Part One

Making a Difference in People's Lives: *Achievements and Challenges*

Part One begins, in Chapter 1, by reviewing the dramatic decline in mortality in the 20th century. Income growth and improved educational levels – and consequent improvements in food intake and sanitation – have accounted for part of the mortality decline; but access to new knowledge, drugs and vaccines appears to have been substantially more important. The decline in mortality has had far-reaching consequences for every aspect of life: fertility began a rapid decline, populations are ageing and better health has contributed to the wide diffusion of rapid economic growth.

Chapter 2 then turns to the double burden of disease that health systems of the 21st century must address. One element of the double burden results, ironically, from the successes of the 20th century: as a consequence of the ageing of populations, epidemics of noncommunicable disease and injury now drive the demand for health resources. Meanwhile, not everyone has shared the benefits of better health. Large inequalities persist in well-off countries, and as many as a billion people still suffer heavily from conditions that are virtually unseen among the non-poor. This unfinished agenda – the second element of the double burden – is described, and the chapter shows that relatively inexpensive tools exist for dealing with these problems.

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Health and Development in the 20th Century

The 20th century has seen a global transformation in human health unmatched in history. The magnitude of this transformation can be illustrated by looking at the example of Chile. By the mid-1990s, Chile had a per capita income of about US$ 4000 (adjusted for purchasing power of currency), i.e. it had a high average standard of living, with an income level sufficient to provide its people with more than adequate food, shelter and sanitation. Yet Chilean women today have a life expectancy of 79 years – perhaps 25 years more than women in a country with a similar income level in 1900 (and 46 years more than Chilean women had in the early 1900s). This chapter briefly describes this 20th century revolution in human health, then examines both its profound consequences for human demography and its contribution to the worldwide diffusion of rapid economic growth.

The 20th Century Revolution in Human Health

The steady improvement in life expectancy that began in Europe in the late 1900s continued virtually without interruption throughout the 20th century. In England and Wales for example, life expectancy was around 40 years in the late 19th century; but by early in the 20th century it had risen to almost 50 years. Other countries experienced similar take-off periods. In Europe these mostly occurred in the late 19th or early 20th century.

Economic historians and demographers debate the genesis of these increases in life expectancy, but the increases appear to be at least partially linked to the economic changes resulting from the agricultural and industrial revolutions. One aspect of economic change – urbanization – actually affected health adversely by exposing an increasing proportion of the population to crowded conditions, thereby facilitating the spread of infection. Somewhat more than counterbalancing this effect, though, were increases in nutrient intake and improvements in sanitation and water supply resulting from higher income levels *(1)*. Better health and nutritional status were both a result and a cause of income growth. Although northern Europeans had began immunizing against smallpox by early in the 19th century, this was exceptional, and other specific knowledge and tools for improving health probably played only a limited role in the minor health improvements of the 19th century *(2)*. In contrast, the 20th century health revolution appears to have resulted far more substantially from the generation and application of new knowledge.

Mortality rates in European countries continued their decline in the 20th century, and by the second half of the century this mortality revolution had spread to the rest of the world. The 20th century global revolution in health transformed – and is transforming – not only the quality of individual lives, but also the demography of populations. These changed health and demographic circumstances have themselves contributed to wide diffusion of economic growth. This chapter overviews the health revolution and its demographic and economic consequences, as well as looking at why it occurred. Chapter 2 then turns to the epidemiological consequences of the health revolution that result from ageing populations, and describes how the incompleteness of the health revolution has left perhaps a billion people behind. Addressing this "double burden" is perhaps the central issue for health policy for the 21st century.

Table 1.1 Life expectancy at birth, selected countries, around 1910 and in 1998

Country	Around 1910		1998	
	Males	Females	Males	Females
Australia	56	60	75	81
Chile	29	33	72	78
England and Wales	49	53	75	80
Italy	46	47	75	81
Japan	43	43	77	83
New Zealand[a]	60	63	74	80
Norway	56	59	75	81
Sweden	57	59	76	81
United States[b]	49	53	73	80

[a] Excluding Maoris.

[b] Registration states only; includes District of Columbia.

Sources: 1910 data: **Preston SH, Keyfitz N, Schoen R**. *Causes of death: Life tables for national populations.* New York and London, Seminar Press, 1972. For Australia: **Cumpston JHL (Lewis MJ ed.)** *Health and disease in Australia: A history.* Department of Community Services and Health, Canberra, AGPS, 1989.

