

HEALTH, ECONOMIC GROWTH, AND
POVERTY REDUCTION

HEALTH, ECONOMIC GROWTH, AND POVERTY REDUCTION

THE REPORT OF WORKING GROUP I OF THE COMMISSION ON
MACROECONOMICS AND HEALTH

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CONTENTS

FOREWORD	vii
PREFACE	xI
EXECUTIVE SUMMARY	i
1. INTRODUCTION AND OVERVIEW	5
1.1 <i>The value of health</i>	5
1.2 <i>The focus of this Report</i>	7
1.3 <i>Three diseases</i>	10
1.4 <i>HIV/AIDS</i>	11
2. THE DEMOGRAPHIC NEXUS	13
2.1 <i>The demographic transition</i>	13
2.2 <i>The role of life expectancy</i>	14
2.3 <i>The demographic dividend</i>	16
3. HEALTH AS A PRODUCTIVE ASSET	21
3.1 <i>Nutrition and labour market outcomes</i>	22
3.2 <i>Other dimensions of health and labour market outcomes</i>	27
3.3 <i>Cumulative effects of poor health: children's health</i>	34
3.4 <i>Societal returns to health</i>	38
4. HEALTH AND POVERTY	43
4.1 <i>Health of the poor</i>	43
4.2 <i>Poverty traps</i>	52
5. HEALTH AND INEQUALITY	57
6. THREE DISEASES	61
6.1 <i>Tuberculosis</i>	61
6.2 <i>Malaria</i>	66
6.3 <i>Mental illness</i>	71
7. HIV/AIDS	77
7.1 <i>Economic determinants of HIV transmission</i>	77
7.2 <i>The impact of AIDS on economies</i>	82
8. GENERAL CONCLUSION	87
REFERENCES	91
ANNEX 1 LIST OF ACRONYMS	107
ANNEX 2 BACKGROUND PAPERS PREPARED FOR WORKING GROUP I	109
ANNEX 3 LIST OF FIGURES	111
REPORT TEAM	113
<i>Co-Chairs</i>	113
<i>Members</i>	113

FOREWORD

The Commission on Macroeconomics and Health (CMH) was launched in January 2000 by Dr Gro Harlem Brundtland, Director-General of the World Health Organization. Its mission was to analyze the impact of health on development and to examine ways in which health-related investments could spur economic development. The Commission worked to develop specific recommendations that would save lives, reduce poverty, and spur economic growth through a scaling up of investments in the health sector of developing countries. The final report of the Commission, *Macroeconomics and Health: Investing in Health for Economic Development*, was released in December 2001.

The Commission focused its work on the world's poorest people, in the world's poorest countries. Millions of impoverished people die every year of conditions that are readily prevented or treated. Technologies exist to avert millions of deaths due to malaria, TB, HIV/AIDS, diarrhoeal disease, respiratory infection, and other killers. These tragic deaths—and the enormous economic and social costs associated with them—reflect the basic fact that essential life-saving health services are out of reach of hundreds of millions of the world's poor. And yet, without extending these life-saving interventions, poverty is likely to be exacerbated and to be passed to the next generation. The economic costs of ill health, the Commission documented, are enormous and pervasive.

The findings of the Commission are both stark and also encouraging. It will take a lot of money and much more political and organizational effort than has been seen in the past generation to accomplish the tasks at hand. Curbing the HIV/AIDS pandemic, or the resurgence of tuberculosis and malaria, or major killers of children such as diarrhoeal disease and vaccine-preventable diseases, will not happen by itself. Yet the task is possible, with breathtaking achievements possible. The Commission calculates that if the donor countries contribute around 0.1% of their GNP—one penny for every \$10 of income—and if that effort is matched by a suitable increase in effort within the low-income countries themselves, it should prove possible to avert 8 million deaths per year by the end of this decade. As of 2007, the donor contribution would be around US\$ 27 billion per year, or roughly four times the current US\$ 6 billion in official development assistance for health. The reduction in human suffer-

ing would be enormous. The economic gains would also be striking, around the order of US\$ 360 billion per year during the period 2015–2020, several times the costs of scaling up the health interventions themselves, counting both the donor and recipient country efforts.

To arrive at its conclusions, the Commission organized its research and intensive analysis mainly within six working groups, which in turn engaged the energies of a worldwide network of experts in public health, finance, and economics. Each working group held several meetings around the world, commissioned papers, debated alternative approaches, circulated drafts to the policy and scholarly community, and made detailed recommendations to the full Commission in the form of a Working Group Report. Working group members included CMH members, staff of various international agencies, and experts from governments, academic institutions, NGOs, and the private sector. The Working Group Reports, prepared by the working group co-chairs in consultation with the entire working group membership, are a synthesis of the commissioned background papers and the culmination of each working group's detailed review of the literature and intensive deliberations.

The Commission's findings are therefore based heavily on the crucial work of the six working groups, each of which was responsible for taking stock of the existing knowledge base on a particular topic in order to identify implications for policy and for extending that knowledge base as appropriate. The working groups, with their titles, topics, and chairs, are:

- Working Group 1, Health, Economic Growth, and Poverty Reduction, addressed the impact of health investments on poverty reduction and economic growth. Co-Chairs are Sir George Alleyne (Pan American Health Organization, USA) and Professor Daniel Cohen (Ecole normale supérieure, Paris, France).
- Working Group 2, Global Public Goods for Health, studied multi-country policies, programmes, and initiatives having a positive impact on health that extends beyond the borders of any specific country. Co-Chairs are Professor Richard Feachem (Institute for Global Health, University of California-San Francisco, USA) and Professor Jeffrey D. Sachs (Center for International Development at Harvard University, USA).
- Working Group 3, Mobilization of Domestic Resources for Health, assessed the economic consequences of alternative approaches to resource mobilizations for health systems and interventions from domestic resources. Co-Chairs are Dr Alan Tait (former senior IMF

official) and Professor Kwesi Botchwey (Harvard University, USA, and former Minister of Finance, Ghana).

- Working Group 4, Health and the International Economy, examined trade in health services, health commodities, and health insurance; patents for medicines and Trade-Related Intellectual Property Rights; international movements of risk factors; international migration of health workers; health conditions and health finance policies as rationales for protection; and other ways that trade may be affecting the health sector. The Chair of this working group is Dr Isher Judge Ahluwalia (Indian Council for Research on International Economic Relations, New Delhi, India).
- Working Group 5, Improving Health Outcomes of the Poor, examined the technical options, constraints, and costs for mounting a major global effort to improve the health of the poor dramatically by 2015. Co-Chairs for this working group are Dr Prabhat Jha (WHO) and Professor Anne Mills (London School of Hygiene and Tropical Medicine, UK).
- Working Group 6, Development Assistance and Health, reviewed health implications of development assistance policies including modalities relating to economic crisis and debt relief. It focused on the policies and approaches of international developmental agencies. One emphasis was on the appropriate balance between country-specific work and support for activities that address international externalities or provision of international public goods. The Co-Chairs are Mr Zephirin Diabre (United Nations Development Program), Mr Christopher Lovelace (World Bank), and Ms Carin Norberg (Swedish International Development Cooperation Agency).

It is my great pleasure and honour to introduce *Health, Economic Growth, and Poverty Reduction: The Report of Working Group 1 of the Commission on Macroeconomics and Health*. The entire Commission is grateful to its Co-Chairs, George A. O. Alleyne and Daniel Cohen, and to all its members, who have worked strenuously and with ingenuity and insight to identify the linkages between health and economic development. They have done a truly masterful job in elucidating the many ways in which health outcomes affect economic development, and particularly the ways in which a heavy burden of disease and undernourishment in a society is likely to impede long-term economic growth. While the linkages from economic development to good health are well appreciated, the Report of Working Group 1 demonstrates that the causal linkages running from health to development are extremely powerful, indeed much more

powerful than has often been recognized by scholars and policy-makers. These linkages underpin the economic case for greatly increased investments in health, since improved health in the poorest countries will help to unleash the dynamism of economic growth and of course dramatically improve the longevity and quality of life of the world's poor.

The Commission, together with the working groups' co-chairs and members, gratefully acknowledges the financial and technical support provided by the donor community. A particular thank you is due to the Bill and Melinda Gates Foundation, the Government of Ireland, the Government of Norway, the Government of Sweden, the Grand Duchy of Luxembourg, the Rockefeller Foundation, the United Kingdom Department for International Development, and the United Nations Foundation.

Jeffrey D. Sachs
Chair of the Commission on Macroeconomics and Health
April 2002

PREFACE

Although the tide is turning, it is still not unusual to find that those who make financial decisions about allocation to health at the country level think of health in general terms only as a good thing but not grasping importance of investing in a healthy population as a mechanism for stimulating or protecting economic growth. The clear demonstration that health is the asset that people value most highly does not always translate into budgetary allocations. The rationale for the work of Working Group 1 (WG1) was to present evidence beyond the health sector for the thesis that health status contributed to and was a determinant of economic growth and could reduce poverty. The economists and public health experts in WG1 initially brought very different perspectives to the issue, but it was a salutary experience to find out the degree to which the disciplines complemented each other in searching for and analyzing the evidence. It soon became clear that that it could be established fairly readily that there were forward linkages between ill health and loss of productivity.

The work was based primarily on review and analysis of existing literature, and it was pleasant to find historical and more current data that established a clear relationship between health and growth. Some new work was commissioned, particularly in the field of HIV/AIDS and on the long-term consequences on economic performance of early childhood nutrition. The Report clarified much of the relationship between income inequality and health outcomes, and should lead to further work designed to discover whether it is income inequality *per se* or, more likely, that income inequality is a marker or proxy for some other phenomenon that has impacts on health. The Report, as expected, provided much of the background for the rest of the CMH Report and should stimulate further work in the field. It was important to cast the findings in such a way that the poverty focus was not lost. It was tempting to concentrate on the instrumental value of health and perhaps lose sight of its constitutive merit, but we believe that a correct balance has been struck.

The Report did not perhaps emphasize enough the policy aspect of much of the work presented, and that is one area that should merit further work. It is clearly easier to demonstrate the returns to specific disease control or elimination. It will also be of interest to explore the relative importance of the different determinants of health on poverty reduction

and stimulation of economic growth. Another important area for further work is the development of the appropriate health inputs into household surveys, which in general remain a field that is not well used in health research.

The members of WG1 have benefited from the opportunity for the interdisciplinary interaction and the identification of some further areas of work in this growing field.

George A. O. Alleyne and Daniel Cohen

Washington, DC and Paris

April 2002

EXECUTIVE SUMMARY

A healthy population is an engine for economic growth. The most impressive account comes from the work of Fogel, according to whom “the increase in the amount of calories available for work over the past 200 years must have made a nontrivial contribution to the growth rate of the per capita income of countries such as France and Great Britain.” He estimates the effect the provision of adequate calories on the annual UK growth rate between 1780 and 1980 as well as the effect that the provision of sufficient calories would have had on the productivity of those in the workforce. Fogel found that the sum of these two effects would indicate that nutrition contributed to the order of 30% of the UK per capita growth. Robert Barro, among others, has shown that life expectancy is significantly correlated to subsequent economic growth. Using post-World War II data, he estimates that a 10% increase of life expectancy could raise economic growth by 0.4% yearly. More modest studies have followed groups of children who can be separated according to the calorie intakes during their first 3 years of life; these studies have found that those children with higher calorie intakes had higher incomes and therefore were presumably more economically productive approximately 20 years later.

Health used to be viewed as an end product of the growth process: people with higher incomes are healthier because they have a greater command over the goods and services that promote health. But the new thinking—that health enhances economic growth—supplements and, to a degree, realigns ideas of the justifications of spending on health, justifications that were based on humanitarian and equity arguments. Wealth undoubtedly leads to health, but health should also be seen as a form of human capital and therefore an input into the growth process, as well as an output: countries with educated, healthy populations are in a better position to prosper, especially in a favourable policy environment.

In an inverted image of the benefits of good health, this Report examines the toll that has been levied by tuberculosis (TB), malaria, mental disorder, and HIV/AIDS on the countries afflicted by these diseases. The relationship running from health to wealth appears to operate through a number of distinct mechanisms. In this Report we focus primarily on the following four critical items:

I. THE DEMOGRAPHIC NEXUS

A successful demographic transition from high to low fertility depends in large part on improvement in health. A fall in child mortality results in a fall in fertility; with fewer children, parents are likely to invest more in the education of each child. Rising life expectancies mean that there is a longer time in which to reap the benefits of investments in education. Thus rising life expectancies act to drive economic growth and human development. The lag between declines in mortality and fertility, when appropriately responded to, results in a “baby boom” generation that can kick-start a period of economic growth as it enters the workforce. This effect is called the *demographic dividend*, the realization of which, however, is heavily reliant on policies that allow extra workers to be absorbed into the workforce.

2. HEALTH AS A PRODUCTIVE ASSET

Healthier workers are physically and mentally more energetic and robust, so they are less likely to miss work due to illness, either of themselves or their families. They are more productive, and earn higher wages; they also help to attract foreign direct investment. Ill health may mean that people who are able to work have a reduced productivity, shortened working lives, and increased numbers of days lost to illness. Health and success in education are also clearly linked. Healthy children are able to learn better, and they become better-educated and higher-earning adults. In a healthy family, children’s education is less likely to be interrupted due to their ill health or the ill health of their family. The importance of hookworm and its attendant anaemia is shown in another one of the more classic examples of ill health interfering with productive activity.

3. HEALTH AND POVERTY

A heightened concern for the health of the poor is founded in the knowledge that across the world ill health disproportionately afflicts poor people. Causes of greater ill health among the poor are manifold and interrelated. Poor nutrition, for example, weakens the body’s defences against infection. Infection, in turn, weakens the efficiency of absorption of nutrients. The main asset of the poor, their bodies, is left without insurance. Ill health therefore imposes a higher level of risk on the poor than on people with more assets. When any form of ill health strikes down their principal asset, they cannot earn the money needed to provide themselves

and usually others too with food or medicines. In other words, a health shock is highly likely to be catastrophic. The findings of a study based on Indonesian data imply that there are nontrivial costs to the Indonesian economy from incomplete insurance of even very extreme health events.

4. HEALTH AND INEQUALITY

We also discuss the relationship between health and inequality. Clearly the idea that income determines mortality before the “epidemiological transition” and, after this transition, income inequality determines mortality has great appeal. In poor countries, income protects against many of the causes of diseases, while in rich countries income inequality indicates the quality of social arrangements, stress, and mortality. Still, there is no need to assume that the relationship between income and mortality changes with economic development. If it is poverty, not inequality, that drives mortality, the effects of inequality will endure, for even in rich economies there are some who are not so rich.

I. INTRODUCTION AND OVERVIEW

I.1 THE VALUE OF HEALTH

In a simple and important sense, health is wealth. If one measures welfare more broadly than income or consumption, poor health is itself a deprivation that is part of poverty. Amartya Sen (1999) has characterized poverty as “capability deprivation”, where a person lacks the “substantive freedoms” he or she needs to lead “the kind of life he or she has reason to value.” The Human Development Index (HDI), introduced in 1990 by Mahbub ul Haq and colleagues, reflects achievements in “the most basic human capabilities—leading a long life, being knowledgeable, and enjoying a decent standard of living” (UNDP, 1990) that can be represented as health, education, and income, which are indeed the three pillars of human development.

Health has always been a valued possession, as shown by the numerous ancient religious injunctions to preserve health through a variety of means. It is still considered the most valuable thing in life. The Millennium Poll, a huge worldwide survey prepared for the Millennium Report of the Secretary-General of the United Nations, revealed that health consistently ranked number one in the things men and women desired in life. Health has historically also been valued as a good in its own right, and also as an instrument for something else. Ancient armies depended on their doctors to maintain them effective, and some of the great conquests were due not to force of arms but the effects of ill health. The conquest of Montezuma by Cortés was most likely due to, or at least facilitated by, the ravages of smallpox and other diseases that the Spaniards brought with them. There is also good evidence that slave owners paid particular attention to the health of their property, and in Jamaica there was quite clearly a rapid decrease in the number of physicians in the island after emancipation when they were no longer being contracted by plantation owners to attend to the slaves.

Increasingly, research is now showing that a healthy population is an engine for economic growth. The most impressive account of these historical trends comes from the work of Fogel, whose seminal studies have elucidated the relationship between body size and food supply, and have shown the latter to be critical for long-term labour productivity (Fogel,

1991, 1997, 2000). The secular declines in mortality that have been observed over the past 200 years in Europe have been essentially due to the increased availability of calories. He goes on to state “The increase in the amount of calories available for work over the past 200 years must have made a nontrivial contribution to the growth rate of the per capita income of countries such as France and Great Britain.” The effect may be mediated in two ways. First, there is an increase in the productive labour force, because large numbers of persons whose caloric intake was simply not enough to allow for any productive work would enter the labour force. Fogel estimates that the incorporation of the bottom fifth of the population into the workforce through the provision of adequate calories would have contributed 0.11% to the annual UK growth rate between 1780 and 1980. In addition, the provision of sufficient calories would have allowed those in the workforce to be more productive. This increase in energy available for work was estimated as contributing 0.23% to the annual growth rate. Since British per capita income was estimated to have grown during this period at an annual rate of about 1.15%, then the sum of the two effects described above would indicate that nutrition contributed to the order of 30% of the British per capita growth. Although these may be estimates, the direction of the change is clear.

Fogel focused on nutrition as the critical determinant of the secular trends in mortality and, in addition, on the effect of nutrition on productivity. But the current evidence is accumulating that other health-related variables, when viewed over a long time span, also have a marked effect on macroeconomic growth. Robert Barro (1997), among others, has shown that life expectancy is significantly correlated to subsequent economic growth. According to his estimates, a 10% increase of life expectancy could raise economic growth by 0.4% yearly. For similar cross-country econometric estimates, see also Arora (1999) or Bloom and Canning (2000). Studies on a more modest scale have followed groups of children who can be separated according to the calorie intakes during their first 3 years of life, and it is clear that those with higher calorie intakes had higher incomes and therefore were presumably more economically productive approximately 30 years later (Hernandez, Fuentes, and Pascual, 2001).

This new thinking supplements and, to a certain extent, realigns the traditional justifications of spending on health, which were rooted in humanitarian and equity arguments. Health used to be viewed as an end product of the growth process. People with higher incomes have a greater command over the goods and services that promote health, such as better

nutrition, access to safe water, sanitation, and good-quality health services. Wealth undoubtedly leads to health, but health should also be seen as a form of human capital and therefore an input into the growth process, as well as an output: countries with educated, healthy populations are in a better position to prosper, especially in a favourable policy environment (Bloom and Canning, 2000).

1.2 THE FOCUS OF THIS REPORT

The relationship running from health to wealth appears to operate through a number of distinct mechanisms. In this Report we focus primarily on the following four critical items:

1. The demographic nexus
2. Health as a productive asset
3. Health and poverty, and
4. Health and inequality.

1.2.1 *The demographic nexus*

In developing countries with high infant mortality rates, early death represents a disproportionate societal loss. Some of the strength of Edwin Chadwick's argument in 1842 for the alleviation of sanitary conditions of the poor was that his argument was already based on the calculation of the economic loss suffered as a result of the early death of children. His *Report on the sanitary conditions of the labouring population of Great Britain* is a classic, not only for the impact it had on the social reform it spurred, but also because of the economic arguments used to justify more attention being paid to the working conditions of the poor (Chadwick, 1842). Children who died before reaching adulthood represented an economic waste. Engels is said to have computed that each child costs 100 Marks at birth and progressively more until, at age 20, he would have cost 2130 Marks. Since half died before that age, then the societal cost of a young adult would have been twice that amount (Fisher 1909). The converse approach to the calculation of the benefits of good early care of children, so that they are optimally productive as adults, is now fully developed and has more to do with the development of the full capacity of the human capital (Van der Gaag and Tan, 1998).

It is now widely acknowledged that improvement in health is the cornerstone of a successful demographic transition from high to low fertility. As child mortality falls, so does fertility; parents are then likely to invest more in educating their children to a higher level. Most importantly, rising life expectancies offer a longer horizon over which to recoup the ben-

efits of investments in education, thus acting as a fundamental driver of economic growth and human development. When appropriately dealt with, the lag between declines in mortality and fertility results in a “baby boom” generation, which can kick-start a period of economic growth as these people enter the workforce. This effect is called the *demographic dividend*, the realization of which, however, is heavily reliant on policies that allow extra workers to be absorbed into the workforce.

