-preventable									
childhood infections	5.0	9.6	6.7	0.9	4.5	1.6	6.0	0.1	0.1
Malaria	2.6	10.8	0.3	*	1.4	0.4	0.2	*	*
Worm infections	1.8	1.8	0.9	3.4	3.4	2.5	0.4	*	*
Respiratory infections	9.0	10.8	10.9	6.4	11.1	6.2	11.5	2.6	2.6
Maternal causes	2.2	2.7	2.7	1.2	2.5	1.7	2.9	0.8	0.6
Perinatal causes	7.3	7.1	9.1	5.2	7.4	9.1	10.9	2.4	2.2
Other	3.5	4.6	4.0	1.4	3.3	5.8	4.9	0.6	0.5
Noncommunicable diseases	42.2	19.4	40.4	58.0	40.1	42.8	36.0	74.8	78.4
Cancer	5.8	1.5	4.1	9.2	4.4	5.2	3.4	14.8	19.1
Nutritional deficiencies	3.9	2.8	6.2	3.3	4.6	4.6	3.7	1.4	1.7
Neuropsychiatric disease	6.8	3.3	6.1	8.0	7.0	8.0	5.6	11.1	15.0
Cerebrovascular disease	3.2	1.5	2.1	6.3	2.1	2.6	2.4	8.9	5.3
Ischemic heart disease	3.1	0.4	2.8	2.1	3.5	2.7	1.8	13.7	10.0
Pulmonary obstruction	1.3	0.2	0.6	5.5	0.5	0.7	0.5	1.6	1.7
Other	18.0	9.7	18.5	23.6	17.9	19.1	18.7	23.4	25.6
Injuries	11.9	9.3	9.1	16.7	11.3	15.0	13.0	16.6	11.9
Motor vehicle	2.3	1.3	1.1	2.3	2.3	5.7	3.3	3.7	3.5
Intentional	3.7	4.2	1.2	5.1	3.2	4.3	5.2	4.8	4.0
Other	5.9	3.9	6.8	9.3	5.8	5.0	4.6	8.1	4.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Millions of DALYs	1,362	293	292	201	177	103	144	58	94
Equivalent infant deaths (millions)	42.0	9.0	9.0	6.2	5.5	3.2	4.4	1.8	2.9
DALYs per 1,000 population	259	575	344	178	260	233	286	168	117

*Less than 0.05 percent.

Note: DALY, disability-adjusted life year; STD, sexually transmitted disease; HIV, human immunodeficiency virus.

Source: World Bank data.

baby girl represents a loss of 32.5 DALYs; a female death at age 30 means the loss of 29 DALYs; and a female death at age 60 represents 12 lost DALYs. (Values are slightly lower for males.) The sum across all ages, conditions, and regions is referred to as the global burden of disease (GBD). More details on the GBD are presented in Appendix B.

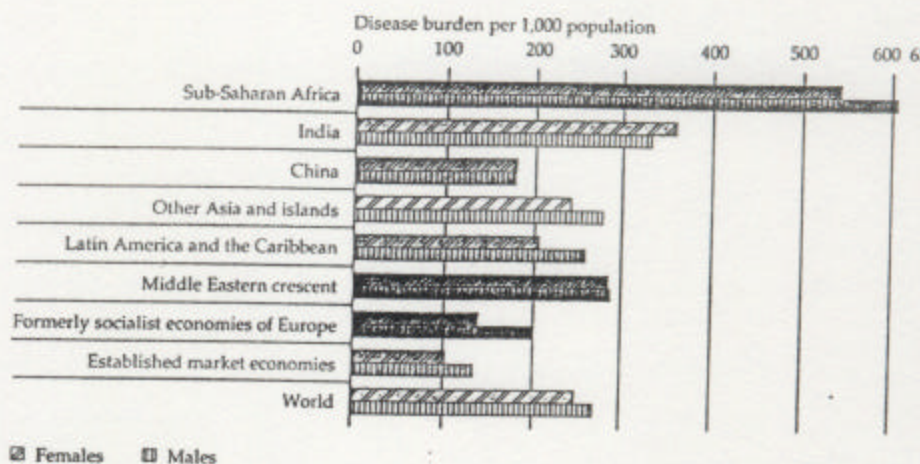
The global burden measures the present value of the future stream of disability-free life lost as a result of death, disease, or injury in 1990. It is thus based on events that occurred in 1990 but includes the loss of disability-free life in future years. This Report expresses the burden in three distinct ways: as the number of DALYs, as a percentage of some larger aggregate (such as the percentage of total loss attributable to a specific disease), and in relation to population size in 1990. This last measure calls for careful interpretation because all future loss is expressed in relation to the current population, and the measure can easily exceed

one year per person. A baby who died in 1990 contributed about thirty-two years (the discounted value of about eighty years of expected life) to the burden but counted as one in the population. To take an extreme case, if the entire population of the world were to be killed in one year, the burden per 1,000 population in that year would exceed 20,000 DALYs. There is therefore no absolute scale with which the GBD per 1,000 population can be compared; the only comparisons that make sense are those between categories—of regions, risk factors, disease groups, or sex. Box table 1.3 shows the GBD by cause and demographic region.