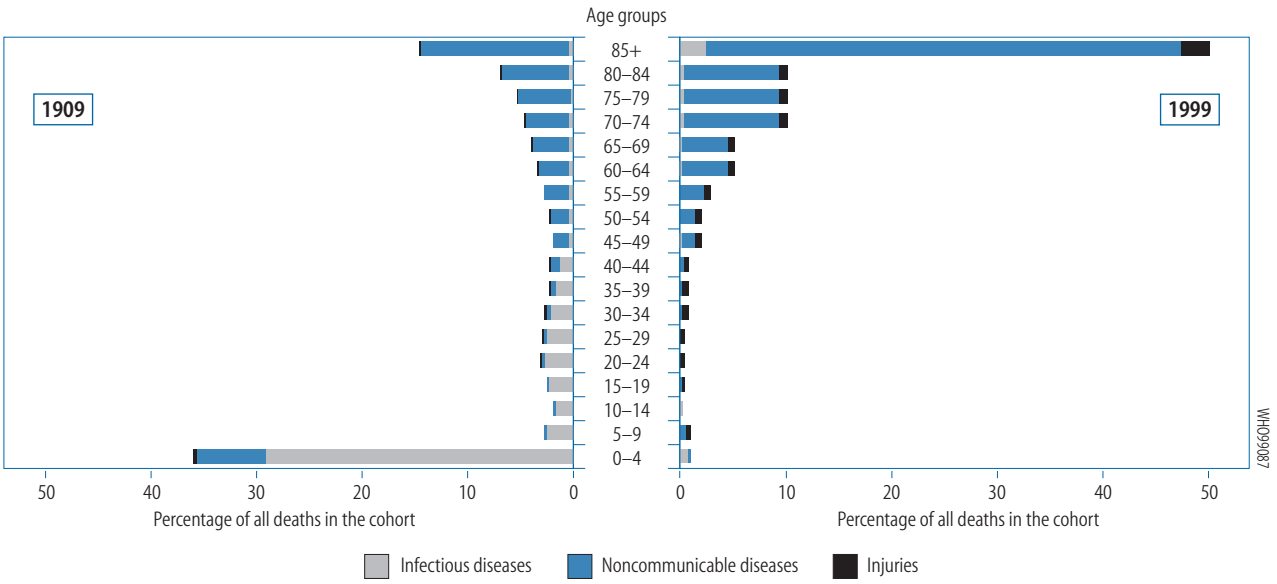
1998 data: **United Nations Population Division.** *World population prospects: The 1998 revision.* New York, United Nations, 1998.

The precipitous decline in mortality

Whereas life expectancy in England and Wales varied around an average of 40 years during the two centuries prior to 1870, in the subsequent 125 years it almost doubled. Other countries shared this pattern of improvement in the 20th century, as Table 1.1 shows.

Chile, to continue with the example, provides an interesting and well-documented case where the take-off in life expectancy occurred well within this century. The life expectancy at birth for a Chilean female in 1910 was 33 years. Today her life expectancy would be 78 years, an increase of a remarkable 45 years. How has that made a difference in the lives of Chilean women? Figure 1.1 quantifies one obvious dimension of change: the probability that a Chilean female would die before her fifth birthday has declined from 36% to 1.9%. Less obvious, perhaps, is that throughout middle life death rates are far lower; she is now much less likely to die as a young adult from tuberculosis or in child-

Figure 1.1 Age distribution of deaths in Chile, females, 1909 and 1999 cohorts



birth, or in middle age from cancer. Mirroring this mortality reduction – but less easily quantified – are marked changes in her health-related quality of life. She will spend less time in pregnancy and child-rearing. From an average of about 5.3 children at mid-century, Chilean women's fertility has dropped to its current level of 2.3 – barely above replacement level. She will have fewer infections, less anaemia, greater strength and stature, and a quicker mind. Her life is not only much longer, it is much healthier as well.

While Chile's progress in this century has been exceptional, most low and middle income countries have undergone (or are undergoing) a similar transformation of health and mortality levels. Recent exceptions to these favourable trends occur in AIDS-ravaged parts of Africa and, for a variety of reasons, among adult males in central and eastern Europe.

Demographic transition

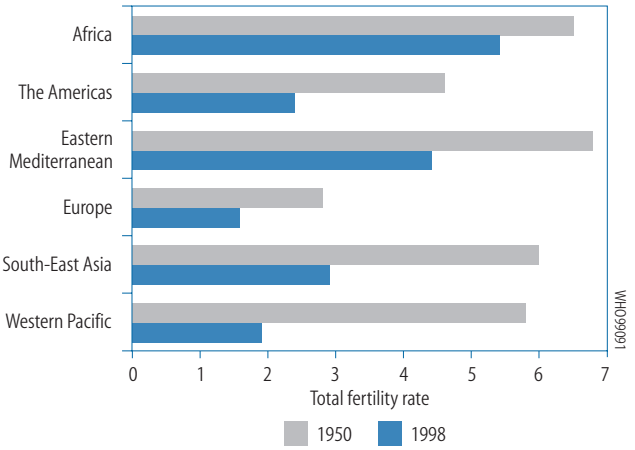
Although mortality declines have typically led to increases in population growth rates, these increases prove temporary. Fertility decline accompanies or soon follows mortality decline, bringing growth rates back to low levels. Figure 1.2 shows a half century of decline, for each WHO Region, in total fertility rate (TFR) – the expected number of children a woman would bear at the prevailing age-specific fertility rates. A TFR of a little over 2 represents a replacement level of fertility, i.e. a level that if maintained in the long run would result neither in population growth nor decline.