1.2.2 *Health as a productive asset*

Healthier workers are physically and mentally more energetic and robust, more productive, and earn higher wages. A healthy workforce is important when attracting foreign direct investment. Healthier workers are also less likely to be absent from work due to illness or illness in their family. Illness and disability reduce hourly wages substantially, with the effect especially strong in developing countries where a higher proportion of the workforce is engaged in manual labour. Ill health may leave persons able to work, but reduce their productivity, shorten their working lives, and increase the numbers of days lost to illness (World Bank 1993). In Indonesia, for example, anaemic men were found to be 20% less productive than men who were not anaemic. When the anaemic men were treated with iron, their productivity increased nearly to the levels of the nonanaemic men (WHO, 1999). There is also a clear relationship between health and success in education. Healthy children are able to learn better, and become better-educated and higher-earning adults. In a healthy family, children’s education is less likely to be interrupted due to their ill health or the ill health of their family. The importance of hookworm is shown in another one of the more classic examples of ill health interfering with productive activity. Much of the early economic development of the southern United States has been linked to the elimination of hookworm and its attendant anaemia. Ettling (1981) describes lucidly the effects and conquest of the “germ of laziness” that was responsible for low productive capacity in peace and war. He attributes some of the failing of the southern troops in the Civil War to the anaemia that must have been a chronic condition in many of them. There was an infection rate of 43% in North Carolina even in 1910, which, if extrapolated to the whole region, meant that there would have been some 7.5 million persons affected in the South. These data were the basis for the establishment of the Rockefeller Commission, whose work in developing the public health infrastructure to eliminate the disease must rank as one of the great public health triumphs of all time. There are similar experiences on a smaller scale, and as a his-

torical vignette, there is the effort of a lone doctor working in the mines in Guyana in early decades of this century who could measure the productivity of mine workers before and after treatment for their hookworm and demonstrate to the satisfaction of the manager that there was economic value to the treatment of the disease (Giglioli, 1969).

1.2.3 *Health and poverty*

A heightened concern for the health of the poor is rooted in the knowledge that across the world, within and between countries, ill health disproportionately afflicts poor people. Causes of greater ill health among the poor are manifold and inter-related. Poor nutrition, for example, weakens the body's defences against infection. Infection, in turn, weakens the efficiency of absorption of nutrients. As the World Bank has noted, "the body is poor people's main asset, but one with no insurance." Ill health therefore imposes a higher level of risk on the poor. When disease, injury, or some other form of ill health strikes down their principal asset, they cannot earn the money needed to provide themselves and usually others too with food or medicines. In other words, a health shock is likely to be catastrophic. In a study based on Indonesian data, Gertler and Gruber (2001) estimate that 35% of the costs of serious illness are not insured by other than household resources. They also find that the more severe the illness, the less likely households are able to insure against that illness. Households are able to insure fully the economic costs of illnesses that do not affect physical functioning, able to insure 71% of the costs resulting from illnesses that moderately limit an individual's ability to function physically, but able to insure only 38% of the costs from illnesses that severely limit physical functioning. Their findings imply that there are nontrivial costs to the Indonesian economy from incomplete insurance of even these very extreme health events.

1.2.4 *Health and inequality*

We also discuss the relationship between health and inequality. Judging by the explosion of interest and of citations, there is a strong appeal to the idea that, before the "epidemiological transition", income determines mortality, while, after this transition, income inequality determines mortality. Our thesis is that, in poor countries, income protects against poor sanitation, unhealthy working and living environments, poor nutrition, and a plethora of infectious diseases. In rich countries, on the other hand, where these evils are but distant memories, income inequality is an indicator of the quality of social arrangements, of stress, and of mor-

tality. Yet, even if it is true that, at higher income levels, income inequality appears to become more important as a cause of death, the work by Deaton (2001) shows that there is no need to assume that the relationship between income and mortality changes with economic development. If it is poverty, not inequality, that drives mortality, so that income has a much bigger effect on health at low than high incomes, then average income will eventually cease to be associated with poor health, while the effects of inequality will endure for much longer because even in rich economies there are some who are not so rich.

1.3 THREE DISEASES

There are numerous descriptions of the economic impact of diseases such as malaria and tuberculosis (TB), and now the world is consumed by the spectre of the tremendous human loss and suffering as well as the possible economic ruin that may attend the recent epidemic of HIV/AIDS in developing countries. We shall review some findings on the measurement of their impact on economic growth, and in addition refer to the special case of mental illness.

Tuberculosis is the first case that we analyse. Tuberculosis is the most common human infectious disease. Infectious and parasitic diseases cause 80% of all communicable diseases, and TB is the leading killer among them all. It is not only the leading killer among infectious diseases, but it kills or debilitates more adults aged 15 to 59 than any other disease (World Bank, 1993). Approximately one-third of the world's population is infected with the TB bacillus, and between 5% and 10% of people who are infected with TB become ill or infectious at some stage of their lives. It is estimated that unless control is strengthened, about 35 million persons will die of TB in the next 20 years. WHO estimates that the economic costs to the poor amount to more than US\$ 12 billion per year (WHO, 2001).²

Malaria is our second case study. Between 1965 and 1990, countries with high transmission of malaria experienced an average per capita GDP growth of 0.4% per year, while average growth in other countries was 2.3% per year. Such a strong negative relationship suggests that malaria potentially plays a significant role in inhibiting long-term economic growth and development. After controlling for standard growth determinants used in macroeconomic analyses, such as levels of human capital, life expectancy, initial income, and macroeconomic policy indicators of various kinds, the analysis finds that countries with high rates of transmission of falciparum malaria in 1965 had annual economic growth rates

that were 1.3% lower than nonmalarious countries over the period from 1965 to 1990.

Our third example is mental illness. There is now ample evidence that the magnitude of the disability caused by mental illness is much larger than was formerly considered. All neuropsychiatric disorders accounted for some 11.0% of the total global burden of disease in 1999, and the figure is estimated to rise to 15% by the year 2020 (WHO, 2001). Given the fact that mental illnesses—like physical illnesses—impair function, it would appear obvious that they must have an effect on productivity. Because they are usually chronic and occur throughout the life cycle, they impair productivity and reduce the formation of human capital. The burden of the illness falls on the sufferers, family and friends, employers, and on society as a whole.

Cost-of-illness studies are more frequent in the developed countries. In one study from the United States, the aggregate cost of all psychiatric disorders was estimated at US\$ 148 billion (Rice et al., 1990).

The evidence from developed countries suggests that mental disorders affect employment of men and women. The estimated impact of mental illness was to reduce employment levels by 14 percentage points for women and 12.6 for men (Ettner, Frank, and Kessler, 1997). Data are scarce for developing countries, but such as they are, they also show a significant cost of mental illness and an impact on productivity. One large household and community survey from Indonesia has also confirmed the impact of a cluster of mental symptoms on employment and productivity (Bir and Frank, 2001).

1.4 HIV/AIDS

Our last example is HIV/AIDS, which is dealt with in a specific section. Twenty-two million people worldwide have now died of AIDS, and the number of deaths is certain to rise from its current level of 3 million per year. More than 36 million people are currently living with HIV/AIDS, and over 5 million were infected with HIV in 2000. Infection rates may be stabilizing in sub-Saharan Africa, home to 70% of those infected with the virus, principally because relatively few high-risk individuals remain uninfected. In other areas, however, the pandemic is still growing. Russia reported more new infections in 2000 than in all the previous years of the epidemic combined, and the reported number of cases in Eastern Europe and Central Asia has risen by more than two-thirds in the last year. With UNAIDS also voicing concerns over complacency in the West and in Asia (Bloom et al., 2001) and with the number of young gay black men in the

United States now reported to be infected with HIV rising rapidly (Haney, 2001), it seems likely that we continue to underestimate the future impact of this devastating pandemic.³

Increased morbidity and mortality have significant impacts on national economies. One study claims that gross domestic product (GDP) in Trinidad and Tobago could be reduced by 5.3% by 2005 as a result of the disease. Even conservative forecasts suggest that future annual growth rates of per capita income in sub-Saharan Africa will be roughly 0.30% points lower than if the epidemic had not occurred—this in a region that registered a negative GNP per capita annual growth rate of -0.9% in the 20 years to 1995 (UNDP, 1999a).

2. THE DEMOGRAPHIC NEXUS

2.1 THE DEMOGRAPHIC TRANSITION

The idea behind the demographic transition is that whenever mortality declines, it is followed, after a lag, by a decline of fertility. The first phase of the transition, when mortality declines, is typically brought by better sanitation and various public health measures. So long as fertility does not change, the decline in mortality brings an increase in population. In the second phase, fertility rates start declining as well, until—eventually—population growth is restored to earlier levels, and then sometimes lower levels than before.

What are the factors that lie behind the fall of fertility? The simplest and most common explanation is that parents adjust to the fall of child mortality so as to restore their previous desired targets regarding their number of children. Why it should take so long before this is evidenced may be interpreted as the lag between the change in environment and the change in either habit formation or in reliable knowledge regarding the new environment. This explanation, however, predicts only that gross fertility is reduced, not that net fertility (net reproduction rates) should fall. What are the reasons that a net fall of fertility has been observed in industrialized countries where the demographic transition is over? A number of compelling explanations have been proposed in the literature. One interesting channel has been explored by Kalemli-Ozcan, namely the fact that a “precautionary demand for children” is reduced with the fall of mortality. In effect, high mortality declines do not only increase the expected length of a child’s life span, but also lower its variability. This leads parents to produce fewer children, which causes a decline in fertility larger than the average decline on mortality and hence reduces the expected number of surviving children, which eventually will cause a net decline in population growth (Kalemli-Ozcan, Ryder, and Weil, 1998).

Other and more traditional explanations are that other determinants of economic growth and mortality, such as technological progress, have a positive effect on wages and change the behaviour of women towards labour force participation. In economic terms, the opportunity cost of rearing children is increased, and (net) fertility consequently falls. As they get richer, parents then substitute quality for quantity and rear fewer chil-

dren of whom they take better care and educate better. One must caution, however, in imputing determinism too strongly in explaining the observed fact of the fall on fertility following the fall in child mortality.

2.2 THE ROLE OF LIFE EXPECTANCY

Besides the opportunity cost of rearing children, which is then triggered by other forces, such as the impact of technological progress on income, the rise of educational achievements of children may be the outcome of the sheer effect of increased life expectancy. The relation of education to income has been well established. The parallel evolution of declining rates of mortality and the rise of educational achievement are demonstrated by the data. For example, the average number of years of schooling in England rises from 2.3 for the cohort born between 1801 and 1805 to 9.1 for the cohort born between 1897 and 1907. It rises even further, to 14, for the 1974 through 1992 cohorts. The data show a very strong positive correlation between life expectancy and years of schooling. The correlation goes both ways. It has been shown that school enrolment is a good predictor of good health (Lleras-Muney 2001). The other correlation is also likely to be at work, as the decline of youth mortality directly raises the return to early age education. It is indeed not true that most of the mortality decline occurs in infancy and should then be irrelevant for the human capital decision, as some authors have argued. The mortality changes around ages 10 to 15 are also large. Ram and Schultz (1979) point to the post-World War II experience of India as evidence that the improvement in mortality has created an important incentive to increase education at any age.

Higher life expectancy implies a higher rate of return on human capital investment: the value of education depends on future earnings gains, and it is obvious that these gains can be realized only if the person lives long enough to enjoy them. Furthermore, by allowing a worker to live longer, that longer life also directly raises his productivity as he gets a chance to become more productive by accumulating more experience. Raising life expectancy can then be expected to be channelled into better-trained workers. Experience is indeed an important determinant of human capital. About half the wage dispersion that is explained by the human capital model, such as the model found in Mincer (1974), arises from the build up of experience. There is, therefore, a critical interaction between income and life expectancy.

Long lives and high incomes are highly correlated in a statistical sense. This is documented by the celebrated Preston curves (1975). Preston

had in mind a causality running from income to life. As the work by Deaton (2001) that we shall review in Chapter 5 demonstrates, the impact of income upon health is attenuated at higher level of income by the fact that the curve is flattening. Even at high level of incomes, however, “thick wallets make healthy bodies” (Smith, 1999). Long lives are not just driven by higher incomes, however. Preston himself has stressed how much average life expectancy has been increasing at any given level of income. Middle-income countries today, for example, have reached per capita income levels close to that of the United States around 1900. Yet in 1900, life expectancy in the United States was only about 49 years, whereas in many middle-income countries today life expectancy exceeds 75 years and, indeed, is close to that of the United States. The twentieth century witnessed extraordinary and unprecedented declines in mortality rates at all ages.

According to World Bank research, which analyzed data from 1952 to 1992 (Wang et al., 1999), income growth is less important to improving health outcomes than other factors, such as access to health technology. In the period studied, average per capita income increased from \$1530 to \$2560 (in 1985 international dollars). If the income mortality relation had remained as it was in 1952, infant mortality would have dropped from 144 per 1000 to 116 per 1000 live births by 1992. In reality, however, it fell much more sharply, to 55, with factors other than rising wealth affecting the outcome. Similarly, it has been found that 40% of differential mortality improvements between countries can be accounted for by differences in their income growth rates. Again, a significant proportion of health gains is left unaccounted for. The World Bank work concluded that 45% of the reduction of child mortality can be accounted for by the generalization and utilization of new knowledge, 38% is due to the educational achievements of female adults, and only 17% to the sheer effect of income. Like economic growth, health improvements rely on new technologies, exploited through new institutions, new investment and new labour requirements. The situation is similar with a number of other quality of life indicators. Economic growth can lead to improvements in these indicators, but sometimes it does not, and sometimes it does so only after a lag of variable length.

Several approaches shed light on the sources of mortality decline. A generalization of the earlier work of Preston was undertaken for WG1 (Jamison, Sandbu, and Wang, 2001); the essence of the new work was to relax the (unrealistic) assumption of previous work that the rate of technical progress is constant across countries. Allowing for country-specific

rates of technical progress or diffusion of best practices further reduces the importance of income growth in explaining infant mortality declines. Epidemiologists and demographers have carefully tracked specific communities for many years to assess what causes mortality decline and for what reasons. An interesting example of this approach (Pison et al., 1993) found, in rural Senegal, that much of the rapid mortality decline there could be traced to the introduction of interventions addressing specific conditions. Another approach to assessing causes of mortality decline is historical. Easterlin (1998), for example, examines the interplay of economic growth, urbanization, and mortality in nineteenth- and twentieth-century Europe. He finds little correlation between the timing of periods of economic growth and mortality decline, and concludes that income growth probably had a modest impact on reducing mortality through its influence on food availability and environmental conditions. This modest effect was partially offset by increased infectious disease transmission resulting from urbanization. See also Deaton and Paxson (2001b), who show that neither income nor income inequality can help explain the patterns of mortality decline; instead, more rapid decline appears to be linked to specific technological changes.

It may then be instructive to categorize mortality history into three or four epochs. Epoch I, extending up to the late eighteenth century, was a period of ups and downs in mortality rates unaccompanied by any upward trend. Epoch II, in the nineteenth century, witnessed very slow but real mortality reductions that resulted from the consequences of income growth, but that were partially counterbalanced by the effects of urbanization. Epoch III, in the twentieth century, was a period of very rapid mortality decline based on the generation and utilization of new knowledge. A possible Epoch IV, in the first quarter of the twentieth-first century, would involve bringing all communities' mortality rates to the levels technology has made possible even at low levels of income.

2.3 THE DEMOGRAPHIC DIVIDEND

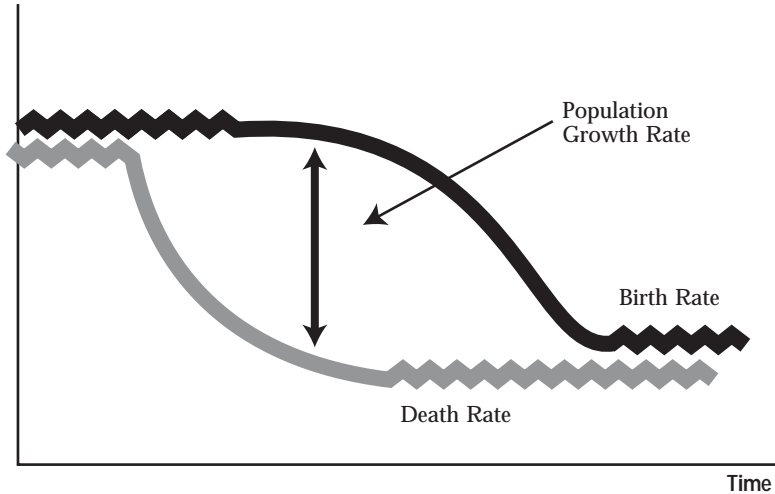
If one accepts that the decline in mortality is accompanied later on by a decrease in net fertility, which is the historical record of industrialized countries, then a graph of population dynamics will be hump-shaped. In the transition, however, population pressures are bound to arise. The direct effect of population growth on wealth has been the subject of speculation from the time of Malthus, and the simple view that increased population meant fewer resources to be shared seemed, at face value, to be reasonable. Review of the current situation and the development of alter-

native approaches have been the subject of the work of Bloom, Canning, and colleagues. It is clear that many countries have seen remarkable economic growth while at the same time increasing their populations, and the preferred view is that technological progress among other things has more than compensated for the increased population. Bloom and Canning (2000) come to the conclusion that the empirical studies over the past 15 years have shown that population growth has a small and insignificant effect on a country's economic growth. Their new approach is to examine the birth and death rates separately in their growth equations. At its most simple level, countries with low death rates and low birth rates do well in terms of economic growth and, conversely, countries with high death rates and high birth rates do badly. But their main advance has been to look at the age structure of the population in examining economic growth, and they adduce the mechanisms through which age structure and population exert effects.

The essence of the labour market effect is the consideration of the dependency ratio directly, rather than birth and death rates separately.⁴ As the dependency ratio falls, there are more persons of working age compared with those who are dependent, and given the conditions for optimal productivity, the national wealth will increase. Bloom and Canning (2000) cite the case of East Asia as an example of the fall in dependency ratio accompanying an economic boom. The demographic shift is triggered by a fall in infant and child mortality followed by a fall in fertility. There is an initial increase in the young with a rise in the dependency ratio, but this soon gives way to a marked fall in the ratio as the new wave of the young workers enter the labour market with consequent increased economic production (see Figure 2.1).

The duration of this demographic dividend in East Asia is said to last for roughly half a century. It will be of more than passing interest to see whether this analysis, which seeks to explain much of the economic progress in that region, applies in other parts of the world.

Direct econometric estimates of the relationships between life expectancy, economic growth, income distribution, and poverty allow one to simulate the consequences of recent and foreseeable improvements in life expectancy on poverty. The simulations by Bloom and Canning (2000) cover 31 countries for which sufficient data are available, with a combined population of 3.1 billion as of 1990. They argue that if life expectancy had been 10% higher in 1990, this would have had a strong positive effect on income growth and a modest negative effect on income inequality over the following 25 years. The estimates suggest that these

Figure 2.1 THE DEMOGRAPHIC TRANSITION

Source: *Paper on Population change and economic growth* by Bloom, Caning, and Sevilla (2001).

health improvements alone would lift 30 million people out of absolute poverty by 2015. Two-thirds of these would have lived in India and a third in Africa, mirroring the huge importance of health for regions at an early stage of development. Their analysis does not provide a guide for achieving this improvement, however, leaving unanswered the crucial issues of whether poverty reduction is best achieved via policies aimed at achieving broad-based health improvements or health improvements directed specifically at the poor. The conclusion that is reached suggests that, if two countries are compared, identical in every respect except that one has a 5-year advantage in life expectancy, the healthier country will experience growth in income per capita that is 0.3 to 0.5 percentage points faster than its counterpart.

These numbers are consistent with those that are reported by Barro (1997). When holding constant other determinants of economic growth—such as initial income, schooling, and other institutional characteristics such as democratic governments—Barro estimates that life expectancy at a given point in time is significantly correlated to subsequent growth. According to his estimates, raising life expectancy by 10% raises economic growth by 0.4% a year for the subsequent decades.

There are clearly many potential explanations for these correlations. Life expectancy is, first of all, a summary statistic of many determinants of health, and such regressions are silent on which of these dimensions are really important. Skeptics would also point out that life expectancy is likely to be correlated to other factors, such as high productivity of land, that have a direct bearing on economic growth. More work that will compare these macrostudies to the results that are obtained in the microstudies on the benefits of health is clearly needed here. These numbers can be compared, for instance, to what we know of the benefits of increased experience for the productivity of a worker. The approach by Mincer (1974) that we alluded to earlier demonstrates that an additional year of experience raises, on average, the productivity of a worker by about 3%. A 5-year increase of life expectancy, if translated into 5 additional years in the workforce, could raise labour productivity by 15%, which is about half the value predicted by the macrostudies. But good health, such as proxied by life expectancy, also has a direct bearing on how productive a worker can be when he or she is not sick. We now turn to the analysis of the studies that have examined these relationships.

3. HEALTH AS A PRODUCTIVE ASSET

We now review the evidence of the relationship between the health and the productivity of a worker. We start with nutrition and labour market outcomes, as nutrition has been clearly shown in numerous experimental studies to affect physical capacities and the capacity to work. Both experimental and nonexperimental studies have also shown that there is a link between nutrition and labour market outcomes. We then turn to the relationship between other indicators of health and economic outcomes: height and body mass index, sickness, and the capacity to perform simple activities. A third section most clearly shows that health is a capital asset to be invested in; it reviews the evidence on children; and it shows that poor health and nutrition in childhood has long-term, largely irreversible consequences, both because investments in childhood largely determine health in adulthood, and because health in childhood is linked to human capital investments.