The approach used to compute the GBD can also be used to track improvements in a nation's health over time by following changes in the national burden of disease. Preliminary plans for initial national assessments have been developed for Costa Rica, South Africa, and Andhra Pradesh State in India.

Disease burdens per 1,000 population vary substantially by region.

Figure 1.5 Disease burden by sex and demographic region, 1990



Source: Appendix B.

1,000 population for the established market economies is easily the lowest, at 117. It turns out that these broad rankings are not significantly affected by differences in age distributions between regions.

Females have about a 10 percent lower disease burden per 1,000 population than males for the world as a whole. They lose fewer DALYs from premature mortality, but their DALY loss from disability is about the same as for males. Within the disability category, however, the female disease burden from the group of communicable causes is considerably higher than that for males, partly because of a substantial toll from maternal causes but also because of the much greater female burden associated with STDs. Effective interventions exist for much of this excess female burden. For all causes together, the female advantage ranges from more than 30 percent in the formerly socialist economies, where adult mortality is much higher for men than for women, to negative in India, where females suffer a disadvantage of 8 percent. Both India and China show a female disadvantage in disease burden per 1,000 population, and, not coincidentally, both countries also have large num-

bers of "missing" (and presumed dead) women in relation to the expected population balance between the sexes. In China illegal female infanticide (and, in the recent past, illegal sex-selective abortion) is thought to be the main reason.

Table 1.2 Burden of five major diseases by age of incidence and sex, 1990 (millions of DALYs)

Disease and sex	Age (years)					Total
	0-4	5-14	15-44	45-59	60+	
Diarrhea						
Male	42.1	4.6	2.8	0.4	0.2	50.2
Female	40.7	4.8	2.8	0.4	0.3	48.9
Worm infection						
Male	0.2	10.6	1.6	0.5	0.1	13.1
Female	0.1	9.2	0.9	0.5	0.1	10.9
Tuberculosis						
Male	1.2	3.1	13.4	6.2	2.6	26.5
Female	1.3	3.8	10.9	2.8	1.2	20.0
Ischemic heart disease						
Male	0.1	0.1	3.6	8.1	13.1	25.0
Female	**	**	1.2	3.2	13.0	17.5

** Less than 0.05 million.
Note: DALY, disability-adjusted life year.
Source: World Bank data.

The figures on disease burden by age (Table 1.2) suggest how health officials should target their programs. More than 80 percent of the DALY loss from diarrhea is a result of infections in children under age 5. Worm infections are concentrated among children ages 5-14. More than half the burden of tuberculosis is borne by the 15-44 age group. More than 60 percent of the burden of ischemic heart disease falls on the population over age 60.

The higher the disease burden, the higher the proportion attributable to the communicable group of causes (Figure 1.6). Sub-Saharan Africa has the highest disease burden per 1,000 population, and 71 percent of this is from the communicable disease group, whereas in Latin America (a medium-burden region) the figure is 42 percent and in the established market economies it is only 10 percent. Noncommunicable diseases show the opposite pattern, accounting for 19 percent of the total burden in Sub-Saharan Africa, 43 percent in Latin America, and 78 percent in the established market economies. Despite these marked differences in relative burden, however, the absolute rates of loss for both groups are highest in Sub-Saharan Africa and lowest in the established market economies. The pattern is plain: as health improves, the burden from all types of disease declines, but the distribution of the burden shifts dramatically from a preponderance of communicable disease to a preponderance of noncommunicable disease.

Despite the sharp improvements in health around the world, the GBD calculations show that a large burden of premature mortality and disability still remains, particularly in the world's poorer regions. There are inexpensive and effective ways to eliminate the share caused by communicable diseases (other than maternal and perinatal conditions), which is roughly 35 percent of the world burden and more than 60 percent in Sub-Saharan Africa. The remaining 65 percent of the world burden is less responsive to such measures, and reducing it will require changes in the behavior and life-styles of adults.

Challenges for the future

New health challenges will emerge over the next few decades. Some are certain; these involve the significant increase in noncommunicable diseases arising from the continuing demographic transition. Others are less certain: the spread of HIV and the increase in AIDS deaths; the increasing num-

The share of communicable diseases in the disease burden declines as mortality rates fall.

Figure 1.6 Distribution of disability-adjusted life years (DALYs) lost, by cause, for selected demographic regions, 1990 (percentage of total DALYs lost)

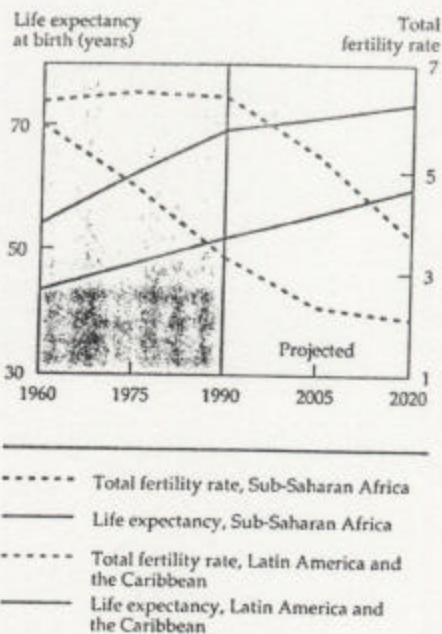


a. Includes maternal and perinatal causes.
Source: Appendix B.

ber of drug-resistant disease strains; and the continued use of health-damaging substances such as tobacco. Although nobody can forecast the impact of these challenges with any precision, reasonable projections are possible. For example, outside the established market economies the number of deaths attributable to smoking is expected to increase from 1.7 million in 1990 (40 percent of which were in the formerly socialist economies of Europe) to more than 3 million by 2005 and to about 4.5 million by 2015. Other challenges are potentially important but not forecastable: possible ex-

Worldwide, fertility and mortality declines go hand in hand.