At mid-century, fertility rates were extremely high in most countries of the world (with the exception of the high income countries). TFRs of 6 were not uncommon. Figure 1.2 shows that every region except Africa has experienced sharp declines in fertility. And evidence is mounting that the decline in Africa has now commenced.

Declining birth rates lead to stabilization in the size of the youngest age cohorts. Over time these youths become middle-aged, while the younger cohorts remain about the same size. Figure 1.3 provides a further example of change, with data illustrating the population age distributions (pyramids) in WHO's South-East Asia Region for 1950, 2000 and 2050. After the rapid decline in fertility, age distributions change, but only slowly. If the South-East Asia Region's TFR remains at 2.9, its average population age will continue increasing for decades to come.

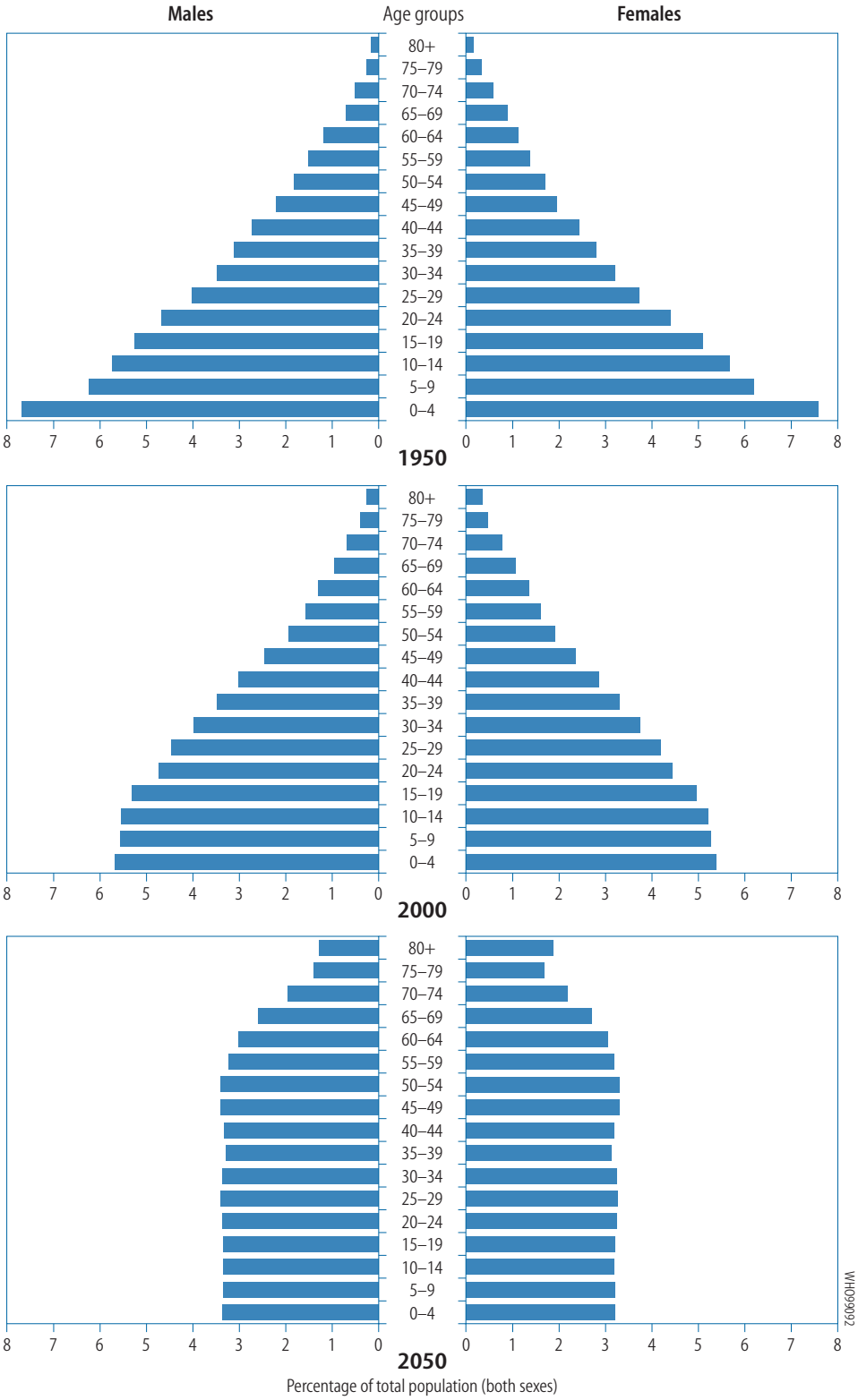
The world today is perhaps somewhat past the halfway point of a two-century period during which the demographic characteristics of the human population will have been totally transformed. This transformation (or demographic transition) entails a move from very high birth and death rates to low ones; a move from initially low population growth rates through a period of high rates and a vast increase in total population then back to low or zero growth rates; and a move from an age distribution with numerous young and few elderly to one with nearly equal numbers in most age groups. Enormous social, economic and epidemiological changes follow the demographic transition, which is itself a consequence of the still-ongoing revolution in mortality. Chapter 2 will point to the epidemiological consequences of the demographic transition and the concluding section of this chapter will outline possible economic consequences. This report simply notes the great importance of these changes, rather than discussing them in any detail.