The first two sections are based mainly on a background paper for this Report: Health, nutrition, and economic prosperity: a microeconomic perspective by Duncan Thomas, who reviews microeconomic data to demonstrate that nutrition is a good marker or proxy for general health status and bears a close relation to productivity and labour market outcomes. This background paper extends the earlier comprehensive reviews by Strauss and Thomas (1995 and 1998). It reviews both experimental and observational studies. Experimental studies involve some form of randomization of treatments and controls, and proceed to examine the impact of an intervention on economic outcomes. These studies can provide direct evidence on the causal effect of health on the outcome studies. They can also be controlled in fine ways, which allow the researcher to identify precisely specific channels through which health affects economic outcomes. Experiments can present problems such as selective attrition, as the controls may be more likely than the subjects to leave the experiment, and not all questions can be addressed through experiments. On the other hand, experimental evidence is usefully complemented by observational studies. These studies are based on survey data and estimated in conjunction with a model of the behaviours of individuals and households that seeks to provide a plausible argument for interpreting the evidence in a causal framework. Finally, some studies take advantage of natural exper-

iments, where the variation present in the data approximates the situation found in an experiment.

3.1 NUTRITION AND LABOUR MARKET OUTCOMES

The link between nutrition and productivity arguably provides the best-documented evidence in the literature on inter-relationships between health and economic prosperity. Moreover, there is evidence that, along with genotype and environmental influences, diet plays a role in the etiology of many chronic diseases. Nutrition provides a good starting point for an assessment of the evidence.

In recent years, substantial strides have been made in our understanding of the links between nutrition and health in low-income settings. In earlier decades, it was generally believed that poor nutrition arose primarily because of inadequate energy or protein intake, and effort was focused on increasing energy intakes among the poor. As it became apparent that protein-energy malnutrition was only one element to be addressed in improving the nutritional status of people in low-income settings, the focus has shifted towards better understanding the influence of micronutrients such as iron, iodine, zinc, calcium, and several key vitamins on health and nutrition. This work suggests that labour outcomes are probably influenced by both macro- and micronutrients.

3.1.1 *Nutrition and physical capacity*

Experimental designs are well suited to isolate the impact of specific nutrients on work capacity. Several such studies have demonstrated that there is good reason to believe there is a causal effect of iron deficiency on reduced work capacity. Haas and Brownlie (2001) provide an excellent review.

Iron plays an essential role in oxidative energy production. Iron deficient anemia (IDA)—that is, low levels of haemoglobin (Hb) in combination with abnormal levels of other iron indicators—is associated with, *inter alia*, greater susceptibility to disease, fatigue, and reduced child development. In severe cases, it is associated with elevated infant and maternal mortality. Iron deficiency affects physical activity primarily through two pathways. First, as haemoglobin levels decline, the maximum amount of oxygen that the body can use (aerobic capacity) declines. Second, as iron stores are depleted, the amount of oxygen available to muscles declines, reducing endurance, and the heart works harder to produce the same amount of activity.

Rigorous studies of both animals and humans have demonstrated a causal relationship between iron deficiency and reduced maximum aerobic capacity (VO^2max). For example, studies indicate that experimentally induced anaemia results in about a 30% decline in VO^2max , whereas iron supplementation for around 12 weeks produces about a 25% increase in VO^2max (Celsing et al., 1986; Li et al., 1994; Woodson, Wills, and Lenfant, 1978). There is also evidence that IDA is associated with reduced endurance at below maximal work rates. In contrast, iron deficient (but nonanaemic) individuals—individuals with normal Hb but depleted iron stores as evidenced by, for example, low transferrin saturation or elevated levels of transferrin receptor (TfR)—may also suffer from fatigue, but there is little evidence that for these individuals iron status has any effect on VO^2max or endurance (Scrimshaw, 1991; Haas and Brownlie, 2001).

3.1.2 *Nutrition and work capacity*

Demonstrating that maximal capacity and endurance are impeded by iron deficiency does not necessarily inform us about the economic consequences of iron deficiency in daily life. Those consequences may be more closely aligned with energy efficiency, which is the amount of physiological energy, required to perform a given task and is usually assessed by indirect calorimetry. Laboratory studies indicate that iron deficiency impairs energetic efficiency (Zhu and Haas, 1998; Li et al., 1994). Li and collaborators, for example, conducted a randomized treatment-control study of Chinese female cotton mill workers. After 12 weeks of iron supplementation, they found a 5% increase in gross and net energetic efficiencies among the treated subjects relative to the controls. They also observed a significant reduction in heart rates and a 17% increase in the production efficiency of the women. There was no increase in work output (which was constrained by the technology of the mill) but time spent on leisure activities increased among the treated, as did energy expenditure in these activities. A similar finding is reported by Edgerton et al. (1979): iron supplementation of Sri Lankan female tea plantation workers is associated with increased voluntary activity. These results are important because they suggest that iron deficiency affects how an individual allocates time.

3.1.3 *Nutrition and labour market outcomes*

3.1.3.1. Experimental evidence

Whereas causal effects of nutritional status on aerobic capacity and endurance have been extremely well documented in both animals and

humans, establishing a link between nutrition and labour market outcomes is more difficult: the experiments have to be pursued over a longer period of time, which can make attrition problems more severe, and the conditions of the field studies do not necessarily allow subjects to obtain higher wages.

Nevertheless, there is agreement on the fact that iron deficiencies lead to lower productivity, even though there is some debate on the scale of this effect. The strongest evidence is provided by a longitudinal study of nearly 400 male rubber tree tappers and weeders in Indonesia (Basta et al., 1979). Baseline health measures indicated that 45% of the study population was anaemic (Hb < 13g/dl). It is likely that hookworm explains a good part of the high levels of anaemia. Among the anaemic, baseline productivity measured by kilograms of latex collected by tappers per day and the area of trenches dug by weeders was about 20% lower than the productivity of nonanaemic workers. In the experiment, workers were randomly assigned to one of two groups, irrespective of their anaemia status. The treated subjects were given a daily iron supplement (100 mg ferrous sulphate) for 60 days; the controls were given a placebo. Workers received an incentive payment to take the pills as scheduled. At the end of the period, blood haemoglobin, aerobic capacity (measured by the Harvard step test), and output of those who were initially anaemic, and received the treatment, increased to nearly the levels of the nonanaemic workers whose biological indicators did not change. Among those in the control group who were anaemic, productivity and blood haemoglobin levels also rose, although the increase was substantially smaller than among those in the treatment group. This is attributed by Basta et al. to the effect of the incentive payment, a claim that is corroborated by a comparison of dietary intakes before and after the experiment: they point out that, during the experiment, anaemics in the control group spent more on leafy greens as well as other foods that provide higher amounts of iron. The results suggest that the output of workers who are IDA can be raised by around 20% through supplementation. This is a very large effect, but its magnitude may be somewhat overstated due to the large and potentially nonrandom attrition in the sample.

Results from less specific food supplementation interventions are not as clear. Immink and Viteri (1981) report that sugar cane cutters in Guatemala who received calorie supplements were no more productive than controls. Randomization in this study was at the village level, and it may be that changes in productivity between villages during the study confound the estimates. In contrast, calorie supplementation had a small but

significant positive impact on the amount of road dug by road construction workers in Kenya, where the 47 study subjects were randomized at the individual level (Wolgemuth et al., 1982).

3.1.3.2 Nonexperimental evidence

The relationship between nutrition and labour market outcomes has also been the subject of numerous observational studies. Focussing on piece rate work or on self-employed workers identifies pure productivity effects. One of the best known among the early studies is a study of farm workers in Sierra Leone, by Strauss (1986). Farming in Sierra Leone is a strenuous activity, which suggests that the workers' productivity on the farms should be related to their nutritional status. Using very rich data on farm production and self-reported data on availability of calories, Strauss estimates a farm production function where efficiency units of labour is an input, and calorie consumption determines the efficiency of labour. Recognizing that calorie intake is a choice, and should thus be treated as endogenous, he uses the prices of foodstuff as an instrument for calories. He allows for a flexible functional form for the relationship between calorie and output, and shows important nonlinearities: the elasticity of the output with respect to nutrition at the sample mean is 0.33. The highest output is obtained at 5200 calories, and it flattens after 4500 calories. At an intake of 1500 calories, the calories elasticity is 0.75. Improvement in nutrition matters most for those who receive far from adequate levels. Sahn and Alderman (1989) also report that farm output and wages of males, respectively, rise with calorie intake. Thomas and Strauss (1997) use a measure of food intake more accurate than recall data, where food prepared for consumption and leftovers were weighed daily for a week in a Brazilian survey of 50 000 households. Using those data, they report that per capita calorie and protein intakes have a significant impact on wages on both the self-employed and employees. Moreover, they find that wages increase with improvements in quality of diet, measured by the fraction of calories consumed from protein.

Two studies by Foster and Rosenzweig (1993, 1994) show that improvement in productivity is not necessarily conducive to improvement in wages in settings where the employer cannot observe productivity. They use a data set where they observe workers working both for piece rates and for hourly wages. They find that an increase in the number of calories results in an increase in the earnings of those who are on piece rate, but not of those who are on wage rates: the result on piece rate suggests that improved nutrition does increase productivity. But since the employer does

not directly observe nutrition, it does not translate into higher wage rate in the presence of asymmetric information. In contrast, higher body mass index (BMI) does result in an increase in hourly wage, but not in the piece rate.

3.1.3.3 Other benefits of improved nutrition

The two experimental studies mentioned above (Edgerton et al., 1979, among tea pickers in China; and Li et al., 1994, among Chinese factory workers), show that the evaluation of the benefits of improved nutrition should not necessarily be seen in immediate improvements in wages of those who benefit from the intervention. In those studies, iron supplementation did result in increased work capacity, but only in a modest improvement in output per worker. However, in both cases, there may be other benefits than output per worker.

First, interventions are targeted at specific individuals, but these individuals belong to a larger household. If individuals share the benefits of the intervention with other household and family members, the intervention has a spillover effect, which can be large. This might arise, for example, if road workers who received a calorie supplement ate less food at home, to make room for other household members. In addition to changes in hours worked and type of work, it is also possible that healthier workers will allocate more time to nonwork activities, including leisure and home production. This is likely to result in increased levels of well-being and possibly even indirect benefits on productivity through elevated levels of functioning. Enhanced productivity at home may also provide benefits for the next generation if, say, parents invest more in their children. Examining the effects of experimental health interventions on labour market outcomes of subjects, their psychosocial well-being, time allocation, and productivity in nonmarket work is feasible. It calls, however, for a modified approach to evaluation that is broader in scope and that includes measurement of a wide array of health, nutrition, social, and economic indicators of both subjects and members of their households, as well as a longer run in time frame (to capture the immediate and longer-term effects of interventions). Integrating the benefits of experimental designs with broad purpose, repeated-observation social surveys is likely to be profitable.

Second, the immediate productivity increase may be much smaller than the longer-run benefits in some settings where the technology is fixed in the short run. This was the case in the Chinese study: although the work efficiency of workers clearly increased, output per worker did not, because

the technology was not flexible enough. One might think, however, that the technology could adapt fairly rapidly to a general increase in workers' productivity, thus generating an additional multiplier effect. At a minimum, workers whose productivity increased could change tasks or change jobs. This may not have happened if the experiment was known to be of a short duration.

3.2 OTHER DIMENSIONS OF HEALTH AND LABOUR MARKET OUTCOMES

3.2.1 *Physical indicators: height and body mass index (BMI)*

The best-documented fact in observational studies is that there is a significant correlation between height and wages (see [Figures 3.1a and 3.1b](#)).

As noted earlier, seminal work by Fogel (1994) documented secular increases in height that parallel economic growth in the historical literature. Fogel also showed that the high rate of beggars in modern Europe can be explained by the physical incapacity of people to work because they simply did not have enough to eat. Finally, slaves in the southern United States were taller than some free men or a sample of poor boys from London around the same time: their owner understood the benefits of feeding them appropriately to ensure a high productivity, and this was reflected in their height.

Similar patterns have been documented for many of today's low-income countries. At the micro level, many studies have demonstrated that height is positively correlated with hourly earning. A semi-parametric study by Strauss and Thomas (1998) shows that derivative of earnings with respect to height is much higher for short people. Ribero and Nuñez (2000) showed from their studies in Colombia that men earn 8% more per centimeter of height, while for women the figure is 7%. Although the empirical result is very robust, its interpretation is complex. Taller people are probably stronger—an attribute that is likely to be more highly rewarded in a low-income setting. However, height is much more than a just proxy for strength. Since height is largely determined in early childhood, it reflects investments made by parents when the worker was a young child, including not only investments in nutrition but also broader health and human capital investments such as education. It is thus possible that the returns to height as such would be overstated by looking only at the cross-sectional relationship between height and labour market outcomes. Nevertheless, a recent study by Behrman and Rosenzweig (2001) suggests that cross-section estimates of the effect of height on wages may

Figure 3.1a WAGES, EDUCATION, AND HEIGHT OF MALES IN BRAZIL AND THE UNITED STATES

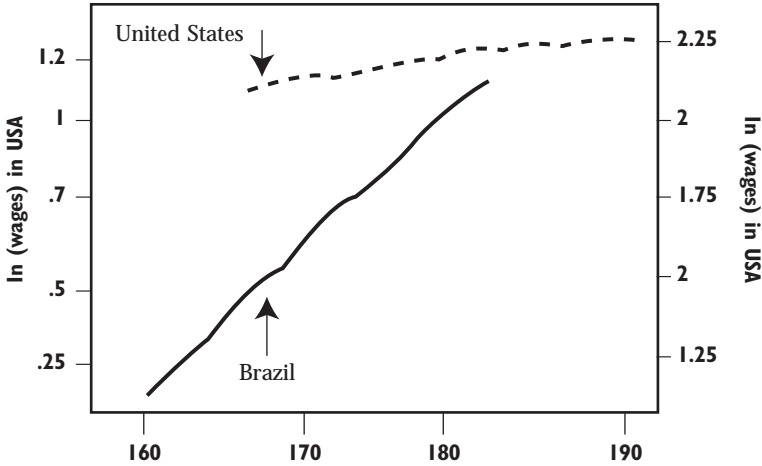
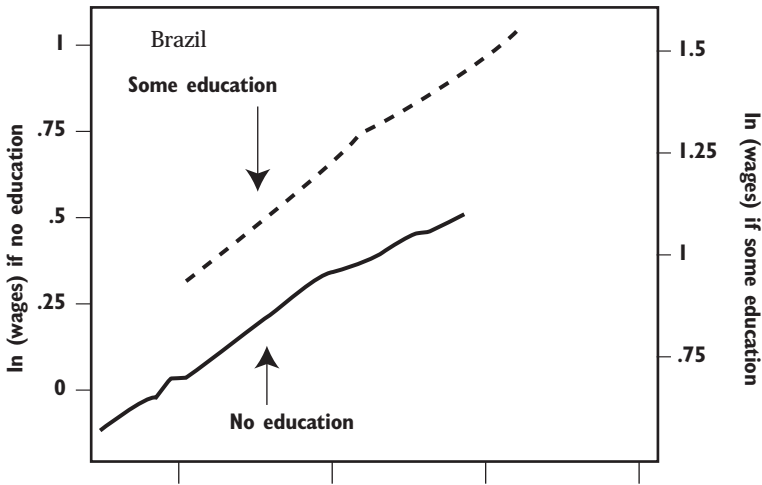


Figure 3.1b



Source: Strauss and Thomas, 1998.

not be overestimated. They compare height and wages of monozygotic twins who share a common genotype and a common background. The returns to height implied by this comparison are actually three times bigger than those coming from the simple regression of wages on height. Of course, these results must be interpreted with care: we do not understand very well why two monozygotic twins achieve different height. It could be

due to events that also affected their earnings capacity, which would affect these results.

In contrast to height, BMI varies through adolescence and adulthood and thus may capture both longer-run and shorter-run dimensions of nutritional status and health. Clearly BMI is related to energy intake, net of output; it has also been shown to be related to maximum oxygen uptake during physical work ($VO_2\max$), which, in turn, is related to aerobic capacity and endurance, independent of energy intake (Spurr, 1983, 1988; Martorell and Arroyave, 1988).

Evidence on labour market outcomes is mixed. In higher-income settings, high BMI (or obesity) is thought to reduce wages (Averett and Korenman, 1996). Controlling for endowments using the data on twins, however, Behrman and Rosenzweig (2001) find that this association disappears and they argue that it likely reflects reverse causality. The focus of the literature outside of the developed world has been rather on the link between low levels of BMI and labour outcomes. Haddad and Bouis (1991), for example, find that BMI has no effect on earnings of rural workers in the Philippines; using the same sample, Foster and Rosenzweig (1993, 1994), in the study mentioned earlier, report that BMI does affect the wage of workers who earn a time-wage rather than piece-rate. They argue that health is difficult to observe and employers use BMI as a marker for health. In urban Brazil, Thomas and Strauss (1997) find that BMI affects the hourly earnings of both employees and the self-employed. They argue that BMI is probably correlated with strength, since its effect is largest among the least educated who are more likely to do manual labour. Glick and Sahn (1998) report that BMI is associated with wages among self-employed males and females in urban Guinea as well as males who work in the market sector. Croppenstedt and Muller (2000) produce similar evidence from Ethiopia. BMI has been shown to affect the proportion of working time that is spent on very physically demanding activities by men (Pitt, Rosenzweig, and Hassan, 1990; Bhargava, 1997; Fafchamps and Quisumbing, 1999).

3.2.2 *Sickness and general health status*

3.2.2.1 Measurement

Evaluating the effect of dimensions of health other than nutrition or anthropometric measures on productivity and labour markets outcomes is made difficult by the scarcity of good data on health status at the micro level. Relatively few socioeconomic surveys contain an extensive battery of physical assessments apart from anthropometric measures. Several sur-

veys contain self-reported health indicators such as General Health Status (GHS), the ability to perform certain Activities of Daily Living (ADL)—such as bathing, carrying a heavy load, etc.—days of limited activity, and days in bed. GHS is typically assessed by asking the individual to assign a rank to his or her own health (for example, on a scale of 1 to 5, where 1 is excellent and 5 is very poor). The ability to perform ADLs is assessed by asking the individuals whether they can perform the activity easily, with difficulty, or not at all. Finally, household surveys often contain recall questions about specific morbidities or symptoms and expenditures on health. These indicators contain information about a respondent's perception of his or her health and will reflect important domains of health that are not captured by the physical assessments. Indeed, GHS has been shown to be a powerful predictor of future morbidity and mortality, after controlling a series of other observable health status indicators (see Idler, Ellen, and Benjamin, 1997, for a review). However, self-reports do raise an additional level of complexity in analyses of labour outcomes (see, for example, Bound, 1991; Mathiowetz and Laird, 1994; Dow et al., 1997). A recent household survey (Das and Sanchez, 2001) shows that traditional health surveys may substantially underestimate the occurrence of sickness and poor health.

Moreover, people who have a better knowledge of their bodies may be more likely to report symptoms of sickness: richer people, who visit doctors more often, and are perhaps better informed, may thus be more likely to report themselves as being in poor health. This will have the effect of biasing downwards any estimate of the relationship between health and productivity or labour market outcomes. A study by Dow et al. (2001) shows that this is indeed a serious issue. In this study, health care prices were raised by up to 200% in randomly selected locations in Indonesia—the government was planning an increase of the prices of services and first conducted a pilot study by increasing prices only in some locations. In the regions where health care prices did increase, households report far fewer visits to the doctors. Strangely, they report that they are in *better* health than those who live in areas where the health prices did not increase. However, the data on the more objective ADL and on the days spent in bed because of illness suggest a different picture: individuals who live in areas where prices were increased have the worst ADL scores and have spent more time in bed. This suggests that using GHS as a measure of health may lead to misleading conclusions.

To shed light on the links between health and economic prosperity, it is therefore important to try to collect better data on health by experi-

menting with different ways to ask people questions about self-reported health, for example by asking about symptoms with more precision, or by asking about specific chronic conditions, and by combining self-reported health measures with physical measurements. Recent studies (Das and Sanchez, 2001; Case and Wilson, 2001; Case, 2001a, 2001b) have worked in these directions. Some of the questions with which they have experimented on a small scale should be implemented on a larger scale.

3.2.2.2 Experimental evidence

Experiments and quasi-experiments indicate that several domains of health have a causal impact on economic prosperity.

Some experiments are designed to assess the effect of specific illnesses. A recent experiment in Britain randomly assigned men with back pain to an exercise program or usual primary care management. After a year, the treated subjects reported less back pain and fewer days of missed work relative to the controls (Moffett et al., 1999). For other illnesses that are common in developing countries, experimental evidence is more ambiguous. This is the case, for example, for the effects of schistosomiasis on adults. Schistosomiasis, which is caused by exposure to parasitic worms that live in slow-moving water, will usually result in fevers, aches, and, often, fatigue. Two studies produced contrasted results. In one study, sugar cane workers in Tanzania were randomly assigned to two groups, one of which received chemotherapy. Prior to the treatment, those workers who showed signs of exposure to schistosomiasis cut less cane per day. After treatment, their output increased, although not to the same level as those who had no signs of schistosomiasis (Fenwick and Figschou, 1972). A slightly earlier study of sugar workers in Cameroon found no effect of chemotherapy on the output of exposed workers (Gateff et al., 1971). In both studies, schistosomiasis was treated effectively. The reason for the difference in results regarding productivity is not at all clear. It may be that the sample size in the Cameroonian study is too small to detect effects or the time frame of the study may have been too short, or it may be that other, unmeasured factors—such as other dimensions of health—may constrain the workers' productivity.