Figure 1.7 Trends in life expectancy and fertility in Sub-Saharan Africa and Latin America and the Caribbean, 1960–2020



Source: Appendix A and World Bank data.

amples are the emergence of new microbes as devastating as HIV and the inadvertent spread of biological agents developed for use in war.

This section reviews predictions concerning three major challenges in the light of their contribution to the GBD: the aging of populations, AIDS, and drug-resistant strains of disease.

Aging populations

The mortality decline that has occurred almost everywhere has usually been accompanied by steep falls in fertility. The overall transition from high mortality and high fertility to low mortality

Box 1.4 The demographic and epidemiological transitions

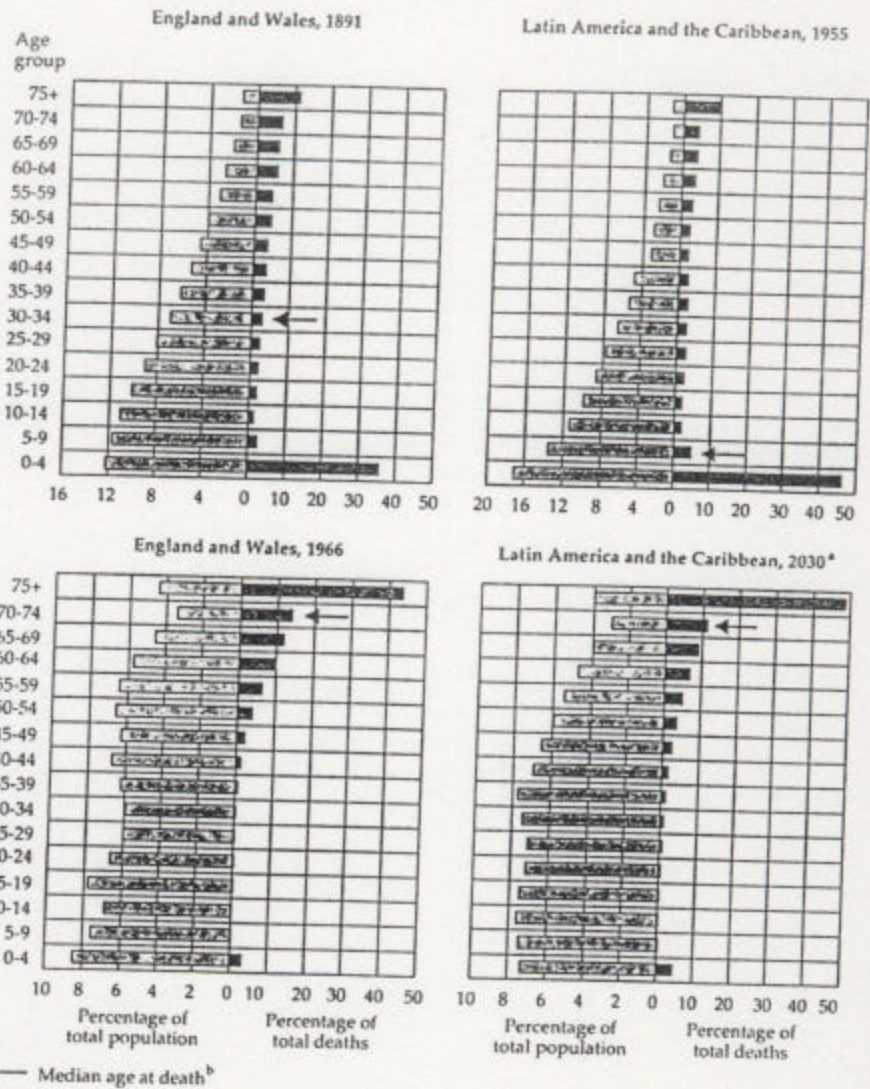
Changes in the pattern of disease proceed in two steps. The first is the demographic transition, when mortality from infectious disease declines and, partly as a result, fertility decreases as well. The second, a consequence of declining fertility and differential rates of decline among causes of death, is the epidemiological transition. The population grows older, and noninfectious diseases become the main causes of ill health. Health patterns in the developing world over the next three decades will be profoundly influenced by both these transitions.

It is commonly assumed that when a country going through its demographic transition, the changes in its health indicators are primarily a function of declines in mortality. In fact, both the age structure and the cause-of-death structure are strongly influenced by the rapid decline in fertility. When fertility is high, the age structure of a population is heavily skewed toward the young, irrespective of the level of mortality. Because birth rates remain high and larger numbers of women enter the reproductive ages every year, the base of the population is continually expanding. When birth rates start to fall rapidly, the absolute number of babies born each year may remain unchanged or even decline. As Box figure 1.4 shows, the shape of the age structure of the population then begins to be transformed from a broad-based triangle into a rectangle, and even into a pear shape with a more pronounced narrowing of the base.

and low fertility is essentially complete in the high-income countries and has almost been completed in China and Latin America. Even in Sub-Saharan Africa fertility seems to be starting to decline.