Figure 1.2 Declines in fertility by WHO Region, 1950 and 1998



Source: **United Nations Population Division.** *World population prospects: The 1998 revision.* New York, United Nations, 1998.

Figure 1.3 Distribution of the population of the South-East Asia Region, by age and sex, 1950, 2000 and 2050



Source: **United Nations Population Division.** *World population prospects: The 1998 revision.* New York, United Nations, 1998.

Sources of mortality decline

Income improvements can lead to mortality reductions, and numerous studies have attempted to quantify this effect. Analyses undertaken as background to this report, for example, assessed for all countries the effects of national income on health outcomes during the period 1952–1992. Figure 1.4 shows results from this analysis in curves relating the infant mortality rate (IMR) to gross domestic product (GDP) per capita (adjusted for purchasing power). Income increases do indeed correlate with mortality declines and there are good reasons to believe that the relation is causal in both directions.

How much of the remarkable decline in infant mortality rates has resulted from income growth during that period? The upper curve shows the income–mortality relation in 1952 and the lower one, for 1992, shows how much lower mortality rates had become by then for any given level of income. Figure 1.4 suggests that however important income growth may be, *the changing relation between mortality and other factors (e.g. access to health technology) is likely to be more important.* Between 1952 and 1992, for example, per capita income increased by about two thirds, on average, across the countries included in the analysis – from about $1530 to $2560. The upper curve in Figure 1.4 shows that had the income–mortality relation remained as it was in 1952, the IMR would have declined from 144 to 116. In fact it declined to only 55.

Table 1.2 reports the results of an attempt to quantify the relative importance of key determinants of mortality reduction. It draws on a statistical assessment of how the relation has changed over time between various health indicators and both income levels and average educational levels (of adult females). The table reflects a decomposition of the causes of improvement in health into three components: increases in average income levels; improvements in average educational levels; and a favourable shift in the underlying curve. This favourable shift is ascribed to the generation

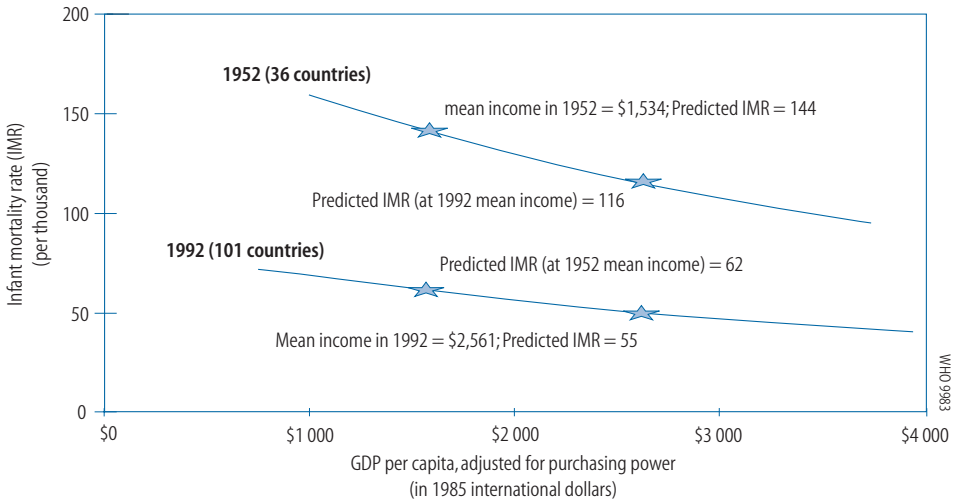
Table 1.2 Sources of mortality reduction, 1960–1990

Reduction	Percentage contribution of gains in		
	Income	Educational level of adult females	Generation and utilization of new knowledge
Under-5 mortality rate	17	38	45
Female adult mortality rate	20	41	39
Male adult mortality rate	25	27	49
Female life expectancy at birth	19	32	49
Male life expectancy at birth	20	30	50
Total fertility rate	12	58	29

Note: The results are based on analysis of data from 115 low and middle income countries.

Source: **Wang J et al**. *Measuring country performance on health: Selected indicators for 115 countries.* Washington DC, The World Bank, 1999 (Human Development Network, Health, Nutrition and Population Series).