Variations in health care prices make it possible to evaluate the relationship between general health status and economic outcomes. A well-known example is the RAND health insurance experiment, which randomly assigned subjects to different combinations of deductibles and copayments, with the most generous program providing free care. Those who received free care used more health care, although the impact on

health outcomes was muted except for the poorest and sickest (Newhouse, 1993). It turns out that females who received free care increased their labour force participation rate relative to other females; a similar finding emerged for males who had not completed high school. A similar experiment in Indonesia (Dow et al., 2001) involved changes in the prices of health services. In the experiment, user fees at public health centres were raised in randomly selected “treatment” districts while prices were held constant in real terms in neighbouring “control” districts. A baseline household survey was conducted prior to the intervention, and the same households were re-surveyed 2 years later. Health care utilization declined in those areas where prices were increased. As discussed above, the score on ADL significantly decreased in those areas, indicating that people’s health was worse. In addition, labour force participation declined in the treatment areas, relative to controls, with effects being particularly large and significant for men and women at the bottom of the education distribution—those whom we would expect to be the most vulnerable. The most plausible interpretation of both the health insurance experiment (HIE) and Indonesian results is that the average treatment effects on labour supply indicate a causal role of improved health on the allocation of time to the labour market.

Results from Canada support this conclusion. During the 1960s and early 1970s, Canada introduced national health insurance. Exploiting the fact that the introduction of the system was phased across provinces and occupations, Gruber and Hanratty (1995) found that employment and wages increased as workers were covered by national health insurance. The authors conclude that labour demand rose because workers were more productive either because there was increased job mobility and therefore better matching of skills, or because they were healthier as a result of being covered by health insurance.

Although the introduction of national health insurance was not designed as an experiment, Gruber and Hanratty take advantage of the fact that some people were covered by the system earlier than others. The plausibility of their results rests crucially on the extent to which this “natural experiment” approximates random assignment; the authors provide a compelling argument in favour of this interpretation. It is feasible to design health interventions to provide a similar “natural experiment” in order to evaluate the effect of the intervention—on health status and on other outcomes including economic prosperity. It is unfortunate that there have been relatively few such designs. Programs that seek to reduce, con-

trol, or eradicate malaria, TB, onchocerciasis, and HIV would seem to be especially fertile ground.

3.2.2.3 Nonexperimental evidence

ADLs have been used extensively in the study of health status and health care utilization in the United States (Manning et al., 1987; Manton and Woodbury, 1992) and more recently in developing countries (Strauss, et al., 1993). Several studies in the United States have documented a correlation between ADLs and labour force participation of older men: Stern (1989); Blau, Gilleskie, and Slusher (1997); and Bound et al. (1999). Evidence in least-developed countries (LDCs) is more limited (Lavy, Palumbo and Stern, 1995; Schoenbaum, 1995; Swaminathan and Lillard, 2000) although ADLS have been shown to be strongly correlated with socioeconomic status (Strauss et al., 1993).

Studies that have examined the relationship between the number of days ill (or days in bed) and labour outcomes tend to find that hourly earnings and days ill are negatively related (Schultz and Tansel, 1997; Ribero and Nuñez, 2000). Murrugarra and Valdivia (2000) use data from urban Peru and treat reported days ill as jointly determined with wages, which are measured as income over the last 12 months divided by hours worked over that period. They report that an extra day ill in the 4 weeks prior to the survey results in a 1% decline in hourly earnings of male workers in the wage sector and a 3% decline among those who are self-employed. The decline for females is around 2%. They proceed to measure these effects across the distribution of wages and find that among male wage-workers, days ill are penalized only at the bottom of the wage distribution. Among the self-employed, the effects are more uniformly distributed.

Case and Wilson (2001) examine the relationship between chronic conditions and income in South Africa. They find a strong negative correlation between earned income and the incidence of chronic conditions such as heart trouble, stroke, asthma, and cancer. The effect of a chronic condition on income is due both to the probability of being employed and to the reduction of earnings conditional on being employed. For example, they report that stroke and cancer reduce the employment probability by 20% and, conditional on being employed, diabetes and asthma reduce earnings by 50%.

3.3 CUMULATIVE EFFECTS OF POOR HEALTH: CHILDREN'S HEALTH
Nowhere is it more clearly apparent that health is a capital asset than in the case of children's health. This paragraph will review a few studies that show a strong relationship between children's and adults' health, and between children's health and investment in other forms of capital. The idea that investment very early in life, and even in utero, is an important determinant of adult health has been most strongly defended by the "Barker group" (Barker, 1990). Several studies (Barker, 1990; Scrimshaw, 1997) have shown that, in developed countries, several adult diseases (such as diabetes and hypertension) can be linked to prenatal malnutrition. The links between child nutrition health and productivity later in life has the potential to be much stronger in developing countries.

3.3.1 *Long-term productivity effects*

The evidence that poor nutrition has long-term consequences is that, after episodes of low nutrition in early childhood (especially from age 1 to 3), children's height for age does not recover its normal level before puberty, even after normal nutrition is resumed (Martorell and Habicht, 1986). Ashworth (1969) studied growth rate of weight and height of undernourished children in Jamaica after a sufficient diet is resumed. Weight for height shows a rapid convergence, but after it recovers a normal level, the assimilation of nutrients levels off and height does not catch up. Duflo (2000) studied the effect on child weight for age and height for age of a large pension program in South Africa, received by grandparents and affecting disproportionately poorer children. Both young and old girls have a bigger weight for height in households that receive a pension. However, only younger girls have a higher height for age. A year after the program was fully implemented, older girls are still smaller in households that receive the pension than in other households: this is not surprising since these girls have spent the first 2 or 3 years of their lives in poorer households.

Poor health in childhood is also associated with worst health in adulthood. Evidence is difficult to collect, since collecting retrospective information on health status in childhood is difficult, and the practical difficulties associated with experimental studies are amplified when the subjects need to be followed over long period of time. One recent study by Doblhammer and Vaupel (2001) shows that, in Austria and Denmark, month of birth has a strong effect on life expectancy at 50, though the effect is diminishing over time for latter-born cohorts. The argument is that seasonal availability and price variation of foods, especially fruits,

vegetables, and eggs, affected in-utero development and thus cardiovascular disease and diabetes in later life. The Australian pattern is shifted by exactly 6 months, and people born in Britain who died in Australia have the “northern” not the “southern” pattern!

Another piece of research, an econometric study by Knaul (2000) using retrospective, cross-sectional survey data, relies on age at menarche as an indicator of childhood nutrition. There is ample evidence from the medical and historical literature to suggest that girls who have suffered from undernutrition experience their menarche later. Knaul (2000) examines the link between wages of adult Mexican women and age at menarche. She finds that earlier age at menarche, which is indicative of better nutritional status during childhood, is associated with higher wages, controlling for other human capital variables and individual characteristics. As with most nonexperimental studies, these findings, although suggestive, could, however, be given an alternative interpretation. For example, it is possible that today’s social and physical conditions, which are included among the instrumental variables that are related to age at menarche, are correlated with wage level for reasons that have nothing to do with childhood nutrition.

There is also experimental evidence of the long-lasting effect of nutrition. In 1969, the Institute of Nutrition of Central America and Panama (INCAP) instituted a study in four rural communities in eastern Guatemala. Children from two of these communities received supplements of a protein-rich gruel (cases) and the children from the other two received a fruit drink that supplied energy supplementation alone (controls). The subjects who received the supplementation were all the children born between 1969 and 1977. It is important to note that the subjects were offered the supplementation *ad libitum* and there was not a fixed amount given to each child, although the amount taken was carefully recorded. Several studies have given the experimental details and the results of follow up at various intervals (Martorell, 1995; Rivera et al., 1995). The case children, when followed up as adolescents and young adults, were taller and performed better.

The study carried out for Working Group 1 (Fuentes, Hernandez, and Pascual, 2001) presents new findings in relation to the economic performance and other variables. Children from the original cohorts were followed up in 2000 to determine if there were any differences in earning capacity between the two groups. It soon became clear that a simple separation between the original groups was not ideal. A more careful analysis shows that there might have been an initial bias with regards to such

variables as general levels of schooling and socioeconomic environment in favour of the communities that received the fruit drink. Surprisingly, initial analysis showed that the subjects from the two sets of communities who were born between 1962 and 1977 had significant differences in income, with the higher income being earned by the subjects in the communities in which the fruit drink was the only supplementation. However, it was noticeable that the general level of economic activity was higher in those communities in general.

The most significant analysis was derived from an examination, not of the differences between protein and nonprotein supplementation, but of the difference established at the level of the variation in calorie intake. It was possible to stratify all the subjects into groups depending on their calorie intake during the first 36 months of life. There was significantly higher monthly income of those who had had higher calorie intakes. Because of the differences between the communities, the effect of caloric supplementation was subsequently analysed in the communities in which there was protein supplementation and in which the earnings were in general lower than earnings in the other communities because of the general economic situation. It was clear that those adults who, as children, had received on average an additional intake higher than 3200 calories total over the course of the first 36 months of life as compared with those in the same communities who had no additional calories, had monthly incomes that were 47% higher. In addition, these “high calorie” adults were less likely to be receiving donations and aid and received more remittances from family members. This difference did not obtain only when the intakes were stratified into high and low or no calorie intakes, but there is a significant linear correlation between calorie intake in the first 36 months of life and subsequent income.

This study is being extended by the same workers to an examination of even those adults who have migrated to examine their current situation and to explore further the mechanisms by which the earning capacity has been enhanced. This study is unique in providing evidence of the economic returns to investment in adequate early child nutrition.

3.3.2 Health and education

Nutritional deprivation in older children can also impair their cognitive development. Balasz et al. (1986) and Pollitt (1997 and 2001) review the studies that link nutrition and brain development. In most of these studies, a deficit in key nutrients such as iron and vitamin A is associated

with a retardation in the development of cognitive abilities. Two recent studies are particularly worth mentioning.

In a comprehensive analysis of a longitudinal survey from Tanzania, Bhargava et al. (2001) showed that treatment against hookworms and schistosomiasis improved the haemoglobin concentration of the children. Moreover, this survey contained detailed information on children's scores on educational and cognitive tests and on the school infrastructure. The authors were able to argue convincingly that removal of intestinal parasites will improve the iron status and cognitive development of school children in developing countries where sanitation is typically poor.

An experimental study by Kremer and Miguel (2001) confirms this possibility. In a large-scale randomized experiment, they allocated treatment effective against hookworms, roundworms, and schistosomiasis. In contrast with previous experimental studies, they did not randomize at the individual levels within schools, but at the school levels: the 75 schools present in the program received the treatment in a random order. Once a school was part of the treatment, all the children in the school received the treatment, except girls above 12. They were excluded because the treatment is not recommended in case of pregnancies. In contrast with these previous studies, they find very large results on attendance but no effect on cognitive test scores: after 1 year of treatment, school attendance increased by 10%. The gains were especially high for younger children. In addition, even girls who were not treated show substantial improvement in weight for height indices and attendance: this suggests very large externality effects (up to 6%), underlining the social nature of ill-health to which we will return in the next part of this Report. Previous studies, by focusing on individual children within schools, doubly underestimated the effect of the treatment, by ignoring the externalities and by underestimating the direct effect (since the treated subjects were compared with controls who did benefit from the program, albeit indirectly).

The results of this paper (Kremer and Miguel) can be used to get a rough sense of the rate of returns of a simple health intervention targeted to young children, such as the deworming program. The return to education to a year of primary education in Kenya is about 17%, 40% of which is due to the return of spending 1 more year in school, over and above any gain apparent in the cognitive tests score gain. Thus, the return to 1 year of schooling due to the deworming program would be 7%. Income per worker in Kenya is about US\$ 570, and 1 year of treatment increased school participation by 6%. Assuming that workers stay in the labour force for 40 years and discount future earning at a rate of 10%, the ben-

efits from 1 year of treatment would amount to US\$ 15, over 10 times its costs. Even after taking into account the opportunity cost of children's time, assuming, which is an upper bound, that a child is half as productive as an adult, the labour market return of the deworming treatment remains US\$ 9.80, for a rate of return of 600%. To this figure, we must add the benefits arising from the externalities of the program, which, using the same calculation as above, amount to 400%. (This may be a lower bound, since it does not take into account the benefits to children not enrolled in schools or to adults). Even considering the elasticities of the relationship between health and nutrition, these figures are extremely large, and show that protecting children's health can have considerable benefits.

3.4 SOCIETAL RETURNS TO HEALTH

Economywide benefits to health may be greater than the sum of the economic returns to individual health, however calculated. This is difficult to calculate positively, as is the case with many of the benefits to health, and the calculus is usually in terms of reduced enterprise productivity that derives from the ill health of individuals or the possibility of contracting disease in a specific location. There is reduced direct investment or poor returns from investment.

The classic example of disease impeding economic development is the construction of the Panama Canal. It is estimated that 10 000 to 20 000 people died, primarily from malaria and yellow fever, in the first years of the project between 1882 and 1888; this was perhaps the dominant reason for the failure of de Lesseps to repeat the triumph of Suez in the Americas. The cost of the failure was about US\$ 30 million. It was the experience gained by William Gorgas in controlling those diseases in Havana that was applied in Panama that was one of the main factors that led to the successful completion of the canal by the United States (Jones, 1990).

The recognition of the relation between disease and trade is as old as the ancient quarantine measures that date back to the fourteenth century in Venice. The more recent International Health Regulations, which were adopted by the World Health Assembly in 1969 and are now under revision, are specifically designed "to ensure the maximum security against the international spread of disease with a minimum interference with world traffic." The Pan American Sanitary Code is even more specific, as it is designed to prevent the spread of communicable diseases "so that greater protection against them shall be achieved and unnecessary hin-

drance to international commerce and communication eliminated” (Pan American Health Organization, Basic Documents, 1991).

Two relatively recent examples of the overall impact of communicable diseases will suffice. Cholera, though endemic in parts of Africa and Asia, had been absent from the Americas for almost 100 years; its return to Peru in January 1991 led to widespread consternation. There were 366 000 cases and about 400 deaths in the first year. The epidemic spread rapidly through Latin America and is now endemic to many countries. There was an almost immediate ban on importation of the major Peruvian agricultural products. There was increased cost of doing business due to such measures as prolonged storage, with increased losses and more stringent sanitary inspection of products. The initial cost for 1991 was estimated initially at US\$ 22.7 million, but was subsequently revised downwards to about US\$ 13 million. But it was tourism that was initially badly affected, with an initial estimate of a loss of US\$ 180 million (this was also subsequently revised to about US\$ 84 million) (Petrera and Montoya, 1993; Suarez and Bradford, 1992).

The second and more dramatic episode was the outbreak of the plague in Surat, India, in the summer of 1994. The whole episode has been described by Garrett (2000) in chilling detail in her book *Betrayal of trust*. The epidemic that was eventually only about 6500 cases with 56 deaths led to international panic on a massive scale. As she described it, some of India’s major trading partners banned all flights, goods, and citizens from India. There was the worst decline in tourist visits in a decade, as 20% of all tour packages to India for October were cancelled. It was estimated that the international stigmatization of India would cost that country US\$ 1.3 billion in losses from trade and tourism.

Tourism is especially sensitive to health issues. Tourism increases every year: globally, international arrivals reached 698 million in 2000 and receipts were US\$ 476 billion. In the Americas alone, tourist arrivals are predicted to grow by an average of 3.9% annually, with a projection of 282 million visitors in 2020 (WTO, 2001). In small economies, such as those of the Caribbean, tourism constitutes the major source of income and health concerns have to be prominent (Alleyne, 1990). So much attention is given to preserving the health of the traveller that, given the intense competition for destinations, a health advisory or mere rumor of a health problem such as those that occurred in India and Peru can have devastating economic effects. On the other hand, tourism for health reasons is a major source of income to many countries (Feinsilver, 1989), and is only

one aspect of the trade in health services that is assuming more importance, especially in small economies (Alleyne, 2001).

The presence of disease impedes investment, as has been shown for malaria in the case of sub-Saharan Africa in Chapter 6 of this report. Throughout history, malaria has suppressed the economic linkages between malarious and nonmalarious regions. Foreign investors from nonmalarious regions shun malarious areas for fear of contracting the disease, or because malaria reduces the economic returns on investment. Tourism, for example, is likely to be hard hit by high levels of malaria transmission. Similarly, investments in all sorts of production—in mining, agriculture, and manufacturing—may be crippled if the labour force faces a high disease burden, or if the disease burden raises the costs of attracting the needed labour to a malarious region. As we have noted, individuals from malarious regions may themselves be hindered in their ability to travel abroad or to other malarious regions because of the partial and time-limited nature of acquired immunity. In an economic era in which international trade and finance is critical for economic development, these adverse effects on foreign trade and investment are likely to be of tremendous macroeconomic importance, though they are completely unmeasured by the traditional cost of illness (COI) approach.

Agriculture and services account for over 60% of world output, cover a wide spectrum of employment, and represent the sectors of fastest growth in job creation. Health concerns figure prominently in the discussions over the movement of these services, especially in this era of expanding globalization. The movement of agricultural products is governed by a complex set of arrangements that fall under the World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary measures, which is known as the SPS agreement. This incorporates safety aspects of foods in trade, and a fundamental provision is the right of the WTO members to take the sanitary measures necessary for the protection of human health. On occasion, the application of such measures can lead to bans on importation with consequent severe economic hardship, especially in developing countries in which the inspection procedures come under suspicion. This was seen in the case of food from Peru during the outbreak of cholera. There are several such cases that are brought before the SPS Committee; the recent case of Tanzania that follows is taken from the WTO records.

In March 1998, the European Commission informed the SPS Committee that it had taken safeguard measures with respect to imports of fruit, vegetables, and fish products in light of a cholera outbreak in Kenya, Mozambique, Tanzania, and Uganda. The inspection procedures in these countries had shown deficiencies, but the European Community (EC) planned to consult with them to find arrangements by which they could put in place proper hygiene requirements. WHO did not consider the ban necessary, because in spite of the theoretical risk of cholera, transmission associated with some food commodities moving in international trade has rarely proved significant and the point was made by WHO that “authorities should seek means of dealing with it other than by applying an embargo on importation.”

In June 1998, Tanzania reported that the EC continued to prohibit the importation from the four African countries although tests had not found any cholera bacteria. Tanzania stressed that the ban was having severe economic effects on its economy, and that, according to the SPS Agreement, Members should help developing countries comply with their SPS measures. There was a satisfactory conclusion in that the European Community responded “that it was now satisfied the necessary guarantees were in place and that a new measure restricting trade with the four African countries would probably enter into force on 1 July 1998”, although of course some damage had already been done (WTO, 2000).

4. HEALTH AND POVERTY

The elimination or reduction of poverty is now one of the most important priorities of all the major institutions that are concerned with human development. The International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), the United Nations (UN), and the World Bank Group have jointly described seven international development goals; the first one is to “Reduce the proportion of people living in extreme poverty by half between 1990 and 2015.”

It is critical to note that three of the seven goals are directly related to health. These are reducing infant and child mortality, reducing maternal mortality, and providing access to reproductive health services. The importance of health for the poor is also reflected clearly in the World Bank publication *Voices of the poor*, which draws on the views and experiences of more than 60 000 poor persons from 60 countries (Narayan, 2000).

In this chapter, we try to shed some light on the many relationships that link health and poverty. To start with, we document how poverty is specifically associated with poor health outcomes. Second, we document how loss of health or severe illness can lead to loss of income, or the expenditure on restoring health can be of such magnitude as to lead to poverty or prevent persons from escaping from poverty. The phenomena that fall under this latter may be described as *health shocks*. Poor people are often in a vicious spiral—their poverty leads to ill health, which, in turn, keeps them poor, and so the circle spins.