The systematic relationship between gains in life expectancy and reductions in fertility is expected to continue into the next century. Figure 1.7 shows this relationship for two developing regions at different stages of the transition, Latin America and Sub-Saharan Africa. The projected changes for Sub-Saharan Africa are substantial, but they are similar in magnitude to those that have already occurred in Latin America. In much of the developing world the decline in death rates has preceded the decline in birth rates by two decades or more, resulting in temporarily high rates of population growth of 3 or even, occasionally, 4 percent a year. (By contrast, in the established market economies and the formerly socialist economies of Europe birth and death rates declined more or less

Box figure 1.4 Evolving patterns of age distribution and mortality in England and Wales and in Latin America and the Caribbean



a. Projected.
 b. The age below which half of all deaths in a year occur.
 Source: For England and Wales 1891, Preston, Keyfitz, and Schoen 1972; for England and Wales 1966, United Nations, *Demographic Yearbook*, 1978; for Latin America and the Caribbean, 1955 and 2030, World Bank data.

in tandem beginning in the late nineteenth century, and population growth rates rarely exceeded 2 percent a year.)

These demographic changes are having, and will continue to have, dramatic effects on age distributions in developing countries. As fertility declines, age structures in these countries are evolving toward the existing patterns in the established market economies and the formerly socialist economies (see Box 1.4). The proportion of the population age 65 and over is expected to increase from 4 percent in 1990 to 9 percent by 2030 (in absolute numbers, from 184 million to 678 million). As a result, the burden from noncommunicable dis-

eases will increase sharply, both absolutely and proportionately. At the same time, the challenge of communicable diseases of the young will persist. Despite declines in fertility, the number of births each year in developing countries will rise somewhat, from 127 million in 1990 to 145 million in 2020, before decreasing to 142 million in 2030. The number of children under age 5 will increase more rapidly, from 552 million in 1990 to 682 million in 2030. These changes, which took a century to complete in today's high-income countries, are occurring within fifty years or less in parts of the developing world.

In judging the importance of the health problems of the young in comparison with those of the elderly, one useful guide is the median age at death. For all six regions of the developing world, the median was below 20 in 1950, indicating the dominance of the health problems of children. By 1990 the median had risen close to age 60 in China and in Latin America but was scarcely above 5 in Sub-Saharan Africa and was still below 25 in the Middle Eastern crescent (see Figure 1.8). By 2030, assuming that current trends continue, the median age at death will have risen above 60 in all regions except Sub-Saharan Africa, where it will still be close to 40.

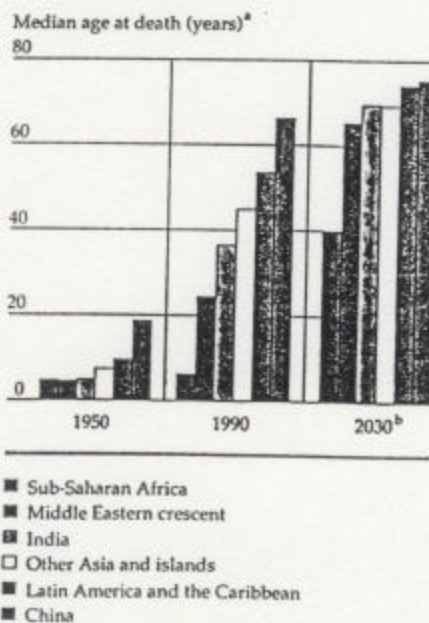
The message from these population projections is that health services must plan for a modest increase in child-related demands over the next forty years. At the same time, the numbers of the elderly, with very different health needs, will be rising sharply. The pace of demographic change has been, and is expected to continue to be, faster in the developing world than it was in the high-income countries, and the problems of adaptation are therefore greater. Because treatments for noncommunicable diseases are often expensive, there is a danger that these diseases will absorb resources needed to combat communicable diseases (which will still be widespread). This kind of dilemma has already been noted in World Bank studies in Brazil and China.

HIV and AIDS

More than 80 percent of the estimated 8.8 million people infected with HIV in 1990 lived in developing countries. There the disease is primarily one of heterosexual adults, with substantial perinatal infection of young children. Of the eight demographic regions used in this Report, only the formerly socialist economies, the Middle Eastern crescent, and China have little recorded spread of

All regions will experience the health transition, but the timing will differ.

Figure 1.8 Median age at death, by demographic region, 1950, 1990, and 2030



a. The age below which half of all deaths in a year occur.

b. Projected.

Source: World Bank data.

Table 1.3 Evolution of the HIV-AIDS epidemic

Region	HIV incidence (millions)		HIV prevalence (millions)		AIDS-related deaths (millions)	
	1990	2000 ^a	1990	2000 ^a	1990	2000 ^a
Demographically developing group ^b	1.6	2.5	7.4	25	0.3	1.7
Sub-Saharan Africa	1.1	1.0	5.8	12	0.3	0.9
Asia ^c	0.3	1.3	0.4	9	**	0.6
EME and FSE ^d	0.1	**	1.4	1	0.1	0.1
Total	1.7	2.5	8.8	26	0.4	1.8

** Less than 0.05 million.

Note: Incidence refers to new infections in a given year; prevalence refers to the total number of persons infected.

a. Conservative estimates.

b. The countries of the demographic regions Sub-Saharan Africa, India, China, Other Asia and islands, Latin America and the Caribbean, and Middle Eastern crescent.

c. India, China, and the demographic region Other Asia and islands.

d. EME, established market economies; FSE, formerly socialist economies of Europe.