Figure 1.4 The role of improvements in income in reducing infant mortality rates



Note: Results are based on a cross-sectional time-series regression that relates, at 5-year intervals, the natural logarithm of IMR to the natural logarithm of income, the square of the natural logarithm of income and indicator variables for time. Data sources are the same as for Annex Table 6.

and application of new knowledge. Other indicators of social welfare show a similarly modest relation to income growth along with favourable time trends at any given level of income *(3)*. Much research remains to be done, however, in order to achieve a complete understanding of why the income–health relation has improved so much. Typically, half the gains in health between 1952 and 1992 result from access to better technology. The remaining gains result from movement along the curve (income improvements and, more importantly, better education). Figure 1.4 (which does not control for education changes) illustrates the magnitude of the effect of moving along the curve relative to shifts in the curve *(4,5)*. Higher levels of income and education affect health through a variety of mechanisms, often involving many sectors of the economy. Box 1.1 outlines the main multisectoral determinants of health.

The historical evidence points in the same direction. In some countries, many decades of economic growth saw no change in health status (for example, England and Wales); in Sweden the take-off in health occurred at about the same time as in Britain but economic growth began three-quarters of a century later; and in India the take-off in life expectancy preceded that for economic growth *(2)*.

Shifting the curve and *moving along the curve* are, then, both sources of improvements in health. Some countries lie far above the curve, i.e. their mortality rates are much higher than would be predicted by their income. For these countries, *joining the curve* may be the quickest way to improve health. Chapter 2 will illustrate the extent to which some of the world's most populous countries could make great health gains by joining the curve.

What conclusions can be drawn from this analysis? First and foremost, it is clear that

Box 1.1 The multisectoral determinants of health

Hungry children easily acquire diseases, and easily die from the diseases they do acquire. Dwellings without sanitation provide fertile environments for transmission of intestinal infections. Air dense with particulates or acids destroys lungs, and lives. Hopeless life circumstances thrust young girls (and boys) into prostitution with its attendant risks of violence and sexually transmitted diseases, including HIV/AIDS. Manufacturers of tobacco and alcohol profit enormously from advertising and promotion that spreads addiction. Rapid growth in vehicular traffic – often with untrained drivers on unsafe roads – generates a rising toll of injury. Poorly designed irrigation projects create breeding grounds for vectors of disease. The list could be much extended, and it could be rephrased in terms of factors favorable to health, but the point is clear: determinants of health are truly multisectoral.

An assessment commissioned for WHO's 1997 Ad Hoc Committee on Health Research estimated the percentage of deaths, by region and globally, associated with each of ten risk factors. It concluded that the following risks contributed to global mortality in 1990:

- tobacco use – 6.0%;
- hypertension – 5.8%;
- inadequate water and sanitation – 5.3%.
- risky sexual activity – 2.2%;
- alcohol use – 1.5%;

Underlying most specific risks are more general determinants of health – income and education levels. The effects of income and education operate for the most part through influencing risk (and being able to utilize health services effectively). For example, poorer societies may forego expensive mechanisms for cleaning polluted air or water from factories, and poorer households lack the resources to purchase indoor sanitation or piped water. Poorly educated individuals may fail to observe basic hygiene or neglect appropriate weaning practices for their children; and they are increasingly the population that smokes. The effects of education and income are indeed real and quantitatively important, even though only about half of health improvements in developing countries in the period 1960–1990 result from these factors.

If an important fraction of ill-health results from poverty and low educational levels – or from their consequences in inadequate food or sanitation or other specific risks – then ought the task of the health professional lie principally in addressing these underlying problems? In one sense the answer is surely yes: the health community should measure the effects on health of actions outside the health sector. It should ensure that these findings are communicated, and are considered in making policy choices. The magnitude of the demonstrated effect of girls' education on health and fertility outcomes, for example, provides a powerful argument for investing in extension of educational access to girls.

But the health community has limited capacity for direct action outside the health sector – and limited credibility. It will make more of a difference if it focuses its energy, expertise and resources on ensuring that health systems efficiently deliver the powerful interventions provided by modern science.

Source: *Investing in health research and development. Report of the Ad Hoc Committee on Health Research Relating to Future Intervention Options.* Geneva, World Health Organization, 1996 (document WHO/TDR/Gen/96.1).

health system development is a key priority. The effects of economic growth on health, while real, are relatively weak and likely to be slow in coming. Rather than waiting for movement along the curve, *countries should focus health system development on the task of joining the curve* or going beyond it to the point of best practice.

Second, in the medium to long term, shifting the curve will underpin health improvements. The high income countries now commit vast sums (over US$ 55 billion per year) to the research and development (R&D) efforts that will shift the curve favourably. But only a fraction of that amount is directed to solving the particular problems of poor and disadvantaged people. Greater R&D commitments to such problems would be likely to pay off enormously in improving health. Ensuring an adequate commitment to R&D is surely an integral element of health system development.

There is every reason to expect, then, that focused investments by health systems on specific problems of the poor can generate major short to medium term gains in health, and that investment in R&D can sustain medium to long term gains. Such gains are of immense intrinsic value. The association between income and health moreover suggests that health investments may have an economic payoff as well. Supporting evidence for this assertion is presented below. Indeed, rather than continuing to point to poverty as the root cause of ill-health, decision-makers may come to focus on the two-way relationship between poverty and ill-health, identifying the latter as one of the root causes of poverty – and one that is particularly amenable to public intervention.