4.1 HEALTH OF THE POOR

This chapter is based mainly on the background paper prepared for WG1, Poverty and health (Wagstaff 2001). He summarizes the empirical literature in this area and points out four key findings. First, health patterns are almost always to the disadvantage of the poor—they die earlier and have more morbidity. Second, inequalities tend to be more pronounced for “objective” indicators of ill health, such as measures of malnutrition and mortality. Third, there are large variations in the extent of health inequalities across countries, though these variations vary depending on the indicators used. Fourth, socioeconomic inequalities in health seem to be

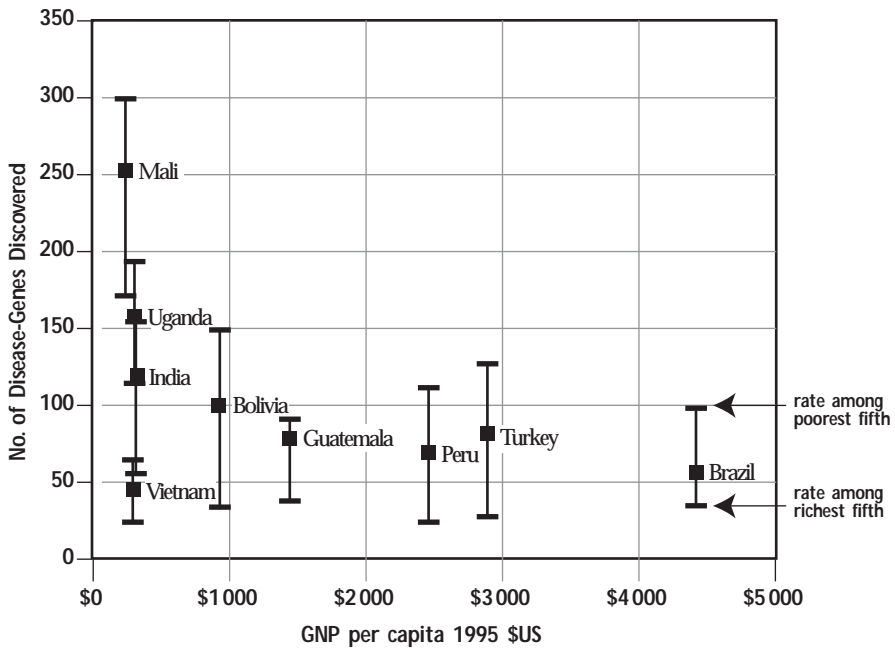
widening rather than narrowing in both the developing and developed world.

4.1.1 Poor people have worse health

The gaps in health outcomes between the low- and middle-income countries (LMICs) and the high-income countries (HICs) are staggering. For example, in several sub-Saharan African countries, as many as 200 out of every 1000 children born will die before their fifth birthday; in Sweden, by contrast, the under-five mortality rate is currently only 5 per 1000 live births. This tendency is shown in **Figure 4.1**, where the population under-five mortality rate (indicated by the marker) is usually higher in poorer countries. There are, as Figure 4.1 makes clear, exceptions to this rule. Viet Nam, for example, is very much poorer than Peru and Turkey, and yet has a lower under-five mortality rate. Evidently, at the national level, there is more to high child mortality than low income and poverty (Pritchett and Summers, 1996). But the vertical bars in Figure 4.1 show another important fact that has provided the impetus behind much of the recent debate on poverty and health, namely that poorer people—however affluent or poor their country—tend to have worse health than better-off people. Thus, for example, children in the poorest fifth of the population in Bolivia have an under-five mortality rate of over 150, while those in the richest fifth have a rate of 32. But again, the picture is not clear-cut: the gaps in survival prospects between poor and better-off children vary from one country to the next. Viet Nam, for example, not only has a low national average child mortality rate, especially given its income, but it also has a small gap in survival prospects between poor and better-off children.

4.1.2 Ill health is a dimension of poverty

The growing interest within the international development community in improving the health of the world's poor reflects the ever-broader interpretation being given to the term *poverty*. This, in turn, reflects trends within the academic literature (Sen, 1999) and the increasing tendency of aid agencies and nongovernmental organizations to define their goals in terms of poverty reduction. Poverty reduction was adopted during the 1990s as the overriding mission of the World Bank, and especially following the publication of the latest World Development Report (World Bank, 2000) has been interpreted broadly in multidimensional terms. Key amongst these dimensions of poverty are health levels and the *risk* of ill health. One important implication of this shift to multidimensionality is

Figure 4.1 UNDER-FIVE MORTALITY: GAPS BETWEEN AND WITHIN COUNTRIES

Source: Gwatkin et al., 2000, and World Bank, 2000.

that raising the incomes of the poor may not be enough to reduce “poverty” if it does not guarantee that the health of the poor is also improved. But the increasing focus on the health of the world’s poor also reflects a growing consensus that inequalities in health outcomes between rich and poor are unjust—whether they are between the people of Sierra Leone and Sweden, or between poor Bolivians and better-off Bolivians (Le Grand, 1991). Closing inter-country and intra-country gaps between the poor and better-off, by securing greater proportional improvements amongst poorer groups, is not simply a poverty issue—it is also a question of social justice and equity. Indeed, it is this, rather than the emphasis on poverty reduction, that has kept the debate on socioeconomic inequalities in health so buoyant in many of the HICs.

4.1.3 *Ill health generates poverty*

There is another dimension to the equity and health debate that also links up with poverty. It stems from the fact that we do not desire good health for itself only. It is not simply, as Aristotelians put it, that good

health allows us to flourish as human beings (Gillon, 1986). Health matters too because it is an asset—we require it when we are learning at school, and when we are working. For the poor, it is a crucial asset, for they often have very few others. This should warn us against too rapid a conclusion on the effects of targeting health only. Because the poor have so few other assets, they have to rely on their health for production and for consumption, while richer people rely more heavily on human and financial capital, thus we expect ill-health to be correlated with poverty, and the correlation is unlikely to go away without doing something about poverty (Muurinen and Le Grand, 1985).

4.1.4 *Health, or health of the poor?*

Much of the literature to date on equity and poverty aspects of health has focused on the inequalities in health outcomes *between the poor and the better-off*. There is, however, another approach, which says that health is a dimension of poverty or well-being in its own right, and that the focus should be on improving health outcomes amongst people in bad health, irrespective of their income. Concerns about equity and justice ought, it might be argued, be more appropriately tackled either by undertaking to reduce health inequalities across people, whatever their income, or by undertaking to focus on those whose health is worst irrespective of whether they are poor or rich in an income sense.

4.1.5 *Inequalities aren't everything*

This is not to say that *only* inequalities between the poor and better-off matter and that policy should be directed *only* at trying to reduce health inequalities between poor and rich. That would imply a complete unwillingness to trade off the overall average level of health against the level of inequality—a position that is unlikely to command the support of any right-minded policy-maker. It would, for example, imply rejecting all inequality-increasing policies, however small the rise in inequality and however large the rise in the overall average level of health. Rather the concern seems to be to ensure that in domestic and international policy making, a greater weight should be accorded to the health of the poor than to the health of the better-off when choosing between alternative policies. This means taking into account not just the average health improvement associated with a particular policy but also the degree to which health improvements are proportionately larger for the poor than for the better-off.

It is also difficult to understand the differences in health outcomes between the poor and non-poor without knowledge of what Wagstaff calls the “proximate and underlying determinants of health outcomes.” This establishment of a “hierarchy” of health determinants or inputs is interesting in itself, as it gives primacy to underlying determinants that are defined as the socioeconomic factors that exist. However, regardless of hierarchical considerations, it is the distribution of both the proximate as well as the underlying determinants that explains the differences between the health situations of the poor and non-poor. Health services represent one of, if not the most important, proximate determinants in the richer countries.

4.1.6 *The HICs get health care to the poor*

There is a tendency for the lower-income groups in several OECD countries to use health services more than the better-off (Van Doorslaer and Wagstaff, 1992; Van Doorslaer et al. , 2000). It is not the case that it is underutilization by the poor *per se* that is a major factor in health inequalities in many of these countries. Having said this, there is the issue of whether the poor use services sufficiently more than the better-off, given their apparently greater medical needs. Utilization may be unequally distributed in favour of the poor, but it still may be inequitably distributed in the sense that there is unequal treatment for equal need (horizontal inequity) in favour of the better-off.

4.1.6 *The LMICs do not get health care to the poor*

The picture is far bleaker in the LMICs. A number of so-called benefit-incidence studies of health services have been undertaken (Castro-Leal et al., 1999, 2000; Filmer, Hammer, and Pritchett, 1998; Sahn and Younger, 2000; Yaqub, 1999). These studies start by examining the distribution across income quintiles or deciles of utilization of different types of public health facilities—primary care facilities and hospital outpatient and inpatient facilities. The quintile averages are then multiplied by the public subsidy per unit of utilization for the type of facility in question. This indicates, for each quintile, the amount of subsidy received through utilization of the particular type of facility. By summing across all types of facility, one obtains—for each quintile—the overall average amount of public subsidy received through public expenditure on health services. Since each quintile is assumed to receive the same subsidy per unit of utilization, the subsidy shares for each type of facility simply reflect the utilization differences across quintiles. Thus the fact that, in these studies, the poor typi-

cally receive much less hospital subsidy than the better-off simply reflects the fact that they use hospital services—especially inpatient care—less than the better-off. By contrast, the gap between the poor and the better-off in their use of primary care services is typically less marked.

4.1.7 Child health services are a good example of services that do not reach the poor in LMICs

In contrast, to the HICs it does appear to be the case that inequalities in health outcomes may well be—at least partly—a reflection of the failure of health care services to reach the poor. This is reinforced by the study of Gwatkin et al. (2000), which finds large differences in the usage of maternal and child health services. The pro-rich bias in immunization coverage in several of the countries is striking. From an equity standpoint, the appropriate benchmark for immunization coverage is, presumably, equality. By contrast, oral rehydration therapy (ORT) use ought presumably to be distributed unequally in favour of poor children if they have a higher incidence of diarrhoea. It is indeed the case that diarrhoea is concentrated amongst poor children. But despite this, many countries manage to achieve only a relatively small pro-poor bias in (ORT) use, and, in some countries, ORT usage is actually higher amongst better-off children even though diarrhoea is more common amongst poor children.

4.1.8 Income is a determinant of health

At the household level, income (or, more broadly, financial wealth) and education are key determinants, though intra-household inequality (especially along the gender dimension) is also important in determining health. In LMICs, at least, as has been seen, the better-off tend to use health services more frequently and to a greater degree than the poor. Indeed, the better-off often demand not just more private sector care but also more public sector care (Castro-Leal et al., 1999). The better-off also often use modern providers rather than traditional practitioners (Castro-Leal et al. 1999). Most dietary and child-feeding practices also improve with higher levels of income. Good sanitary practices—e.g. hand-washing and disposal of feces—are also usually positively associated with income. Income is often associated as well with the number of children a woman has and the age at which she has her first child. Higher-income households also typically provide greater stimulation to children.

Given the importance of income, one reason why the better-off use health services more in the LMICs, is because the demand by households for health services is sensitive to the price charged.

4.1.9 *Health service utilization depends on user fees and insurance coverage*

The demand by households for health services is sensitive to the money price they are charged. In Kenya, for example, it has been estimated that an increase in public fees from nothing to 10 Kenya shillings would result in a reduction in the use of public facilities by 18% (Alderman and Lavy, 1996). In Ghana, an increase in public sector user fees by 50% has been estimated to reduce demand in public clinics by 6% (Alderman and Lavy, 1996). The impact of user fees depends on a household's income—the poor tend to be more deterred than the better-off, and to be more likely, as a result of fees, to delay seeking care (Gilson, 1997). It is not just fees that deter the prospective patients—it is also the *uncertainty* surrounding payments in environments where informal payments are rife. By reducing the price people pay out of pocket for health services, health insurance—whether public or private—tends to encourage greater use of services—a phenomenon termed *moral hazard* by economists (Zweifel and Manning, 2000). Insurance coverage in one sector (e.g. the private sector) encourages substitution between sectors (e.g. from the public to the private sector) (Gertler and Sturm, 1997).

As a result, *services are less affordable for the poor*. In many countries, Ministry of Health (MOH) schemes are supposed to provide services free, or at least at heavily subsidized prices, at the point of use. However, in practice, in poor countries funding is extremely limited (and often declining sharply), and the range and quality of services offered by public facilities is very low (and often declining). Thus, in practice, the *effective* insurance coverage is much lower than might seem at first, and is often declining. Some countries charge for public health services, sometimes with fee-waiver schemes for certain groups. Looking at what people actually spend does not, of course, indicate the price people face, since for many services there is no such thing as a single fee per health service contact. The cost can rise or fall depending on what is provided—for example, the better-off may choose to spend more per health service contact in the belief this gives them better-quality care. Calculating the cost of a *fixed bundle* of services, and expressing it as a proportion of household disposable income, gives an indication of the *affordability* of health services to different income groups. For example, in Viet Nam in 1998, the average user charge per spell of inpatient care in a public hospital was equivalent to 45% of the poorest quintile's average annual nonfood expenditure (including, however, expenditures on health) (World Bank, 1999). The figure for the richest quintile was just 4%. Even a visit to a polyclinic in

Viet Nam in 1998 absorbed 9% of the poorest quintile's average annual nonfood expenditure. Fee-waiver and exemption schemes are often intended to protect the poor from user fees, but there is evidence that in practice they benefit better-off groups, such as the military and civil servants, to a surprisingly high degree (World Bank, 1999; Gilson, 1997; Leighton and Diop, 1999). Insurance—both social and private—tends to be even more concentrated amongst the better-off. For example, in Jamaica, 23% of the richest quartile had private insurance coverage in 1989, whilst only 1% of the poorest quartile did (Gertler and Sturm, 1997). Inequalities are often evident too in social insurance coverage. For example, the social insurance program covered 29% of the richest quintile in Viet Nam in 1998, but only 6% of the poorest quintile.

Another key factor at the household level is the unequal distribution of education—especially the mother's education. But it is not just general education that is unequally distributed. Health-specific knowledge is highly unequally distributed between the poor and the better-off. Large gaps in knowledge about HIV/AIDS between poor and better-off women have been documented. In some cases, the large gaps are in countries where HIV prevalence is fairly low (e.g. Bolivia, Mali, and Peru). There are large gaps in high-prevalence countries too, however, notably the Central African Republic, Kenya, Mozambique, Tanzania, and Zimbabwe. Intra-household inequality—especially along the gender dimension—also tends to be greater amongst poorer households.

Poor communities can be held back by social norms. At the community level, too, it is clear that the poor are disadvantaged. For example, they are more likely than the better-off to live in remote areas where the roads become impassable at certain times of the year. Social pressures amongst teenagers tend to be strongest in poor communities, and attitudes towards women tend to be less favourable to good health outcomes in poor communities.

4.1.10 Health facilities serving the poor are inadequate

At the health system level, the poor are further disadvantaged. Taking into account population size, the poor may not always be disadvantaged in terms of availability of some facilities—e.g. primary health facilities—but are clearly at a disadvantage in terms of accessibility, tending to have to travel further (Akin and Hutchinson, 1999) and for longer (Castro-Leal et al., 1999). Quality of care—interpreted broadly to include service and amenities, as well as technical quality—also tends to be lower in facilities serving the poor. This is not always easy to measure. Official statistics

often provide information on the availability of drugs, medicines, growth monitoring and immunization programs, and so on, but these often paint a rosier picture of quality than is warranted. A facility survey in Côte d'Ivoire (Thomas, Lavy, and Strauss, 1996) found a substantial divergence between drugs and medicines that were supposed to be available, according to government records, and those that were actually available, according to the facility survey. These data revealed clear gaps between poor rural areas and better-off urban areas in the proportions of facilities with immunization and growth monitoring programs. Finally, the poor often face a higher price at the point of use than the better-off, simply because they are less likely to have insurance coverage. This is sometimes offset by fee-waiver schemes, but in practice these often end up exempting the near-poor rather than the poor from fees (Leighton and Diop, 1999).

Much of the work on the health of the poor versus that of the non-poor has been content with demonstrating the differences in outcomes, but is of equal importance to examine the distribution of those factors that determine the differences or inequalities in health outcome. This can be attempted by “decomposing” the underlying causes of the health inequalities.

In just the same way as one cannot conclude from socioeconomic distributions alone which proximate determinants are central to understanding the causes of health inequalities, so too is it impossible to conclude which socioeconomic determinants are most relevant simply by looking at their distribution across, say, income quintiles. As before, what is required is a framework linking distributional information to estimates of the impacts of the various socioeconomic determinants on health outcomes. This can be done (Wagstaff, Van Doorslaer, and Watanabe, 2000) by using a regression framework, which links health to its underlying determinants, and then decomposing the concentration index for health outcomes into inequalities in its determinants.

4.1.11 Underlying causes of inequalities in child survival

This regression framework method has been used (Wagstaff, 2000) to unravel the underlying causes of inequalities in childhood survival in Cebu, the Philippines. Several significant determinants of child survival were identified, including the mother's education; household income; health insurance coverage; drinking water availability; sanitation conditions; travel time (or distance) to various health service facilities; staffing levels in local primary care facilities; and the availability locally of vitamins, vaccines, ORT, and female contraceptives. Most important amongst

these, in terms of its contribution to survival inequalities between poor and non-poor children, was income. Inequalities in the mother's education were also found to be a major factor. Inequalities in health service availability were found to be relatively small, so that although they were found to be important influences on the average child's survival prospects, they did not help explain survival differences between poor and non-poor children.

4.1.12 Improving the health of the poor

Beyond health facilities themselves, governments have a role in deciding which nonsector policies also influence the accessibility of services, with transportation being the obvious target. But, in the final analysis, given the clear effect of income on the differences in health determinants between poor and non-poor, it will be government financing and redistributive policies that are likely to have the greatest impact.

4.2 POVERTY TRAPS

Ill health not only affects the poor disproportionately, it also causes poverty. A family struggling to get by day by day cannot afford to be ill: not only because it cannot afford medicine and health care, but because of the loss of earning power that illness causes. The World Bank (1993 and 1995) reports that in an analysis of case studies of people and households that have become poorer, the single most common reason was illness, injury, or death. A health crisis can quickly reverse any progress the poor have made in moving up from subsistence. In one study from north-west Bangladesh, for example, 8 out of 21 TB patients had been forced to sell land or livestock to meet the costs of their treatment and compensate for loss of income. In Uganda, meanwhile, 8 out of 10 TB patients involved in paid work had either lost their job or closed their businesses, while 5 out of 34 had been forced to remove their children from school. Developed societies have generally, through insurance or welfare, devised mechanisms for pooling these risks across communities. Poverty also encourages poor people to make suboptimal choices that have damaging effects on their health when, for example, dung and other biomass are used, rather than, say, liquefied petroleum gas, which requires often substantial deposits for canisters and up-front expenditures for cooking devices. There is a clear association between the use of biomass in traditional ways and respiratory illness and heart failure. Low income and poor health combine to form a poverty trap.

One of the most sizable and least predictable shocks to the economic opportunities of families is major illness. There are two important economic costs associated with illness: the cost of the medical care used to diagnose and treat the illness, and the loss in income associated with reduced labour supply and productivity (Lustig and Gertler, 2001). The size and unpredictability of both of these costs suggests that families may not be able to insure their consumption over periods of major illness, especially in developing countries where few individuals are covered by formal health and disability insurance (World Bank, 1993, 1995). The possibility that there is less than full consumption insurance suggests a potentially large loss in welfare from an illness shock to the household's resources. Recognizing this, many developing countries have or are considering social insurance to help insure against the economic costs of illness.

Although families with sick members in developing countries are not able to access formal insurance markets, they do rely on private informal coping mechanisms such as drawing on savings, selling assets, transfers from their families and social support networks, and borrowing from local credit markets (Morduch, 1999; Townsend, 1995). It may be argued that in this case, there may be relatively little welfare gain from social insurance, as such insurance would serve largely to "crowd out" these other sources of insuring. But this ignores the possibility that the coping mechanism used by these families in the developing countries may indeed induce higher social costs in the long term.

The conclusion that the coping mechanism used by families in developing countries has high social costs appears to be supported by the existing empirical evidence in those countries. Townsend (1994) finds that the percentage of the year that an adult male is sick has no impact on consumption. Kochar (1996) models wage income and informal borrowing as a function of illness in the family, as measured by a member of the family experiencing a loss of work due to illness. She finds that illness to the male lowers wage income and increases informal borrowing during peak periods in the agricultural cycle, but that there are no effects during slack periods and no effects of female illnesses. These studies might seem to indicate that families living in low-income countries are able to insure illness shocks fairly well (Cochrane, 1991). This is somewhat surprising, and it is possible that the illness shocks are not being estimated appropriately.

A key limitation of past work, however, is that the measures of health employed may reflect only small, and even potentially anticipated, changes in health status, not the kind of large unexpected major illnesses

that may be difficult to insure. Even if families are able to insure illness shocks on average, they may be able to insure the frequent small illness shocks more effectively than they are able to insure the large rare shocks. This would imply that it is important to use measures of more severe illness in fully assessing the ability of households to insure consumption.

Gertler and Gruber (2001) find that Indonesian households are not able to insure consumption fully against the economic costs of illness. They estimate that 35% of the costs of serious illness are not insured by other sources available to households. They also find that the more severe the illness, the less households are able to insure. Households are able to insure fully the economic costs of illnesses that do not affect physical functioning, 71% of the costs resulting from illnesses that moderately limit an individual's ability to function physically, but only 38% of the costs from illnesses that severely limit physical functioning.

Their findings imply that there are nontrivial costs to the Indonesian economy from incomplete insurance of even these very extreme health events. They can measure the fall in consumption associated with illness as the aggregate reduction in family resources from illness, times the extent to which that reduction in resources is reflected in lower consumption. Doing so, they find that illness is associated with a fall in consumption of 0.84% of baseline. This is a nontrivial effect, given the very low frequency of very serious health limitations. Moreover, this understates the total welfare cost of illness for at least two reasons. First, there are additional welfare costs from the uninsured variability in consumption, beyond the reduction in the level of consumption. Second, there are costs to others of the resources used to smooth consumption when family members become ill. For example, there is some cost to family and friends from private transfers of resources to the ill household head.