Source: World Health Organization data.

the virus. Spread of the virus may be about to occur even in these three regions. It takes six to ten years, on average, for an HIV-infected adult to develop AIDS. Thus, regardless of future changes in transmission of the virus, there will certainly be an increasing number of AIDS cases over the next few years.

It is difficult to predict the future course of the epidemic because so little is known about the dynamics of HIV transmission. WHO has projected that in 2000, 2.5 million people will be newly infected with HIV, HIV prevalence will have reached 26 million, and AIDS deaths will total 1.8 million (see Table 1.3). These estimates are conservative, since they assume that the rate of new infections in Africa will slow somewhat and that new transmission will be concentrated in India and in the Other Asia and islands region. If no effective interventions to slow transmission are introduced, the total number of deaths may be twice as large, in which case AIDS would be responsible for 8 percent of the global burden of disease by 2000 instead of the 3.5 percent implied by the estimates in Table 1.3. If, however, sexual behavior changes dramatically over the next decade, even the conservative projections given here may prove too pessimistic. Relatively modest reductions in numbers of casual sexual partners, or in the prevalence of STDs—or, alternatively, substantial increases in condom use—could reduce transmission significantly. Early (and still tentative) findings from Thailand are encouraging; perhaps behavior really will change.

Opinions differ concerning the effects of AIDS on population growth. The variables needed to model the epidemic—including baseline rates of infections, behavioral risk factors, efficacy of trans-

mission, incubation periods, survival times, and the role of such factors as STDs—are not well quantified, and accurate projections are therefore impossible. In the African communities that are most severely affected, early assessments predicted absolute declines in population. Later views suggest that population growth will continue, albeit at a reduced rate. Trial projections for Sub-Saharan Africa, based on a high assumption of HIV prevalence of 60 million infections worldwide in 2000, suggest a reduction in life expectancy by 2010 of about six years, in comparison with a low-HIV model, and a 25 percent increase in adult mortality. The effect on population growth would still be modest: a reduction of about 0.25 percentage point a year, to an annual rate of 2.7 rather than 2.95 percent in 2005–10. In areas such as Thailand where fertility and mortality rates are much lower than in Sub-Saharan Africa, AIDS may well contribute to actual population declines over a period of thirty years or more.

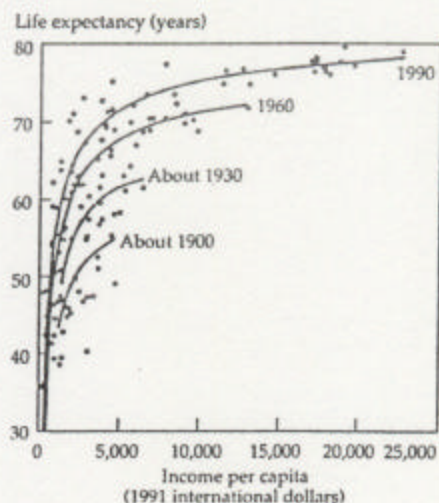
Drug-resistant diseases

Microbes evolve as a result of natural mutation, which throws up new threats, and of drug therapy-induced selection, which fosters drug resistance. Two major new threats have arisen in this century: the influenza virus responsible for the 1918–19 worldwide epidemic, and HIV.

The evolution of drug resistance, partly driven by incomplete or inadequate treatment, is more gradual and less dramatic but no less serious. The everyday bacteria responsible for pneumonias and diarrheas have become resistant to the older antibiotics and will gradually do the same with the newer antibiotics developed over the past few dec-

Life expectancy is related to income, but the relationship has shifted upward during the twentieth century.

Figure 1.9 Life expectancy and income per capita for selected countries and periods



Note: International dollars are derived from national currencies not by use of exchange rates but by assessment of purchasing power. The effect is to raise the relative incomes of poorer countries, often substantially. For illustrative country comparisons and a more detailed explanation, see Table 30 in the World Development Indicators.
Source: Preston, Keyfitz, and Schoen 1972; World Bank data.

ades. Tuberculosis resistant to the standard mix of antibiotics is becoming more common in the industrial world, and it kills many of those who contract it. Chloroquine-resistant malaria has now spread to practically all endemic areas, and although new drug therapies are available, widespread resistance even to several of these is being reported. Malaria has thus reemerged as a significant health risk in urban areas that had been free of it for several decades. Resurgence of the disease has been abetted by the reduced effectiveness of vector control, which is partly attributable to the increasing resistance of mosquitoes to standard insecticides. Resistant strains of many STDs are also

emerging. In the developing world the diseases for which drug resistance is already a major issue (respiratory infections, tuberculosis, STDs, and malaria) accounted for almost one-fifth of the GBD in 1990.