Health and Economic Productivity

The global gains in health documented above constitute, arguably, humankind's most dramatic achievement. In our era it is *possible* for every individual to expect to live a long and substantially disease-free life. This accomplishment transcends the need for economic valuation. Health gains have intrinsic value. That said, two particular reasons exist for assessing the economic consequences of better health:

- Understanding health's economic role may help to understand the sources of another of humankind's great accomplishments of the 20th century – widespread rapid economic growth. To the extent that better health has contributed to increased growth rates, investing in health can become a tool of macroeconomic policy.
- Conquering poverty constitutes the central task for development policy at the beginning of the 21st century. Despite rapid economic growth, over a billion humans still exist in absolute, degrading poverty. Because ill-health traps people in poverty, sustained investment in the health of the poor could provide a policy lever for alleviating persistent poverty.

Research has begun to provide clearer evidence of the economic benefits of improving health. But data sets underpinning the research – on characteristics of countries over time or on large numbers of households within a country at a given time – rarely permit conclusive determination of cause and effect. Conclusions drawn from the literature remain, therefore, suggestive rather than definitive. Those conclusions do, though, accord with common sense: healthier people are more productive. Health differences have played a significant role in determining why some countries have grown more rapidly than others, although technological advances and physical capital accumulation may have been more important still.

What is the evidence? This section summarizes the literature by, first, reviewing cross-country macroeconomic analyses, then by turning to microeconomic comparisons across

households. It closes with a brief discussion of the multiple pathways through which better health influences economic outcomes.

Macroeconomic evidence

Since publication of Adam Smith's *The wealth of nations* over two centuries ago, economists have sought answers to the question of why some countries are wealthy and others poor. Why have economic growth rates differed? The main empirical tool now used to study economic growth is cross-country analysis of the relationship between economic growth (typically measured in terms of the growth rate of per capita GDP) and a range of variables believed to account for why growth rates differ *(6,7)*. Among the factors being explored are: levels and patterns of educational attainment (schooling); population growth, density and age structure; natural resource abundance; personal and government saving (investment rates); physical capital stock; economic policy, for example, the degree of trade openness; the quality of public institutions; and geography, for example, the location and climate of a country.

Recent research has added several specific health indicators to these factors, and looked at the links between them and economic growth. There are direct links between economic performance and health indicators such as life expectancy. Some variables, such as geography and demography, indirectly link health with economic growth. Geography, particularly tropical location, is highly correlated with disease burden, which in turn affects economic performance *(8)*. Demography, on the other hand, is determined in part by health status, and has a direct effect on economic growth through the age structure of the population, in particular the ratio of the working age to the total population.

A major result to emerge from recent research is that survival rates or life expectancy are powerful predictors of income levels or of subsequent economic growth. The studies consistently find a strong effect of health on economic levels or growth rates. Interestingly, economic historians have concluded that perhaps 30% of the estimated per capita growth rate in Britain between 1780 and 1979 was a result of improvement in health and nutritional status *(9)*. That figure lies within the range of estimates produced by cross-country studies using data from the last 30 or 40 years *(10)*.

Health improvements also influence economic growth through their impact on demography. For example, in the 1940s, rapid improvements in health in East Asia provided a catalyst for a demographic transition there. An initial decline in infant and child mortality swelled the youth population, and somewhat later prompted a fall in fertility rates. These asynchronous changes in mortality and fertility, which comprise the first phase of the demographic transition, substantially altered East Asia's age distribution. After a time lag, the working-age population began growing much faster than the young dependent population, temporarily creating a disproportionately high percentage of working-age adults. This bulge in the age structure of the population created an opportunity for increased rates of economic growth. By introducing these demographic considerations into an empirical model of economic growth, analyses undertaken for the Asian Development Bank (ADB) were able to show that East Asia's changing demography can explain perhaps a third to half the economic "miracle" experienced between 1965 and 1990 *(11,12)*.

The ADB study cautions that although a "demographic gift" provides an opportunity for increasing prosperity, it by no means guarantees such results. East Asia's growth rates were achieved because government and the private sector were able to mobilize this burgeoning work force by successfully managing other economic opportunities. Adopting new industrial technologies, investing in basic education and exploiting global markets allowed East

Asia to realize the economic growth potential created by the demographic transition. The next phase for East Asia will involve less favourable dependency ratios consequent to population ageing. In contrast, both South Asia and Africa are now entering the period when demographic factors can enhance growth prospects. Box 1.2 describes ongoing work assessing linkages between health and income in the Americas.

Analysts are extending this research in several ways. One line of work, analysing the effects of climate on income, concludes that countries in tropical regions suffer important disadvantages relative to those in temperate zones. In addition to the effects of climate and geography on soil quality, this work suggests that an important causal mechanism through which this effect operates is the interaction of tropical climates and tropical diseases, particularly malaria which can have a significant cost in terms of economic performance *(8)*. Another line of analysis suggests that the interaction of exogenous demographic changes with human and physical capital development can lead to a virtuous cycle of growth, enabling a country to break free of a poverty trap *(13)*.