The analysis suggests an additional rationale for subsidized medical care prices in developing countries: consumption insurance. Although the results discussed above indicate that families are able to insure the costs of small frequent illnesses, they are unable to insure the costs of illnesses that imply large out-of-pocket health expenditures—cum—high costs on the labour supply of the family. This suggests that there may be an important welfare cost to raising user fees at public hospitals in order to shift subsidies to primary and preventive cares that are affordable. Governments considering raising hospital user fees must consider how to insure the medical care costs of large illnesses, for example through caps on fees for inpatient hospital stays, or by developing prepayment schemes in conjunction with reducing subsidies.

These findings also have implications for another major form of social insurance in developing countries, which is to finance medical care publicly through payroll taxes, but allow beneficiaries to purchase medical care from private providers (Gertler, 1998). Since low-income countries have limited abilities to tax, the resources available for social insurance are severely constrained. This results in a tradeoff between catastrophic coverage, with a high deductible but uncapped coverage, and first-dollar coverage, with coverage of all expenses from the first dollar but a low cap on total covered expenditures. Many low-income countries have adopted the latter strategy, providing the minimum benefits for all illnesses rather than full insurance for less-frequent high-cost illnesses (Gertler and Solon, 1999). The rationale for this choice is the concern that the lower-income groups may not be able to “afford” the deductible, and therefore would not benefit from the insurance. However, if families are able to insure small health shocks, then first-dollar capped benefits provide little increased insurance but rather simply crowds out private informal insurance. Our findings suggest that these countries would be much better served by moving towards catastrophic type models of insurance coverage.

Poverty traps happen at a regional or national as well as at household level. Widespread illness reduces the economic potential of an area. The World Health Organization (1999a) estimates that the total indirect cost of lost productivity in Thailand as a result of morbidity associated with TB amounted to US\$ 57 million, while Gallup and Sachs (2000) suggest that controlling for factors such as tropical location, colonial history, and geographical isolation, countries with severe malaria had income levels in 1995 of only 33% of countries without malaria, whether or not the countries were in Africa. Africa’s geography, as well as inhibiting agricultural productivity, creates a hazardous disease ecology, while ill health may have contributed to Africa’s high dependency burden and its high desired family sizes. Between 1965 and 1990, Africa’s annual income growth was 4.3 percentage points lower than East and South-East Asia’s. Almost all of this difference can be explained by differences in health, age structure, and geography.

Conversely, there is some evidence that health outcomes deteriorate during economic crises. Although infant mortality rates continued to improve in Latin America during the debt crisis of the 1980s, it did so more slowly than it had improved in the previous decade. But health indicators more sensitive to income downturns worsened. In Chile, the percentage of low-birthweight infants and undernourished children rose as

the economy declined. In Mexico, infant and pre-school mortality caused by nutritional deficiency rose in the 1980s, reversing the trend of the previous decade, and it rose again with the economic crisis of 1995. In Indonesia, the share of women whose body mass index is below the level at which risks of illness and death increase rose by 25% in 1998, and the average weight of children under age three declined.

The few studies that have analyzed the impact of natural disasters on health outcomes show that the harm can be significant. Studies of the impact of the 1994 to 1995 drought in Zimbabwe found that women and young children were the most affected. For women, the drought's effect on health (as measured by body mass) was temporary. But children ages 12 to 24 months lost an average 1.5 to 5.0 centimeters of linear growth in the aftermath of the drought. The impact was most severe among children in household with little livestock, the principal asset of these households for smoothing consumption.

Economic crises and natural disasters, thus, through their impact on health, can cause irreversible losses of human capital affecting not only current living standards but also poor people's ability to improve their living standards in the future. This points to the importance of formulating a response that helps reduce the impact of systemic shocks on poor people's health.

5. HEALTH AND INEQUALITY

This chapter is based mainly on the paper Health, inequality, and economic development (Deaton, 2001) prepared for Working Group 1. By reducing income inequality, one would guess intuitively that population health could be improved, for the simple and profound reason that the effects of income on health are greater among poor people than among the rich. Health is a concave function of income.⁵ The effect of income on reducing the probability of death at the bottom of the income distribution is much greater than its effect at the top of the distribution. As a result, if income is redistributed from the rich, whose health is not much affected, to the poor, whose health is much more responsive to income, average health will improve. Other things being equal—and here that includes average income—nations or other groups with a more equal distribution of income will have better average group health. The same is true internationally; anything that raises the GDP of poor countries relative to that of rich countries will improve average health across the world. Within poor countries, infant and child mortality is likely to be particularly sensitive to changes in income near the bottom of the distribution, so that, once again, redistribution towards the poor will reduce child mortality even without raising average incomes.

It is often useful to think of this story of the relationship between income inequality and health in terms of poverty. If a country with a high average income has a great deal of income inequality, then there are a relatively large number of people with low income whose health is poor. If a rich country has a lot of poor people, it will have low average health relative to its per capita income. The inequality-inducing effect of nonlinearity in the relationship between individual income and individual health has come to be known in the literature as a *statistical artifact*, (Gravelle, 1998), in order to distinguish it from mechanisms in which income inequality has a direct effect on individual health. But the term is unfortunate because it falsely suggests that there is no real link between income inequality and health, and seems to carry the implication that redistributive policy cannot improve average population health. By contrast, the effect of nonlinearity is so plausible that it would be surprising if income redistribution did not improve average health, and also surprising if there

were no link between income inequality and average health across population aggregates.

An important application of these ideas is provided by the history of mortality in Britain and the United States in the century. Wilkinson (1989) looks at mortality differences by social class in Britain from 1921 to 1981, and argues convincingly that mortality fell most rapidly at times when income differentials were narrowed, particularly at times when incomes of the poor rose more rapidly than those of the rich, such as during World War II. Sen (1999) shows how life expectancy in England and Wales from 1901 to 1960 grew most rapidly in the decades 1911–1921 (by 6.5 years) and 1940–1951 (by 6.8 years), and more slowly at other times: 4 years in 1901–1911, 2.4 years in 1921–1931, 1.4 years in 1931–1941, and 2.8 years in 1951–1960. Sen shows that the decadal rate of growth of GDP per capita is strongly *negatively* correlated with decadal increases in life expectancy, and, like Wilkinson, he focuses on the degree of sharing during the two wars, as well as on the direct nutritional and health interventions that took place during and immediately after World War II. Both wars brought well-paying employment opportunities to many people in Britain for the first time, including many women. Hammond (1951) discusses how wartime food policy in the 1940s brought fresh milk and vitamins to working people, to the extent that their nutritional status actually improved during the hostilities. Reductions in income inequality during the wars, if they existed, marked an improvement in the conditions of the working people, among whom better incomes and better nutrition would have had the largest effects on mortality.

Conversely, the evidence associating increases in income inequality with mortality changes is unclear, in spite of the fact that, during the 1980s and 1990s, income inequality increased rapidly in the United States. In the United Kingdom, it has been shown that during periods of increasing income inequality, the rate of decline in mortality in infants, children, and adults actually slowed (Wilkinson 1989), although this may have been due to the time period selected for analysis. Longer time sequence casts doubt on the firmness of the relationship between income inequality and decline in infant mortality (Deaton and Paxon 2001b). It should be noted, however, that recent increases in income inequality, though large enough by postwar standards, are probably not large relative to earlier compressions (Lindert, 2000; and Goldin and Katz, 1999). There is also an underlying downward trend in mortality—associated either with increases in average income, or with medical advance, or both—so we must look, not for an absolute increase in mortality in the 80s, but for a relative slowing.

Of this there is no sign. Indeed, the period of most rapid inequality increase in the United States coincided with a period of particularly rapid mortality decline, particularly associated with reduction in cardiovascular disease.

Fogel has commented on the relationship between income inequality and the gaps in life expectancy. The Gini ratio for England was 0.65 near the beginning of the eighteenth century and fell to 0.32 in 1973, with two-thirds of the fall occurring in the twentieth century. The gap in life expectancy also fell during this period, and over this time, seven-eighths of the social gap in longevity disappeared. However, since the 1970s, income inequality in the United States has shown signs of increasing while measures such as life expectancy continue to show decreasing inequality (Fogel, 2000).

The reports about income inequality affecting health appear to be stronger than the evidence. Judging by the explosion of interest and of citations, there is a strong appeal to the idea that, before the epidemiological transition—the stage in which there is a predominance of infectious diseases to one in which, with lengthened life expectancy, there is a predominance of chronic diseases—*income determines mortality while, after it, income inequality determines mortality.* It is suggested that in poor countries, income protects against poor sanitation, unhealthy working and living environments, poor nutrition, and a plethora of infectious diseases, but in rich countries, where these evils are but distant memories, income inequality is an indicator of the quality of social arrangements, of stress, and of mortality. Yet, even if it is true that at higher income levels income inequality becomes more important as a cause of death, there is no need to assume that the relationship between income and mortality changes with economic development. If it is poverty, not inequality, that drives mortality, so that income has a much bigger effect on health at low than high incomes, average income will eventually cease to be associated with poor health, while the effects of inequality will endure for much longer because even in rich economies there are some who are not so rich. Income inequality will continue to affect mortality until everyone ceases to be poor, which happens long after *average* income has risen out of the range of poverty.

There is no robust correlation between life expectancy and income inequality among the rich countries, and the correlation across the states and cities of the United States is almost certainly the result of something that is correlated with income inequality, but that is not income inequality itself. Infant and child mortality in developing countries is primarily a

consequence of poverty so that, conditional on average income, income inequality is important only because, given average income, inequality is effectively a measure of poverty. But it is low incomes that are important, not inequality, and there is no evidence that making the rich richer, however undesirable that may be on other grounds, has any effect on the health of the poor or their children. The only exception to these generalizations is perhaps the case of homicide, where income inequality itself appears to play a genuine role.

These conclusions are not different from those of earlier commentators, particularly Judge (1995), Judge, Mulligan, and Benzeval (1997), and Van Doorslaer and Wagstaff (1999). Yet they must not be misinterpreted. They do not imply that the social environment is not important for individual health, let alone that individual health is determined by individual characteristics and the provision of personal medical care. We know from Whitehall and from other studies that positions in hierarchies matter, perhaps through an ability to control one's life, but in any case through some mechanism that works through relationships with other human beings. The empirical results obtained by Deaton and Lubotsky (2001) have drawn attention to another social factor: the effects of racial composition on mortality, something that remains to be investigated. They have also emphasized several other cases where reductions in deprivation in one dimension, whether it be land ownership, democratic rights, women's agency, or income, will bring benefits not only in and of themselves, but also to the relief from other deprivations, in this case particularly the deprivation of ill-health. This is of course Sen's (1999) theme in *Development as freedom*: that relief from any one of a number of interlinked deprivations, each of which is an important unfreedom in its own right, helps promote relief from the others. This is quite different from a story in which income inequality is the principal actor and main villain.

6. THREE DISEASES

The cost of addressing the problems of specific diseases and the relative impact of the various determinants of health on health outcomes is considered by Working Group 5, but here we analyze the economic impact of the following health problems: tuberculosis (TB), malaria, mental illness, and HIV/AIDS. These were chosen because of the magnitude of the burden of ill health that they cause. In the case of mental illness, it was important to highlight the paucity of data for developing countries.

6.1. TUBERCULOSIS

6.1.1 *The extent of the problem*

Tuberculosis has been with humankind since antiquity; the evidence for human infection dates back over 4000 years. It was the discovery of streptomycin in 1943 that issued in the era of drug therapy for the disease, and it is perhaps the availability of noninvasive curative therapy that led to the false hope that the disease would soon be eliminated. The facts are that TB is the most common human infectious disease. Infectious and parasitic diseases cause 80% of all communicable diseases; TB is the leading killer among them all, killing or debilitating more adults aged 15 to 59 than any other disease (World Bank, 1993). Approximately one-third of the world's population is infected with the TB bacillus, and between 5 and 10% of people who are infected with TB become ill or infectious at some stage of their lives. It is estimated that unless control is strengthened, about 35 million persons will die of TB in the next 20 years. The resurgence of TB in the mid 1980s in the United States led to much more attention being paid to the disease, and the seriousness of the growing epidemic led the World Health Organization to declare it a global emergency in 1993.

The magnitude of the epidemic is shown in the WHO Report (2001) on Global Tuberculosis Control. There are difficulties in estimating the precise incidence of the disease, as the method depends to a certain degree on the validity of trend estimates. But in spite of various caveats, it is estimated that there were 8.42 million new cases of TB in the world in 1999. This figure was higher than that estimated for 1997, and the rise is largely due to a 20% increase in incidence in African countries most affected by the epidemic of HIV/AIDS; the worst-case scenario has a projection of

10.2 total million cases in 2005. Twenty-three countries account for some 80% of all cases, and although China and India head the list in terms of actual numbers, the prevalence rates of persons who have been reported as having bacilli in their sputum are highest by far in African countries. The annual rate of increase in TB incidence is 3% globally, 7% for Eastern Europe, and over 10% for African countries that are most affected by HIV/AIDS. The unfortunate fact is that it is only in the industrialized developed countries that the number of cases is expected to fall in the near future. It is clear from the above that the burden of the disease is enormous. The estimates in 1993 were that it was responsible for 2% to 5% of the burden of disease globally, and given the progression since then, the situation is now probably worse.

This disease has always been known to be associated with poverty (Spence et al., 1993) and the attendant social deprivations. Cross-country regression analyses for the 20 countries with the highest burden of TB show a significant inverse relationship between the rate of sputum positivity and the countries' GDP. Recently, however, other factors have come to the fore as contributing to the global emergency. First has been the appearance of HIV/AIDS. Tuberculosis is already the leading cause of death of HIV-positive individuals; TB accounts for one-third of AIDS deaths globally; two-thirds of HIV-positive patients in India will become ill with TB. The chance of an infected person ever developing active TB is estimated at 5 to 10%, but this figure rises to 30 to 50% in HIV-infected individuals. The treatment of TB in HIV/AIDS patients also important, as TB is the only significant opportunistic infection that is readily transmitted from a person with HIV/AIDS to someone who is HIV negative. Migration is another factor that is increasing the risk of spread of TB. Cross-border movement of infected persons not only increases the transmission of the disease, but when such immigrants are illegal and do not enter the formal care system, this enhances the possibility of spreading the disease, and the intermittent treatment favours the development of the dangerous multi-drug resistant tuberculosis (MDR-TB).

6.1.2 The economic burden of tuberculosis

The sheer magnitude of the problem and the fact that TB is the major cause of death and disability among adults in their most productive years of 15 to 59 makes it obvious that it must have an effect on productivity. WHO estimates that the economic costs to the poor amount to more than US\$ 12 billion per year (WHO 2001). The average GDP for the 20 countries that have 80% of the world's malaria is US\$ 998 per year (circa

1999). The association of TB and poverty probably relates both to the fact that the disease from time immemorial has been associated with the kinds of social conditions associated with poverty, and also that the marked increase in the countries such as those of the former Soviet Union, for example, is possibly associated with those countries' economic collapse with their attendant social deterioration, as evidenced by such behaviours as increased alcohol consumption. A chronic disease such as TB, however, must also have an impact on household income and individual productivity.

6.1.3 *Estimating the costs of tuberculosis*

The first approach to an estimation of the costs of TB might be an examination of the direct effect the disease has on individuals and households, with subsequent examination of collateral effects on groups such as children, and an evaluation of the societal costs of the disease. The traditional approach, at least from microeconomic analysis, is to determine the direct and the indirect costs of the disease (Rajeswari et al., 1999; Kamolratanakul et al., 1999). The direct costs may be medical, which include the money spent on investigations, drugs, and other medical therapy incurred by the patient, as well as nonmedical, which involve such elements as travel, lodging, special food, and similar expenditures. The indirect costs relate to loss of wages through absence or diminished capacity to work, especially if self-employed. A significant factor is the time that elapses between the onset of illness and the first diagnosis of the disease, which seems generally, at least from the studies in Africa, India, and Peru, to be between 60 and 80 days. This delay in seeking treatment may be a result of the denial that often accompanies symptomatic disease in previously healthy individuals, and also of the reluctance of the primary breadwinner to take time off from work. But the cost of attention may also play a role, and in a study from Uganda in which there was a 63-day delay in seeking treatment, 38% cited lack of money as the cause (Needham, Godfrey-Faussett, and Foster, 1998), and there is no doubt that poverty is a factor in the attendance for therapy and the compliance with the treatment regime (Farmer et al., 1991).

In Thailand, the direct costs of TB among the poor are estimated at about 15% of annual household income for infected individuals. Drugs constitute a large part of the direct costs, and such costs may be substantial even in countries where treatment is free. Data from Uganda show that, although drugs were free, the direct costs to the patient represented, on average, three times a nurse's monthly salary (Fryatt, 1997). Because of

differences in currencies and form of analysis, it is impossible to have a global figure for the direct and indirect costs, but there are data from Zambia to show that these may be as much as 40% of family annual income, and the nonmedical direct costs may be as high as 55% of the patient's mean monthly income (Needham, Godfrey-Faussett, and Foster, 1998). These figures are considerably higher than those reported by the World Bank in 1991, which indicated that in 8 developing countries the potential income loss from illness was 2.1 to 6.5% of yearly earnings. It is of interest that among the 8 countries there were only 3 that, at least in 1999, were among the 23 countries that contribute 80% of the world's TB cases. The TB control program in Peru is one of the best in the developing world, but a recent detailed analysis of the cost of the disease and the cost of treatment is probably in keeping with the situation in the developing world. The total costs of the disease represented 0.2% of GDP, 14% of public expenditure in health care, and 4% of the total expenditure in health care (Ministry of Health of Peru, 1999).

The loss from inability to work will vary with the severity of the disease and the age of the patient, with older patients losing more time away from work. However, in India, which currently has the largest number of cases in the world, one study shows that the average period of loss of wages was three months (Rajeswari et al., 1999). The impact of lost earnings will obviously vary with the nature of the occupation and the economic situation of the patient.

The societal losses from TB will vary with the country's level of wealth and unemployment. There will also be differences depending on whether there is accompanying HIV/AIDS. One calculation from Thailand, which used the human capital approach (Over, Bertozzi, and Chin, 1989), took the average GDP for the country as US\$ 1 900 and measured the loss from TB with and without HIV/AIDS (Sawert et al., 1997). For HIV-infected individuals, the average years of productive life lost was assumed to be 2, while for non-HIV-infected individuals, the figure was 15 years. Streams of future life years were discounted at a rate of 5.85%. Death of an HIV-infected TB patient would result in a loss of US\$ 3490 to society, while death of a non-HIV-infected patient results in a societal loss of US\$ 19 400. This gives an idea of the magnitude of the indirect costs that would result from untreated or uncured tuberculosis in middle-income and wealthier countries.

The adoption of proven control strategies, such as the DOTS approach, which has been vigorously promoted by WHO and is shown to be effective, would clearly result in reduced direct and indirect costs. The

same study from Thailand projected that, over a 20-year period, the societal savings in the form of reduced indirect costs would be US\$ 2.4 billion.

Any discussion on treatment must include consideration of multi-drug resistant tuberculosis (MDR-TB), which is threatening the prospect for global control. The emergence of MDR-TB is associated with the proportion of previously treated cases and is also related to a lower GNP/capita (WHO 1999). The cost of curing MDR-TB is extremely high, averaging approximately US\$ 1063 per patient in Peru compared with between US\$ 36 and US\$ 119 for conventional DOTS therapy. These costs are far out of the reach of most developing countries, hence the primary emphasis on proper initial treatment.

The economic cost of TB is also seen in broad changes in household behaviour. The effect on the children in the family may be their ceasing to attend school, with obvious further consequences for their earning capacity, thereby perpetuating the familial poverty. Children in the household may also have to be the breadwinners. When females in the reproductive years are infected, their disease has an impact on their ability to maintain their households and, more importantly, care for the children. None of the costs referred to above include the cost of social exclusion that result from the stigma that is still associated with TB.

A debilitating illness such as TB can serve to drive families into poverty, a classic example of a health shock creating a poverty trap. There is much anecdotal information of families having to dispose of their means of livelihood in order to pay for or access therapy. In the study from Thailand (Kamolratanakul et al., 1999), it was shown that it was the poor who were twice as likely to sell their property to finance the expenses incurred in treating their illness than those whose incomes were above the national average. To the extent that this property included animals and other income-generating assets, they would have been almost permanently economically disadvantaged.

6.1.4 Conclusion

Tuberculosis is one of the world's major killers, accounting for about 2 million deaths per year, and the epidemic seems to be growing. The coexistence with HIV/AIDS makes the disease more devastating in the countries of Africa with high prevalence rates of HIV/AIDS. The economic costs, both direct and indirect, are considerable, and there are societal costs that result from lost earnings. This lethal disease is associated with poverty, but by itself may serve to drive families into a poverty trap from which it is difficult to emerge.