This steady evolution of drug-resistant microbes poses challenges for research and for health care. Better understanding of infectious agents is needed as a basis for the development of new therapies. Health providers must consider the effects of drug use on the evolution of resistant microbial strains. Basic scientific advances can contribute to tracking resistance, as recently shown by developments in identifying drug-resistant strains of tuberculosis. There is little reason to hope for permanent success in humanity's struggle against infection; investments in scientific research and vigilance on the part of public health authorities will remain indispensable.

These problems arising from microbial evolution are most severe in Sub-Saharan Africa. If efforts to control the spread of HIV fail, by 2000 an additional 1 million people in the region will be dying from AIDS each year. Most of them will be young adults who would otherwise have gone on to live healthy lives. If malaria develops resistance to all available drugs, the number of people it kills every year could increase sharply, from the expected 1.5 million deaths in 2000 to 2.3 million. Sub-Saharan Africa might also suffer from a tuberculosis epidemic, driven partly by drug resistance and partly by the spread of the disease by people with HIV. Extrapolation of current trends indicates an annual total of 8.5 million premature deaths in Sub-Saharan Africa by the end of the century. But it is all too easy to project a figure as high as 11.5 million, accompanied by a sharp reduction in life expectancy.

Lessons from the past: explaining declines in mortality

Three factors have been important in the dramatic and unprecedented mortality declines of the past hundred years and in the still more dramatic declines in developing countries since World War II. These factors are income growth, improvements in medical technology, and public health programs combined with the spread of knowledge about health.

Income growth

Increased income allows people, particularly the poor, to buy more food, better housing, and more

health care. Throughout the twentieth century life expectancy has been strongly associated at the national level with income per capita, as seen in Figure 1.9. Life expectancy rises rapidly with income at low levels of income, particularly when income per capita is less than \$3,000 (1991 purchasing power dollars). The figure shows, however, that the relationship has shifted upward over each thirty-year period, so that more health is realized for a given income. For example, in 1900 life expectancy in the United States was about forty-nine years and income per capita in 1991 dollars was about \$4,800. In 1990 that income per capita would be associated with a life expectancy of about seventy-one years. This upward shift shows that health depends on more than income alone.

Improvements in medical technology

Before the 1930s medical technology had little to offer humanity, with the exception of smallpox inoculation, the use of which was widespread in Europe from the late eighteenth century onward, and diphtheria antitoxin, discovered in 1894. Starting in the 1930s, with the introduction of antibacterial drugs and new vaccines, a wide range of effective interventions has become available to counter most communicable diseases.

The effect of these technological improvements on health has depended on other factors, such as income gains for the poor, increased schooling, and public policies that affect health systems. As a result, outcomes have varied widely by country, even within the same region. For example, in the early 1980s child mortality was three times higher in Mali than in Botswana, six times higher in Bolivia than in Chile, and five times higher in Bangladesh than in Sri Lanka. Between the early 1960s and the early 1980s child mortality fell 20 percent in Bangladesh but 65 percent in Sri Lanka, 10 percent in Uganda but 50 percent in Kenya, and 10 percent in Haiti but nearly 80 percent in Costa Rica. Some countries have clearly made better use of the available technology than others.

Public health and the spread of knowledge

The introduction of public health measures—particularly clean water, sanitation, and food regulation—certainly contributed to the decline in child mortality in the late nineteenth century and to the accelerated decline in the early twentieth century. The geographic distribution of mortality declines suggests, however, that until people began to understand the sources of poor health, such public

health measures were responsible for only a small part of the progress made. In the late nineteenth century Robert Koch showed that the bacterium *M. tuberculosis* causes tuberculosis, and people began to understand about germs. They took simple precautions—preparing food and disposing of waste hygienically, eliminating flies, and quarantining sick family members—that had far-reaching benefits. Recent research has shown that child mortality differed little by education or even by income in the United States in the last decade of the nineteenth century but that differences widened sharply as child mortality fell in the early twentieth century. The implication is that affluence and education made little difference until scientific knowledge showed households how to reduce the dangers to their health. Since better-educated individuals acquire and use new information more quickly, this emphasis on knowledge helps to explain the large differences in child mortality by mother's education observed in developing countries today.

The potential for effective action

The recent declines in mortality in the developing world have been sharper than the earlier declines in the high-income countries and more influenced by technical advances. To take one example, Sri Lanka achieved a remarkable decrease in mortality after World War II; the crude death rate fell from 21.5 per 1,000 in 1945 to 12.4 in 1950. Some 23 percent of that drop has been attributed to the malaria eradication program, which mainly involved spraying of insecticide from the air. The same approach also did much to control yellow fever, onchocerciasis, and many other diseases. Widespread use of newly available antibiotics against conditions such as yaws in Africa helped to reduce STDs and (probably) acute respiratory infections. Improvements in water and sanitation curbed the spread of disease, particularly in towns and cities. Whereas at the beginning of this century child mortality rates in today's high-income countries were much higher in urban than in rural areas, the opposite has been true of the developing world since 1950.