Microeconomic analysis

Unlike macroeconomic studies that compare the performance of countries over time, microeconomic analyses study the link between health and the income of households and individuals. Until recently, much of the microeconomic literature has dealt with the impact of education and training on labour outcomes. Recent individual and household level studies have, however, paid more attention to health (particularly nutritional aspects of health) and are reaching increasingly consistent findings *(14)*.

Several examples provide an indication of the results of this research. In Indonesia, men with anaemia were found to be 20% less productive than men without it. In one of the few experimental studies in the literature, the anaemic men were randomly assigned to one of two groups in a clinical trial – they received either an iron supplement or a placebo. Those who were initially anaemic and received the iron treatment increased their productivity nearly to the levels of non-anaemic workers, and the productivity gains were large when weighed against the costs of treatment. Thus the effects of improved health were found to be greatest for the most vulnerable, that is, the poorest and those with the least education. Box 1.3 provides more detail on another study, also from Indonesia and also involving an

Box 1.2 Assessment of the links between health and productivity: a PAHO initiative

In recent years, WHO Member States in the Region of the Americas have expressed interest in improving the understanding of linkages between investments in health, economic growth and poverty reduction. In response, a joint PAHO/Inter-American Development Bank/UNECLAC study has been initiated aiming at elucidating relations between investments in health, economic growth and household productivity. Preliminary data from Latin American and Caribbean countries show that growth in GDP is statistically associated with life expectancy, as has been found in other studies for a wider sample of countries. Life expectancy at birth alone is one of the strongest explanatory variables of growth in GDP.

Estimates based on data from Mexico throw some light on the timeframe in which health affects economic indicators. High life expectancy at birth for males and females has an economic impact 0–5 years later. The impact of male life expectancy on the economy is greater than that of female life expectancy, probably because of the higher level of economic activity among males. The results suggest that for any additional year of life expectancy there will be an additional 1% increase in GDP 15 years later. Similar findings were observed for schooling. In this case, the correlation between female life expectancy and schooling is greater than that for male life expectancy, probably because of the larger role that women play in child-rearing.

This work drew the implication for economic policy that the relationship between health improvement variables and economic growth is sufficiently significant in the long term to justify sustained national commitment to investing in health. Continued work by PAHO – and its collaborators – should further elucidate these linkages at both the household level and the national level.

Contributed by the WHO Regional Office for the Americas/Pan American Health Organization.

intervention. Here the intervention (introduction of user fees) resulted in lower levels of nutritional status and productivity among those initially poor *(15)*.

A careful statistical analysis of the effects of illness on wages and labour supply in Côte d'Ivoire and Ghana found that wages were significantly lower, in both countries, for each day of disability. Ill-health in the form of disability, in these poor communities, contributed to their continuing poverty *(16)*.

At the household level, it is also possible to measure directly the economic burden created by particular diseases. Tuberculosis provides a relevant example. The economic costs of tuberculosis are made up of two main elements. First, there are the direct costs of prevention and treatment (drugs, health care provider fees, transport, and costs of subsistence at a health centre). Second, there are the indirect costs of labour time lost because of illness. Given these two components of cost, there are several ways in which tuberculosis affects economic outcomes. Tuberculosis-related morbidity directly increases household and public sector expenditures. It reduces labour inputs and can reduce human capital as a result of declines in school attendance. In a case study of costs of improving tuberculosis control in Thailand in 1995, the cost of treatment was estimated to be US$ 343 per case. The researchers also estimated the total indirect cost of lost productivity in Thailand as a result of morbidity associated with treated and untreated cases of tuberculosis, amounting to $57 million.

Pathways of influence

Delineating potential pathways of influence sheds light on health's role within the larger web of determinants of income levels and growth rates. A paper presented to the World Health Assembly in 1952 foreshadowed much of the current work on understanding these pathways *(17)*.

Box 1.3 User fees, health outcomes and labour force participation in Indonesia: a two-year study

In an intervention study in Indonesia – the Indonesian Resource Mobilization Study (IRMS) – the effect of changes in prices of publicly provided health services on labour force participation was examined. In the experiment, user fees at public health centres were raised in randomly selected test districts, while fees were held constant (in real terms) in neighbouring control districts. A baseline household survey was conducted at the end of 1991, prior to the intervention, and the same households, evenly divided between those that were subjected to the fee increase and those that were not, were surveyed again two years later. The experiment involved 6000 households in several districts in each of two provinces. One of the provinces was well-to-do and one was poor. Equal numbers of control and test households were selected from each province.