6.2 MALARIA

Malaria affects 300 to 500 million people a year, and is responsible for more than 1 million deaths annually. This burden is not evenly distributed, but rather is highly concentrated in the lowest income countries of the world, with 90% of malaria mortality occurring in sub-Saharan Africa. A comparison of income in malarial and nonmalarial countries shows that the average 1995 purchasing-power parity GDP in malarial countries was US\$ 1526 compared with US\$ 8268 in countries without intensive malaria—more than a fivefold difference. Malarial countries are not only poorer than nonmalarial countries; they also appear to have lower rates of economic growth. A cross-country analysis (Gallup and Sachs, 2000) finds that countries with high rates of transmission of falciparum malaria in 1965 had annual economic growth rates that were 1.3% lower than nonmalarious countries over the period 1965 to 1990, even after controlling for other standard growth determinants used in macroeconomic analyses, such as levels of human capital, life expectancy, initial income, and macroeconomic policy indicators of various kinds.

The high negative correlation between malaria and poverty naturally raises the question of causation. Is it that poverty causes malaria, or is the economic burden represented by malaria so large that it is a major explanatory factor in the poor economic development of highly malarious countries? Poverty can surely be held responsible for much of the excess disease burden in developing countries; issues such as unsafe drinking water, poor hygiene, or lack of basic health care, all linked to household and society-wide poverty, can be blamed for many health problems. In the case of malaria, personal expenditures on prevention methods such as bednets or insecticides, effective government control programs, and general development such as urbanization, can also affect prevalence.

Nonetheless, the severity and difficulty of controlling the disease are critically determined by ecology and climate. Temperature, precipitation, topography, land use patterns, and vector prevalence are critical determinants of malaria transmission. This is evidenced in the case of relatively wealthy countries such as Oman or the United Arab Emirates, which have been unable to control malaria, and by experiments such as the one in Garki, Nigeria, where WHO and the Nigerian Government failed to reduce overall transmission of malaria significantly, despite considerable expenditures on vector control and case management. Indeed, with base case reproduction rates so high in most of sub-Saharan Africa because of climatic and vectorial conditions, the international malaria control efforts in the 1950s and 1960s largely ignored much of the African continent.

6.2.1 *The economic burden of malaria*

The mechanisms through which malaria causes poverty are complex. As a first approximation, one might expect that the cost of malaria at a national level is an aggregation of the burden it places on individuals and households. Studies that attempt to estimate the burden of the disease on households using a microeconomic approach find that it is, in fact, quite large and especially severe for those in the lowest income brackets. However, tallying the private medical costs, the nonprivate medical costs, and some measure of foregone income associated with malaria morbidity and mortality, studies that use this approach generally estimate an economic burden of malaria in the region of 1% of GNP. Although this is significant, it is considerably lower in magnitude than the cost estimated by macroeconomic comparisons. We explore here some of the mechanisms through which malaria may be affecting economic growth and development at both a household and a national level that are simply not incorporated into traditional approaches to measuring the economic burden of the disease.

6.2.2 *Traditional approaches to estimating the economic burden of malaria*

Most microeconomic studies of the cost of malaria use the Cost-of-Illness (COI) approach. This approach attempts to enumerate mutually exclusive categories of costs that are both computable and exhaustive. It takes into account the private and nonprivate medical costs associated with an illness, the foregone productivity from the morbidity and mortality. The standard formula for the COI method of calculating the economic cost of a disease is:

$$\text{COI} = \text{Private Medical Costs} + \text{Nonprivate Medical Costs} \\ + \text{Foregone Income} + \text{Pain and Suffering}$$

The direct costs of the disease are the private and nonprivate medical costs. Private medical costs refer to personal expenditures on prevention, diagnosis, treatment, and care of the individual with the disease. They include such factors as expenditures on bednets, doctor's fees, the cost of antimalarial drugs, the cost of transportation to medical facilities and necessary support for the patient and, if applicable, an accompanying adult, for the duration of stay at the facility. Nonprivate medical care costs are public expenditures on both prevention and treatment of the disease. They include expenditures by the government on such factors as vector control, health facilities, education, and research. Together these constitute the direct costs of the disease.

The indirect costs of the disease are the productivity losses associated with the illness. They are measured here by estimating the income foregone due to both morbidity and mortality. The indirect cost of morbidity is the value of lost workdays as a result of malaria and malaria-related illness, based on estimated wages. In the case of mortality, foregone income is estimated by calculating the capitalized value of future lifetime earnings that would have been earned by those who died prematurely as a result of the disease, based on projected incomes for different age groups, basic longevity data, and age-specific mortality rates. Although the formula includes a cost for pain and suffering, this is naturally difficult to impute in economic terms. It is therefore generally ignored in studies that use this approach, despite the fact that it represents a real cost (Rice, 1966).

An overview of various COI studies shows that, although the COI formula is standardized, in practice diverse data sources and methodologies lead to significant variations in implementation, and most studies are unable to carry out a comprehensive assessment of the costs described. Furthermore, this approach was developed in the industrialized world to assess the burden of illnesses such as cardiovascular or respiratory disease. The pandemic nature of malaria means that there are components of cost associated with it that such a formula cannot even begin to assess. It is perhaps for this reason that a macroeconomic approach to assessing malaria finds that the long-term impacts on economic growth and development are far more significant than those suggested by COI studies.

6.2.3 *Bridging the gap*

There are at least two broad categories of mechanisms through which malaria can impose economic costs well beyond direct costs and foregone incomes. The first is the effects that occur through changes in household behaviour as a result of the disease, which could result in broad social costs. These include such factors as schooling, demography, migration, and saving. The second category is the macroeconomic costs that cannot be assessed at a household level, such as the impact of malaria on trade, tourism, and foreign direct investment. We explore here some of the additional channels through which malaria affects economic performance that are simply not incorporated into traditional COI studies.

6.2.3.1 Schooling

In highly endemic areas, adults generally develop partial immunity to malaria. Young children, however, bear a considerable burden in terms of malaria morbidity and mortality. Naturally, this can lead to a high rate of

school absenteeism. Leighton and Foster (1993) estimate that in Kenya, primary school students miss 11% of school days per year because of malaria, and secondary school students miss 4.3% of school days. In the case of Nigeria, they find that between 2% and 6% of the school year is lost. A study by Kere et al. (1993) in the Solomon Islands finds that the average case of malaria in children between 7 and 13 years of age causes a loss of 5.3 days of school. The adverse effects on schooling are likely to go far beyond the number of days lost per year, since studies have shown that absenteeism is likely to increase failure rates, repetition of school years, and dropout rates.

An even more serious consequence can arise from the impacts of malaria on cognitive development and learning ability. A common side effect of malaria is anaemia, whose impact has already been studied in Chapter 3 above.

6.2.3.2 Demography

Malaria kills more than 1 million people a year, and perhaps more than 2 million when the role of malaria in deaths related to other diseases is also included. Most of the mortality in highly endemic areas is concentrated among children under the age of five. Aside from the direct demographic consequences of higher mortality, there are also likely to be significant indirect effects, such as those that we have examined in Chapter 2 on the relationship between health and demography.

6.2.3.3 Migration

The risk of malaria acquisition has been documented to have significant effects on population mobility and settlements of new lands, with consequent impacts on economic growth and development (Sawyer, 1993). Although adults living in highly endemic areas generally develop partial immunity to the malaria parasite, making them less susceptible to malaria morbidity and mortality, variations in the parasite mean that this immunity is limited geographically. Moreover, the acquired partial immunity of adults is dissipated by the absence from a malarious environment over the course of a few years, for example, during a period of schooling or a job assignment away from the malarious region. This can result in high disease morbidity and mortality upon return, or it can depress the extent of short-term migration for schooling or temporary job opportunities in other locations. The costs of migration may also have serious implications for social equity, as migrants tend to be from the lowest

socioeconomic brackets, and therefore least able to bear the economic costs of the disease.

The lack of geographical transferability of adult immunity can be particularly costly in that mobility of population allows labour to move to regions where it is most productive. By limiting this movement, malaria can interfere with skill matching and generally inhibit maximization of worker productivity. Furthermore, to the extent that greater trade and commercialization exposes individuals to the disease, it will reduce incentives to expand markets, a factor that can hinder economic development in the long run.

6.2.3.4 Savings

The direct costs of prevention and treatment of the disease eat into the disposable incomes of poor families, as do the costs of lost productivity. For example, Nur (1993) documents the negative impact of malaria on household savings as families are forced to hire labour to compensate for days lost to morbidity. Although economic models suggest that increased risk of illness could, in fact, increase savings if families were trying to protect themselves from vulnerability to economic shocks by building a buffer, there is little evidence to support this idea in the poor, rural households that have been studied.

6.2.4 *The impact of malaria on other illnesses*

One of the surprising results to emerge from large-scale trials of insecticide-impregnated bednets (IBNs) is that the reduction in all-cause mortality with the use of bednets is considerably greater than the reduction in malaria mortality. This would imply that malaria is closely linked with other diseases, either as a direct causal factor, or because malaria renders individuals more susceptible to other kinds of diseases. In fact, there is considerable evidence that acute and chronic malaria infections can alter the immune system and increase vulnerability to other infections and the response to vaccines. Furthermore, chronic malaria is a primary causal factor for anaemia (Hedberg et al., 1993; Schiff et al., 1996), which has been shown to have direct physical effects, lowering worker productivity and output (Scholz et al., 1997; Basta et al., 1979). Malaria is also associated with hyperreactive malarial splenomegaly, renal disease, and Burkitt lymphoma. Increasingly, malaria is becoming a factor in the transmission of HIV, as children with severe malaria often need blood transfusions, and much of the blood supply in sub-Saharan African countries is infected with the virus. To the extent that malaria is a factor in other ill-

nesses, the range of costs that are associated with these illnesses should rightfully be included in any assessment of the economic burden of malaria.

6.2.5 *Conclusion*

There is a strong global correlation between poverty and malaria, with almost all areas of intensive malaria being poor and continuing to show low rates of economic growth. We argue here that the relationship is at least partially causal, with malaria representing a significant cost in terms of long-term economic growth and development. Although traditional, microeconomic estimates using COI methodology do find that malaria has a significant cost, the magnitude of the burden estimated using these two approaches has not been sufficiently reconciled.

That the COI methodology can be expected to understate the true extent of the economic burden imposed by the disease is not difficult to see. The pandemic nature of malaria in some parts of the world creates broad costs that this approach is simply not designed to recognize, and these costs have potentially large-scale impacts on economic growth over the long run. Incorporating some of these costs as described above into a comprehensive assessment of the economic burden of the disease will enable us to understand fully the magnitude of the economic burden of this disease.

6.3 MENTAL ILLNESS

Mental disorders are found in all cultures, are prevalent, cause considerable disability, and rank high on the league table of world disease burden. By extension, they constitute a significant economic burden in all countries. They are prevalent over the whole life cycle, and since some of the most disabling ones have a relatively early onset, their morbidity and comorbidity will affect the formation and development of human capital and labour market outcomes. In the United States, the 12-month prevalence of mental disorders has been estimated at about 21%, (Bir and Frank, 2001) and although there may be problems with the definitions used, similar figures are found in developing countries as well. The World Health Report 2000 estimated that mental disorders account for 28.5% of all disability worldwide, ranging from 47% in established market economies, such as the United States, to 16% in Africa. Five of the ten leading causes of disability worldwide are mental disorders: major depression, alcohol use, bipolar disorder, schizophrenia, and obsessive compulsive disorder.

In both developed and developing countries, prevalence rates are influenced by many factors. Prevalence of mental health problems can rise

significantly after natural disasters and conflict. Sharan et al. (1996) assessed survivors in 23 households in three villages in India affected by an earthquake, and found 59% to have a psychiatric diagnosis. The consequences of such mental disorders for the rehabilitation required after a disaster are enormous.

6.3.1 *Economic consequences from mental illness*

6.3.1.1 Data from developed countries

Mental disorders have wide-ranging effects on the individual and society, with resultant costs that can be identified. These include cost of treatment and social welfare, transfer payments, lost productivity in remunerated or nonremunerated roles, costs to the family or caregivers, mortality, and externalities.

Cost-of-illness studies have usually been focused on individual disorders, and have mostly been carried out in developed countries. The US studies based on the Epidemiological Catchment Area (ECA) study (Rice et al., 1990) included a wide range of costs, including training costs, program administration, the net cost for private health insurance, the value of reduced or lost productivity due to morbidity, the costs of premature mortality, victim costs of crime and criminal justice system expenditures, and the value of time spent by family caregivers supporting their relatives. Direct costs were built up from service utilization rates found in the ECA surveys and national expenditure data. Indirect costs were based on the human capital approach: the value of labour at market prices forgone as a direct result of mental health problems, weighted by average incomes. Multivariate statistical methods were used to adjust income effects by taking into consideration other socioeconomic variables. In this way, Rice and colleagues calculated an aggregate cost of US\$ 148 billion (at 1990 prices) for all psychiatric disorders together. One of their most important findings is that the indirect costs either match or outweigh the direct costs for all mental disorders. The development of frameworks to deliver cost-effective interventions will provide a basis for programs that not only reduce the work-related disability but also associated productivity losses. Mental health problems accounted for about 2.5% of GNP in the United States (Rice et al., 1995).

Other investigators have used data from the same ECA study and find significant impact of mental illness. For example, 3% of men and 4.5% of women were unable to work or engage in regular activities because of a mental or emotional problem, and men with a mental disorder had earnings that were 21% lower than for otherwise similar men (Robins and

Regier, 1991; Frank and Gertler, 1991). Clearly, service utilization drives the direct health costs for all disorders. Berto et al. (2000), reviewing cost-of-illness estimates for depression, concentrating on Italy, the United Kingdom, and the United States, found the most important contributor to the direct costs of depression is hospitalization accounting for around half the total in the United Kingdom and three-quarters in the United States.

Mental disorders clearly affect labour supply and productivity. Compared with other conditions, workers with mental disorders are more likely to go to work but perform suboptimally (Dewa and Lin, 2000). The magnitude of “work cutback” has highlighted the previously “hidden” disability of mental disorders. Berndt and colleagues (1998) have shown that, for chronically depressed individuals, the level of perceived at-work performance is negatively related to the severity of the depressive illness, and that a reduction in the severity of depression rapidly improves the patient’s work performance. US data suggest that, for mental disorders, the number of work cutback days is five times the number of days lost through absenteeism (Kessler and Frank, 1997).

6.3.1.2 Data from developing countries

Mental disorders are probably less frequently diagnosed and treated in developing countries, but there is evidence that they constitute a significant part of the care given at both primary and secondary levels. WHO has estimated that about 25% of all primary care attendees were suffering from a mental disorder.

Chisholm et al. (2000) identified evidence on service use and costs in two districts of India and Pakistan. Combining health care and patient/family costs, the economic impact of depression and anxiety in the Bangalore (India) site was Indian Rupees 700 per month, and in the Rawalpindi (Pakistan) site was more than Pakistani Rupees 3000 per month. This was equivalent to between 7 and 14 days of an agricultural worker’s wages in India, and approximately 20 days’ work for similar workers in Pakistan. Suleiman et al. (1997) found that more working days were lost by patients with schizophrenia and their relatives compared with days lost by a cohort with diabetes.

The literature on productivity losses from mental illness in developing countries is scanty, and the best data set available has been analyzed by Bir and Frank (2001). These data come from the first and second rounds of the Indonesian Family Life Survey (IFLS). This survey collects information on the lives of respondents, their households, their families, and the communities in which they live. The sample is representative of

about 83% of the Indonesian population and contains over 3000 individuals living in 13 of the 23 provinces in the country. The IFLS also embraces a community survey that measures infrastructure and availability of services for schools and health facilities and for a sample of communities. When sadness plus two of the symptoms of mental illness were grouped as one cluster, it was clear that this cluster was associated with reduced labour market outcomes. Both males and females with this cluster had a lower rate of employment than those that did not have this combination of symptoms. The margin was greater in males. Both males and females with the cluster of symptoms worked roughly 10% fewer hours than those without. Males with the cluster were less likely to be self-employed than those without. Regression analysis showed that males with the cluster of symptoms were about 52% as likely to be working, and worked 27% fewer hours per week relative to otherwise similar males without the symptoms. The results obtained in this survey show that employment *and* the scale of the reduction in hours of work associated with psychiatric symptoms are greater than are typically found in the United States.

6.3.2 *Treatment of mental illness*

The widening recognition of mental health as a significant international public health issue has led to an increasing need to demonstrate that investment of resources into service development is not only required but also worthwhile in countries with varying socioeconomic circumstances. Specifically, there is a need to generate evidence on affordable, cost-effective, generalizable, and sustainable mental health care strategies that can support mental health policy initiatives by governments and donor agencies alike. Much is already known, at least in developed countries, and the work on depression is helpful in this regard. Simon et al. (2001) reviewed the literature on the impact of depression on work productivity in developed countries and the potential for improved work performance associated with effective treatment. They concluded that productivity gains following effective depression treatment could far exceed direct treatment costs. The work on efficiency and effectiveness of pharmacotherapy, psychological interventions, and various approaches to care management needs to be extended to developing country settings.

6.3.4 *Conclusion*

Mental illness is coming to the fore as a major cause of disability in all cultures and in all countries. These diseases cause loss of productivity by the ill as well as significant indirect costs to be borne by family members and eventually society as a whole. The estimated cost of psychiatric disorders in the United States will be in billions of dollars. Given the possibility of similar frequencies of mental illness in the developing countries, the proportional burden on services and on the economy as a whole is significant. The sparse data that are available from developing countries are consistent with finding a proportional impact of mental illness on productivity. There does, however, exist effective therapy for many mental disorders.

7. HIV/AIDS

This section follows closely the background paper prepared for Working Group 1 by David Bloom, Ajay Mahal, Jaypee Sevilla, and River Path Associates. More than 22 million people have now died of AIDS worldwide, including 3 million in 2000 alone. Thirty-six million people are currently infected with the virus and, although infection rates are stabilizing in sub-Saharan Africa (albeit at a very high level), the epidemic is still growing in Asia and Eastern Europe. The lack of an imminent vaccine or cure means that many more deaths are inevitable.

The seriousness of the AIDS pandemic raises questions about its potential impact on national and regional economies. AIDS disproportionately affects people of working age, and is also creating a huge burden of AIDS orphans. Many political leaders have expressed alarm in light of studies showing the potential devastation of their economies, but relatively few businesses have spoken out decisively.

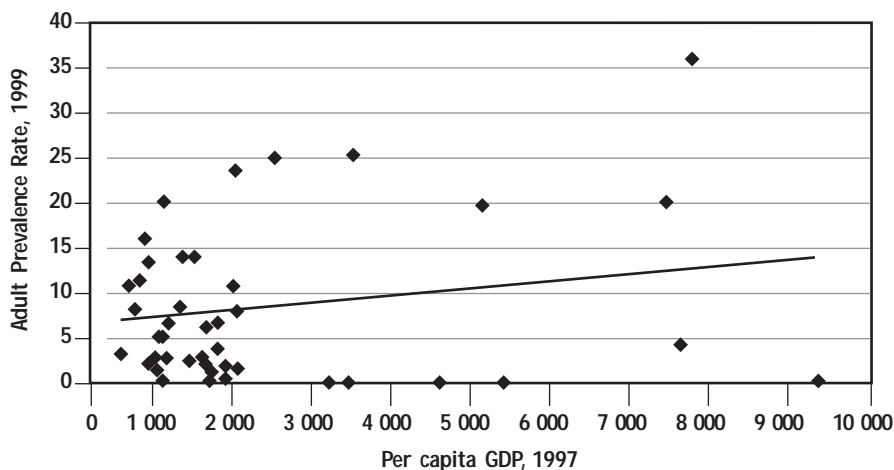
This chapter provides an overview of the links between AIDS and economics. The first section assesses economic correlates of HIV transmission, using macro, micro, and household data. The second section examines the effect of AIDS on economies, both directly and as a cause of demographic change.

7.1 ECONOMIC DETERMINANTS OF HIV TRANSMISSION

This section reviews existing studies of the association between HIV/AIDS and economic status, at both the macro and micro levels, and assesses the impact of development on AIDS.

7.1.1 *The macro level*

The link between income levels and AIDS prevalence is complex and poorly understood. Data from the 1980s and early 1990s, mainly from sub-Saharan Africa, seem to indicate that the wealthy were at highest risk from the pandemic. Two of Africa's richest nations, Botswana and South Africa, are among the most affected nations in the world. **Figure 7.1**, based on data from 1997, shows a continuing disproportionate impact on Africa's richer countries, reflecting the role that better infrastructure and more mobile populations seem to play in the spread of the disease. Within all other continents, there is neither a positive nor a negative statistical

Figure 7.1 HIV AND INCOME, AFRICA

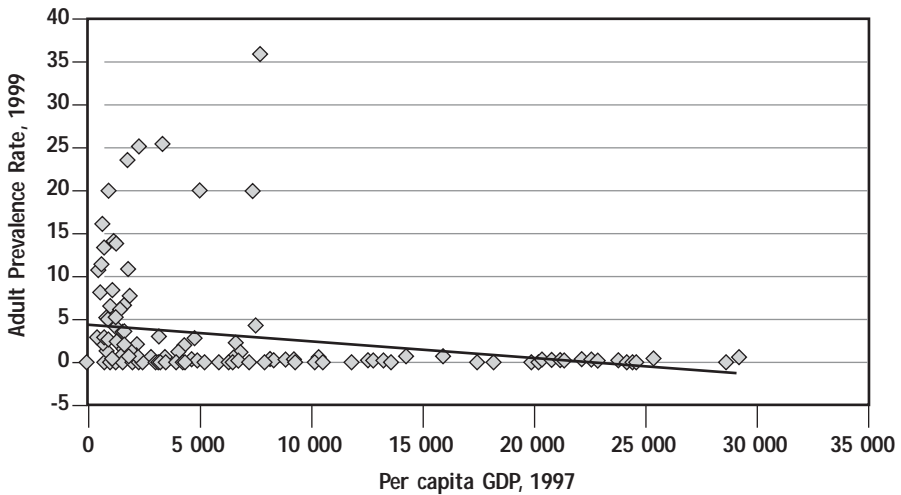
Sources: UNAIDS, 2001; WDI 1999.

association between income levels and AIDS. Examined continent by continent, therefore, HIV appears to be either affecting the rich more than the poor (as in Africa) or is income neutral (everywhere else).