Vaccination, too, has produced dramatic results, including the eradication of smallpox and the elimination of paralytic polio in the Western Hemisphere. About 80 percent of the world's children are now vaccinated against the main infectious diseases of childhood, thanks largely to the Expanded Programme on Immunization (EPI) sponsored by WHO and UNICEF. It is estimated that the EPI

prevented the deaths of 2.6 million children in 1990 alone. Substantial benefits have also come from simple curative measures such as oral rehydration to avert death from diarrhea and a short course of drugs for curing tuberculosis. But there is much more still to be done: in 1990 childhood deaths from diarrhea and immunizable diseases alone accounted for 12 percent of the GBD.

The march of science has increased both the range of inexpensive clinical treatments and practices and the potential performance of health systems. It is now possible to treat at low cost tuberculosis, STDs, many respiratory infections, and risky deliveries, which together accounted for

more than 20 percent of the GBD in 1990. Epidemiological advances are giving governments and households warning of the enormous health damage from smoking. But if the full benefits of scientific advances are to be realized, parallel developments are needed to empower households so that they can put the advances into practice. The key developments are schooling, particularly of girls; economic growth, particularly of the poor; and a flexible, responsive health system able to provide the necessary preventive and curative care. The policies needed to achieve these developments are the subject of the remainder of this Report.



Public health

Health services interact with households in two fundamentally different ways. *Public health programs* strike against health problems of entire populations or population subgroups. Their objective is to prevent disease or injury and to provide information on self-cure and on the importance of seeking care. *Clinical services* respond to demand from individuals. They generally seek to cure or to ease the pain of those already sick. This chapter discusses public health; Chapter 5 turns to clinical services.

Public health programs work in three ways: they deliver specific *health services to populations* (for example, immunizations), they promote healthy *behavior*, and they promote healthy *environments*. Governments play a leading role, and provision of information through public education is a central feature of most programs, especially those designed to change behavior. But difficult choices have to be made about the best use of public money. The Expanded Programme on Immunization (EPI), described below, is highly cost-effective, at about \$25 per DALY gained, but not all programs offer such good value for money. This chapter examines six particularly cost-effective public health services in the realms of population-based services (including immunization), nutrition, fertility, tobacco and other drugs, the household and external environment (including control of insect vectors of disease), and AIDS. Public health packages in developing countries should include components in most or all of these six areas.

Population-based health services

In 1979 the World Health Organization declared that smallpox had been eradicated. It then initi-

ated, in collaboration with UNICEF, a global effort to prevent a range of childhood diseases by immunization. The EPI now reaches about 80 percent of children in developing countries and averts an estimated 3.2 million deaths a year at a cost of \$1 billion a year.

Population-based health services such as the rely on personnel with limited training to provide drugs, vaccines, or specific health services directly to specific populations—in schools, at workplaces or in households. Government finance for such programs is justified because the objective is usually to provide services to all in a community, because the services create externalities or indirect benefits, and because the diseases they typically combat are particular problems for the poor. The types of interventions are immunization, mass treatment for worms and other infections, a screening and referral. Information, education and communication are critical to many such programs, both to attract participation and to achieve durable change in behavior.

Immunization

Vaccines to prevent tuberculosis, measles, diphtheria, pertussis, tetanus, and polio have revolutionized preventive medicine over the past two decades. Costs are less than \$10 per DALY gained for measles immunization and less than \$25 for combination of polio plus DPT (diphtheria, pertussis, and tetanus). These vaccines, together with BCG immunization against tuberculosis and leprosy and immunization of pregnant women against tetanus, form the EPI.

As a result of the EPI, the proportion of children immunized rose from less than 5 percent in 1977 to

20 to 30 percent by 1983. By 1990 coverage with polio, DPT, and measles vaccines had reached approximately 80 percent of all children, and about 35 percent of pregnant women were receiving tetanus toxoid. The lowest vaccine coverage is reported in Sub-Saharan Africa.

Had vaccination coverage remained at the low levels of the 1970s, as many as 120 million DALYs a year (the equivalent of 23 percent of the global burden of disease among children under age 5 in 1990) would be lost to diseases preventable by the EPI. At current levels of vaccination coverage, these diseases cause a loss of 55 million DALYs, or 10 percent of the disease burden among children under age 5 (Table 4.1).

The cost of fully immunizing a child in low-income countries is about \$15, with a range of \$6 to more than \$20, depending on the prices of labor and other local inputs. Reducing the number of contacts needed to immunize each child fully could cut costs dramatically, by as much as 70 percent if only one contact instead of the current five were needed. This prospect depends on the success of ongoing research efforts. Technical improvements in the cold chain (by which vaccines are kept refrigerated until use), good administration, widespread deployment of delivery teams, and effective social mobilization efforts can also contribute to dramatic cost reductions. In the Gambia the cost of immunizations fell from \$19 in 1982 to \$6 in 1988. Costs also depend on the immunization strategy: campaigns achieve high initial coverage, but routine services are more cost-effective. In Ecuador campaigns cost \$66 per DALY gained compared with \$30 for routine services. Because many countries lack the infrastructure to deliver vaccines routinely in remote rural areas, cam-

paigns continue to be justified. In areas with better infrastructure, routine services make more sense.

An ambitious current goal, established in 1988 by WHO's governing body, the World Health Assembly, is to eradicate polio by 2000. Current trends suggest that even if eradication is not achieved on that schedule, it will be soon thereafter. And substantial success has already been achieved: there has been no naturally occurring case of polio in the Western Hemisphere since August 1991.