Use of health care declined in test areas, relative to controls, as did some health status indicators. Using self-reports about limitations in their ability to perform activities of daily living – such as walking 5 kilometres, carrying a heavy load 20 metres, or having spent a day in bed in the previous month – the follow-up study in 1993 showed that the great majority of those where prices had been raised showed at least some ill effects. In IRMS, higher prices are associated with greater difficulty walking 5 kms, more limitations on daily activities and more days spent in bed. For example, both men and women in the test districts reported having had to spend an average of a third of a day in bed more than the control group because of illness. But the effects were much greater among the poor, among men over 40, and among women in households with low economic and educational status. Men in the bottom quartile of per capita income in the test areas reported losing almost a full day more of activity compared to the control group.

Moreover, the follow-up study showed significant declines in labour force participation in the test area among the more vulnerable groups. Men in the over 40 age group had a slight tendency to drop out of the labour market in the test area. Among all women in the survey, both in the control and test groups, labour force participation dropped from 50% to 46% between 1991 and 1993, but there was a 7.3 percentage point difference between those in the test and control groups, to the disadvantage of those paying higher health fees. In the test districts, labour force participation for women with no education fell 14%. Women over 40 were also likely to have high drop-out rates from the labour market in the areas where health costs had gone up.

Wage rates for men were also affected. While on average both test and control groups increased their nominal wages by 30% in the two years, the increase came 15% sooner in the control areas. The comparative slippage in the test areas was particularly great for older workers, whose health is presumably a greater factor in their work performance.

Source: **Dow WH et al.** *Health care prices, health and labor outcomes: Experimental evidence.* Santa Monica CA, RAND, 1997 (unpublished paper).

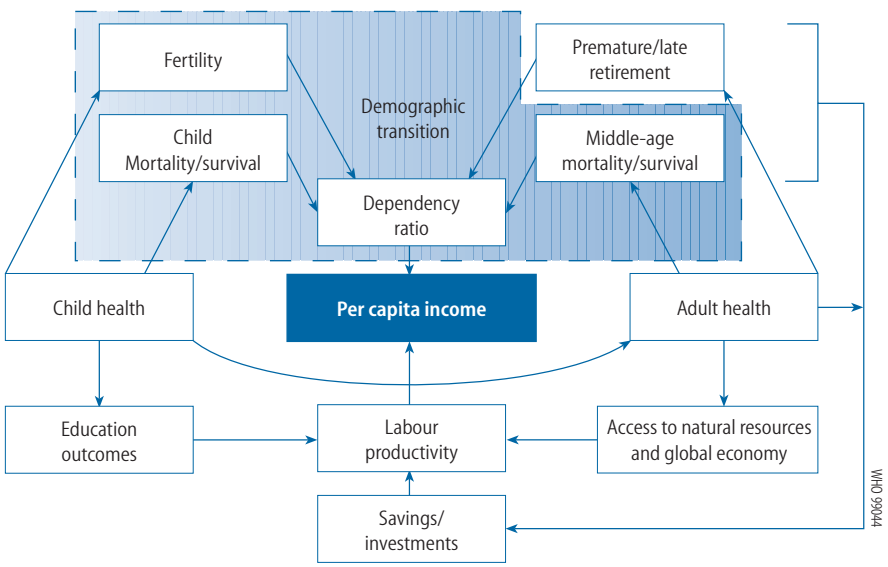
There is evidence that adult health depends in part on child health and itself directly influences labour productivity. Per capita income is defined as the level of income divided by total population. Clearly, the total population consists of economic dependents as well as the economically active. Improved adult health will improve the dependency ratio both by reducing mortality among the economically active and by reducing premature retirement that results from illness *(18),* and this ratio changes as a result of demographic transition (see Figure 1.5, upper part). In Jamaica, for example, individuals with chronic disease were found to be more likely to retire than those who are healthy *(19)*. Better adult health directly affects productivity by increasing work output and reducing absenteeism. Less obviously, geographically specific diseases – onchocerciasis (river blindness) in West Africa is an example – deny communities access to valuable land or productive resources. And high levels of illness in a community may weaken links to the global economy *(20)* – links that through the movement of ideas, goods and capital help create the conditions for more rapid growth (see Figure 1.5, lower part).

Investments both in physical capital and in education underpin labour productivity. A rapidly growing literature documents the effects of ill-health on children's enrolment, learning and attendance rates in school. Many of the conditions affecting schoolchildren (e.g. intestinal worm infections and micronutrient deficiencies) respond to inexpensive but effective interventions. Recent studies in the psychological literature point to steady, long-term gains during the 20th century in the general intellectual ability of the populations of the high income countries (where data were available to generate trends). One suggested determinant of this trend lies in improved health and nutritional status *(21)*.

The ADB's studies on Asia point strongly to the effect of better health on capital formation. Expectations of a longer life appear to stimulate savings.

Economists should never forget the intrinsic value of health – or that today's health systems have the tools to vastly improve the welfare of the poor at modest cost. But neither should health professionals forget an important message for presidents and finance ministers: investing in health accelerates economic growth and is one of the very few viable approaches to rolling back poverty.

Figure 1.5 Links between health and income



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