Two extensions to the EPI appear to be justified. First, coverage should be extended, probably to 95 percent of all children born. The costs of expanding coverage are relatively high, but so are the gains. Those not covered at present often lack any health services and are disproportionately vulnerable to the diseases. Second, it makes sense to include additional items in the package: hepatitis B and yellow fever vaccines for selected countries and vitamin A and iodine supplements in regions where deficiency of these micronutrients is highly prevalent. If micronutrients are not delivered through the EPI, some other vehicle must be found for reaching very young children. Adding these two vaccines and two micronutrients to the EPI (EPI Plus) would improve health substantially, particularly in the poorest households, for a modest increase of about 15 percent in the cost of reaching each child with complete services (vaccine and micronutrients). Table 4.2 summarizes the estimated costs and health benefits of the EPI Plus cluster in two different settings. Total annual costs range between \$2.2 billion and \$2.4 billion for EPI Plus, or less than 2 percent of the public health expenditure of developing countries. Expanding coverage from 80 to 95 percent would probably

Table 4.1 Burden of childhood diseases preventable by the Expanded Programme on Immunization (EPI) by demographic region, 1990

Region	Burden (millions of DALYs per year)	Share of the total burden in children under age 5 (percent)	Burden per 1,000 children under age 5 (DALYs)
Sub-Saharan Africa	23	15	242
India	16	12	137
China	1	3	8
Other Asia and islands	7	10	81
Latin America and the Caribbean	1	3	18
Middle Eastern crescent	7	10	86
Formerly socialist economies of Europe	*	*	1
Established market economies	*	*	1
World	55	10	87

* Less than 1.

Note: The EPI includes immunizations for pertussis, polio, diphtheria, measles, tetanus, and tuberculosis. These estimates exclude the burden from tuberculosis because most of it falls on adults.

Source: Calculated from Murray and Lopez, background paper.

Table 4.2 Costs and health benefits of the EPI Plus cluster in two developing country settings, 1990

Costs and benefits	Low-income countries (high mortality and fertility)	Middle-income countries (low mortality and midium fertility)
Cost per capita (dollars)	0.5	0.8
Cost per fully immunized child (dollars)	14.6	28.6
Cost per DALY gained (dollars)	12-17	25-30
Cost per DALY gained as a percentage of income per capita ^a	0.14	0.03
Potential health gains as a percentage of the global burden of disease	6.0	1.0

Note: Figures are based on 95 percent coverage.

a. Income per capita in 1990 was assumed to be \$350 for low-income countries and \$2,500 for middle-income countries.

Source: World Bank data and authors' calculations.

increase annual costs by between \$500 million and \$750 million. In low-income countries the increase in coverage would reduce by about 6 percent the global disease burden.

Mass treatment for parasitic worm infection

The most common intestinal worms—roundworms, hookworms, and whipworms—each infect between 170 million and 400 million school-age children annually. Schistosomiasis infection, also caused by parasitic worms, affects almost 100 million school-age children annually. The immediate effects of infection—including failure to thrive, anemia, and impaired cognition—can now be rapidly reversed by low-cost, single-dose oral therapy. Studies of single-course treatment of school-children with hookworm or schistosomiasis in Kenya, with worm-induced disease in India, and with trichuriasis in the West Indies showed remarkable spurts in growth and development in all the populations studied, including the large percentages of children with asymptomatic infections. And treatment also appears to have improved cognitive development.

Curing worm infections is simple with inexpensive modern drugs such as albendazole and praziquantel because it is not necessary to determine which species are present. Furthermore, the high level of safety of these drugs has led WHO to develop protocols for their use on a mass basis (where a high prevalence of infection exists) and by providers who are not medically trained—a combination that makes for high cost-effectiveness. Treatment usually cures the current infection, but in endemic areas children will inevitably become reinfected. A return to pretreatment levels of infection typically takes about twelve months for roundworm and whipworm and twenty-four months or more for hookworm. Rates of reinfection

can be reduced by environmental improvements, especially sanitation, but where this is impractical or unaffordable, it is cost-effective to repeat the therapy at regular intervals.

The benefits of individual treatment can be significantly enhanced by community-wide treatment which, by lowering the overall levels of contamination of the environment with infective stages of the worms, slows the rate of reinfection. Treatment programs targeted at the most heavily infected group (school-age children) reduce infection immediately both among those treated and in the rest of the population. Treatment through schools also allows delivery at relatively low cost: a program in Montserrat was estimated to cost less than \$1.50 per person for a cycle of eight treatments. A program managed by a nongovernmental organization in Jakarta initially cost \$0.74 per capita per year, but after expansion to almost 1,000 schools the costs fell to \$0.26. Such programs are extremely cost-effective, at \$15 to \$30 per DALY gained. In light of this cost-effectiveness and the burden of disease addressed, the Rockefeller Foundation and the UNDP are initiating a major program to document and explore the potential of school-based health interventions that focus on deworming and provision of micronutrient supplements.

Mass screening and referral

Mass screening for disease control involves the examination of asymptomatic individuals to identify and treat those affected by disease. Although this method has been used to control some infectious diseases, such as tuberculosis, it is mostly used for noncommunicable diseases. Mass screening makes sense for highly prevalent diseases that can be cured by early treatment, especially when latency periods span many years. An example is cer-