Between continents, however, the picture looks different. Ninety-five per cent of those infected with HIV live in less-developed countries, home to 80% of the world's population. As [Figures 7.2 and 7.3](#) show, at a global level there is a statistically significant relationship between low income and HIV-prevalence rates; that is, the poorer the country, the greater the HIV prevalence. There is a similar relation between income distribution and HIV prevalence, with countries with greater income inequality facing a more serious epidemic. Absolute poverty rates, defined as income below US\$ 1 a day, are strongly associated with HIV-prevalence rates, as are low rankings on the United Nations Development Programme (UNDP) Human Poverty Index, which takes into account mortality, literacy, malnutrition, and access to water, sanitation, and health services. Existing data provide some indication that the relationship between poverty and HIV is growing stronger over time, both between and within continents.

7.1.2 *The micro level*

Compared with existing macro data, micro data studies appear to be better equipped to highlight links between economic status and AIDS. Thus, the intuitive link between knowledge and HIV transmission is sup-

Figure 7.2 HIV AND INCOME, WORLD

Sources: UNAIDS, 2001; WDI 1999.

Figure 7.3 HIV AND THE GINI INDEX, WORLD

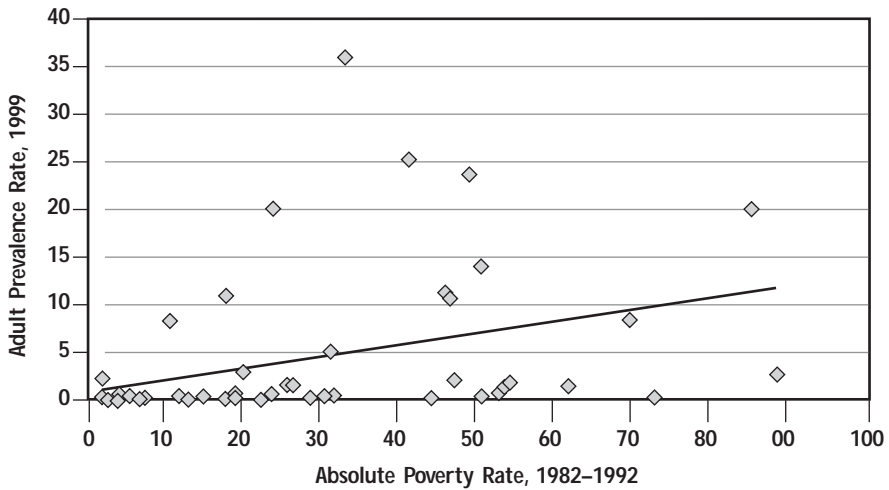
Sources: UNAIDS 2001; Deininger and Squire, 1999.

ported by several studies. School enrolment rates and illiteracy rates in the majority of the developing world, and particularly in Africa, are substantially lower than those in richer countries, and the poor within all coun-

tries are least likely to receive education. The poor are therefore less likely to be aware of the dangers of HIV/AIDS than the rich.

- Analysis of household data from Cambodia, Nicaragua, Tanzania, and Viet Nam shows a strong correlation between both wealth and education and knowledge that condoms prevent AIDS; knowledge of where condoms can be obtained; and self-reported usage of condoms (Bloom et al., 2001).
- Recent research in Cambodia, the country with the most advanced epidemic in Asia, demonstrates that the poorest segments of society have much less knowledge of how AIDS is transmitted and prevented; are more likely to have sex at a younger age; use condoms less frequently; and, in the case of young women, are more likely to turn to sex work as a means of supporting themselves and their families (Bloom et al., 2001).
- A study in Brazil showed that three-quarters of people newly diagnosed with HIV in the early 1980s had a secondary or university education, but by the early 1990s this share had fallen to one-third (Parker, 1997).
- A study in rural Uganda, on the other hand, found that in a cohort of almost 20 000 adults aged 15 to 59 years, followed over three and one-half years, HIV-associated mortality was highest among the better educated (Sewankambo et al., 2000). However, there is evidence that this pattern may be changing over time. Another study in Uganda (see [Figure 7.4](#)) shows that the better educated were hit hardest in the early stages of the epidemic, but that HIV infection rates are now falling quickest among those with more education.
- Education is not the only factor highlighted by micro data. There is evidence that poverty forces many people to work in the commercial sex industry, thereby putting them at risk of HIV infection. A series of small-scale studies from sub-Saharan Africa, Brazil, and Haiti show how poor women can be forced into sex work, or into providing sexual favours in return for money. They are also shown to be less able to insist on condom use than their counterparts, who cater to higher-income clients.

Although the micro data are suggestive of a link between poverty and AIDS, many small-scale studies are based on nonrepresentative samples in the hardest-hit areas, and some larger scale research, such as that conducted in Uganda, shows a negative correlation between HIV and poverty. As with the macro data, there remain many unanswered questions.

Figure 7.4 HIV AND THE \$1/DAY ABSOLUTE POVERTY RATE, WORLD

Sources: UNAIDS, 2001; WDR 1998.

7.1.3 *The impact of development*

Although poverty reduction might be thought to reduce HIV/AIDS rates, in some cases the development process may itself strengthen epidemics. Development is associated with infrastructure development, urbanization, increases in disposable income, the growing importance of cash in agriculture, and growing mobility. Furthermore, inequality often grows in the early stages of development (Deaton and Lubotsky, 2001; Nielson, 1994), creating increased internal migration. Workers migrate to centres of wealth and employment, which is a significant risk factor: men travel away to work, but occasionally return to their families in their village of origin. Development is likely to bring greater opportunities for multiple partnering and a growth in the commercial sex industry. Finally, inequality can create changes in gender relations that may facilitate the spread of sexually transmitted diseases (Farmer, 1999).

There is currently little evidence to quantify the extent of the HIV risks caused by the unintended consequences of development efforts. However, a strong case is building for making HIV-impact assessment a routine part of programs designed to promote development and poverty reduction.

7.1.4 *Poverty to AIDS*

In sum, the link between economic status and AIDS is complex. Although many micro-level studies point to a significant link between poverty and HIV-prevalence rates, macro data are unconvincing, particularly in terms of the causality of the link. Some risk factors for HIV, such as a high level of disposable income, are more prevalent amongst the rich than the poor. Others, such as lack of education, are more prevalent among the poor than the rich. Both groups exhibit the kind of mobility that appears to be associated with HIV transmission.

On balance, it seems plausible that the rich are more at risk in the early stages of an epidemic, and that a combination of factors, including lack of education and other economic exigencies, put the poor at increasing risk as an epidemic progresses. One might therefore suspect that HIV epidemics will become increasingly embedded in poor communities. Although not proven, this hypothesis is broadly consistent with patterns of HIV transmission seen in Africa and other regions, including wealthy industrial countries such as the United States.

7.2 THE IMPACT OF AIDS ON ECONOMIES

The humanitarian case for taking action to prevent HIV/AIDS is clear and compelling. However, there is also value in exploring the economic case for action. With many problems competing for public sector budgets, governments need guidance on where to devote their resources. Businesses may also need to adjust their strategies to respond to the pandemic. This section, therefore, explores the epidemic's economic impact.

7.2.1 *Macro evidence*

A lack of reliable time series data on poverty rates and AIDS makes drawing macro-level conclusions about the impact of AIDS on economies difficult. Intercontinental poverty differences predate the AIDS pandemic, and the hardest-hit continent—Africa—is mired in too complex and deep a development trap to make disaggregating the effects of the pandemic feasible or persuasive.

There are many mechanisms through which AIDS may have a *potential* impact on the economy. Unlike most other deadly illnesses, HIV's prime target is people of working-age. The result is a potential reduction in disposable income, which may have an economic impact. New staff must be trained and recruited, a cost that would not otherwise have been borne. Firms may also suffer a loss of valuable know-how. Moreover, AIDS is debilitating, particularly in the final 2 years before death (Arndt

and Lewis, 2000), and absenteeism for both those infected and those caring for them may have an impact on businesses and other work organizations. Increases in health spending could mean cuts in investment in other growth-enhancing areas, education and infrastructure, for example. The impact on productivity may also decrease an economy's attractiveness to foreign investors and diminish tax revenue.

However, there are other influences that may counter these effects. Workers who die of AIDS may be replaced by people who were previously unemployed and a smaller labour force may even lead to a rise in output per capita. Although HIV/AIDS mortality can reduce overall output, it also reduces population, so per capita productivity may not be reduced (Arndt and Lewis, 2000). Even in the hardest-hit areas, therefore, it is possible that GDP *per capita* may not decline.

Macro evidence from the early phases of the pandemic failed to substantiate the hypothesis that AIDS would have a detrimental effect on growth rates of per capita income. From 1980 to 1992, AIDS had no statistically significant impact on per capita income growth (Bloom and Mahal, 1997). However, the pandemic has since grown rapidly and has begun to have a significant effect on life expectancy and other human development indicators. In South Africa, for example, life expectancy is expected to fall between 18 and 25 years below its pre-AIDS level (Arndt and Lewis, 2000; United Nations, 2001). Recent studies show some evidence of growing macroeconomic impact:

- In the Caribbean, one study (developed for Working Group 1 by Karl Theodore) has argued that, if infections increase according to current trends, the loss to GDP will reach 5.3% per year by 2005. There will be a decrease in savings and investment, and employment in the most productive sectors will decrease (Theodore, 2000).
- Another study claims that AIDS will cut the government budget in Botswana by 20% by 2010, although population levels may fall by a similar rate (UNAIDS, 2000).
- An early World Bank study, of 30 sub-Saharan African countries, concludes that the net effect of AIDS will be a reduction in GDP growth of between 0.8 and 1.4 percentage points per year in those countries (Over, 1992).

Conversely, however, a recent assessment of AIDS in Asia concluded that the region's low prevalence rates are likely to mean that the impact of the virus on Asian economies remains minimal (Bloom et al., 2001a).

Data are far from adequate, but calculations made for Thailand may be instructive for understanding the potential economic effect of AIDS in

sub-Saharan Africa. Thailand's ratio of working-age to total population is projected to be 0.70 in 2015 (UN, 2001). We estimate that cumulative AIDS deaths by that year will be about 1 million, a relatively small number because risky behaviours have declined as a result of Thailand's highly successful anti-HIV policies. Yet if we simulate cumulative AIDS deaths in the absence of these substantial behavioural improvements, they could be as high as 10 million. Add to this an estimate of the number of children that would not have been born because of these deaths, and the population could be about 11.6 million smaller than it would otherwise have been. AIDS mortality is disproportionately selective of adults, and we project that of the 10 million deaths, 92% or 9.2 million would be among adults. To this number, we add the 0.75 million children these adults would have had, and who would have had the chance to reach working age by 2015, and we find that this high-risk scenario causes the working-age population to be smaller by about 9.95 million. This combined effect on the total and working-age population would result in a decline in the working-age share of the population to 0.67. This difference could reduce the average growth rate of per capita GDP between 1990 and 2015 by about 0.65 percentage points, such that annual growth rates are projected to be 2.81% instead of 3.46%. As a result, the level of GDP per capita in 2015 would be US\$ 1272 lower than its projected US\$ 8 500. At Thailand's current prevalence rates, still among the highest outside Africa at an adult rate of 2.15%, the impact on GDP is minimal. Nevertheless, the example demonstrates that an unchecked AIDS epidemic—as some African countries are experiencing—can have a substantial effect on the growth of income per capita because it is so highly concentrated in working-age individuals (Bloom, Reddy, and River Path, 2001).

In reviewing all the available evidence, UNAIDS states that “despite incomplete data, there is growing evidence that as HIV prevalence rates rise, both total and growth in national income—GDP—fall significantly” (UNAIDS, 2000). It is important to emphasize, however, that the data *are* incomplete; many of the studies forecast rather than report impacts; and the methodology of some studies can be questioned. On balance, it appears likely that countries that keep prevalence rates low will see limited economic impacts. As prevalence rates rise, more dramatic effects are possible and, in some cases, these may be very serious indeed.

7.2.2 *The impact on business*

The effects of HIV/AIDS on a business are likely to be felt in two areas: a firm's labour force and its customer base. In addition, it has been

suggested that a company can help its reputation by dealing effectively with AIDS.

There have been a number of studies on the impact of HIV/AIDS on the workforce. In the early stages of the epidemic in Africa, the spread of the epidemic appeared to correlate with wealth, and firms therefore seemed to be losing their most skilled, productive, and expensive-to-replace workers. More recently, however, a study has suggested that overall infection rates will peak at nearly three times the rate for highly skilled workers (ING Barrings, 2000). Generally, turnover in Africa was minimally affected in the early stages of the epidemic (Biggs and Shah, 1997), but as the epidemic has matured, companies in hard-hit areas have begun to feel an impact (Bloom et al., 2001a, 2001b). Some multinational organizations in South Africa, for example, claim to have hired three workers for each position to replace those who die (*Economist*, 2001). Outside Africa, there is as yet no evidence that the epidemic is disproportionately targeting the skilled. Companies in certain sectors may suffer—trucking companies in India, for example (Harvard, 1995)—but large-scale decimation of workforces is unlikely.

There are other potential effects that are even more difficult to quantify. Studies in Kenya and Thailand, for example, have shown that some business leaders believe that motivation and productivity are adversely affected by AIDS-related illnesses and death, for example (Rugalema, 1999). In the future, it is also possible that the quality of available workers will deteriorate, as AIDS orphans (of whom there are currently 13 million) receive less education and are poorly socialized.

The impacts on the customer base will be felt most keenly in Africa, although countries that trade extensively with African countries, as well as multinationals with franchises in Africa, may feel a ripple effect. Studies in Côte d'Ivoire and Rwanda have shown how health expenditure significantly reduces the household consumption of families living with AIDS (UNAIDS, 2000). A study of the epidemic in Thailand claims that it may cost Japan as much as 1.2% of its gross national product (GNP) due to the weakening of this important market for Japanese exports (UNAIDS, 1998). The methodological basis of this and similar studies is questionable, however.

7.2.3 *The effect on households*

The effect of AIDS on affected households is substantial. AIDS is an expensive illness to treat, and caring costs are high. A series of micro-level studies shows the impact of AIDS on households:

- A large-scale World Bank survey of households in Côte d'Ivoire, Tanzania, and Thailand found that household expenditures on AIDS care were much higher than on other illnesses (World Bank, 1997).
- Household income in the poorest quarter of households in Botswana is projected to fall by 13% from current levels in the next 10 years as a result of the disease (UNAIDS, 2000).
- A study in Cambodia shows the poor are forced to sell limited family assets to pay for the cost of caring for a family member with AIDS. They are also likely to borrow, at high rates of interest (Bloom, River Path, and Sevilla, 2001a).

Again, however, the literature is patchy. Many of the micro studies are carried out in extremely hard-hit areas using nonrepresentative samples, and none gives a wholly reliable picture of the effect of the virus.

7.2.4 *AIDS and economics*

The lack of conclusive evidence on the economic impact of the AIDS pandemic reflects the lack of investment in research by governments and donors and a failing in the academic community. Further studies will therefore be needed to provide conclusive evidence of the size and nature of any effects.

7.2.5 *Conclusion*

The connection between AIDS and economics is complex, and drawing firm conclusions is complicated by the lack of concrete data in many areas. The poor appear to be most vulnerable to AIDS, but it is possible that this is not just because they are poor, but because of the interaction between poverty and other factors such as poor education, migration, and weak health systems. Poverty reduction may decrease risk from the epidemic, but it is also possible that ill-planned development efforts will temporarily increase the risk that poor people face.

The impact of AIDS on economies is also hard to measure. It seems clear that there were limited effects early in the pandemic. Although some studies now project increasing impact, they are speculative, even if there is a strong intuition that very badly affected countries will see a significant economic deterioration. It is possible that this effect will be felt only when the prevalence of HIV/AIDS surpasses a certain threshold, however.

Our understanding of the epidemic seems to be somewhat weak, given the time since the discovery of HIV, the global nature of the pandemic, and its ferocity. At a time of huge political interest in health as a tool of development, it is clear that further research is badly needed.

8. GENERAL CONCLUSION

Health is a major cornerstone of the development process. It is part of its outcome: all rich societies invest in health, which is one of the most fundamental goods that a prosperous society wants to buy. It is also a major input of the development process. Good health, we have argued in this Report, generates a number of positive outcomes that range from a demographic dividend to a more productive workforce, while also reducing the risk of poverty traps. As a general conclusion, we would wish to add a number of suggestions and cautions for economists and policy-makers.

For economists: Given the importance of the emphasis on forming human capital as the major pathway through which health contributes to economic growth and poverty reduction, it is important to highlight one critical difference between health and education. It has been relatively easy to appreciate the value of education in the formation of human capital and enhancement of the productive capacity of individuals, especially as that capacity has depended less and less on physical strength. This appreciation and its impact on policy have been facilitated by the use of a relatively simple measure of educational input. In spite of its limitations and the debates on the relative merits of one form of education over another, the years of schooling have provided a robust measure for the input of education into the formation of human capital (Psacharopoulos, 1996; Chiswick, 1997). The situation with health has been different, and that difference has contributed to the difficulty in measuring the value of the change in human productive capacity due to health. The units of change of quality are simply more difficult to obtain. A large number of health indicators have been used, and they serve only to underscore the difficulty in measuring the multiple dimensions of the healthy state that influence the human capital potential (Murray and Chen, 1992). Life expectancy, or some variant thereof, has been the metric most commonly used by economists, but life expectancy does not capture all the aspects of the individual's current health that may affect productive capacity. A year of life tells little about the state of that life or its quality, and the ideal approach of obtaining some physiological measure of the health stock in a population is logistically impossible. The use of adult height is a useful proxy, in that it captures the accumulated nutritional input into the individual over the formative years and it can reasonably be assumed that there is a good

association between this and health. This is an area that needs much more exploration.

For policy-makers: Richard Easterlin has convincingly argued that, although richer societies are in a better position to improve health, it is not inevitable that they will do so. The market does not prompt health shifts, and public health is an area of pervasive and ongoing market failures. Like economic growth, health improvements rely, to a large extent, on new technologies, exploited through new institutions, new investment, and new labour requirements. However, the nature of the new technology and associated requirements is quite different from those for economic growth. It is a matter of choice at a societal level, with strong policies and political commitment having a profound impact on the health of a nation, whatever the size of its budget (Easterlin, 1999). The situation is similar with a number of other quality-of-life indicators. Economic growth can lead to improvements in these indicators, but sometimes it does not, and sometimes it does so only after a lag (Easterly, 1999). Improvement of health has the potential for creating “virtuous spirals” that lead to a remarkable boost to development and reduction of poverty. There is nothing inevitable about these gains, however. They need to be inserted into an environment in which there are appropriate macroeconomic and labour-market policies as well as the machinery for good governance. In summary, health has a *potential* impact on wealth, and wealth has a *potential* impact on health. Improvements in either area raise the possibility of improvements in the other. We trust that this Report has emphasized sufficiently, on the basis of the data available, that the former should be taken as seriously as has been the latter over the years. In the final analysis, the possibility of influencing the potential effects will depend on the institution of the appropriate policies, both in the health as well in those traditional nonhealth sectors that we know can have a major influence on health outcomes.

NOTES

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2. Throughout this Report, the term *billion* indicates 1000 million.
3. The number of people living with HIV/AIDS today is 50% above 1991 World Health Organization predictions. See *UNAIDS: AIDS epidemic update: December 2000*.
4. The *dependency ratio* is the ratio of the dependent (under 15 and over 65) to the economically active population.
5. For both men and women, the log-odds of mortality is approximately linear in the logarithm of family income. As a consequence, when we use the results to plot the age-adjusted probability of death against income, we get nonlinear curves.

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ANNEX I LIST OF ACRONYMS

ADL	Activities of Daily Living
AIDS	Acquired Immune Deficiency Syndrome
BMI	Body mass index
COI	Cost of illness
EC	European Community
ECA	Epidemiological Catchment Area (ECA)
GDP	Gross domestic product
GHS	General Health Status
Hb	Haemoglobin
HDI	Human Development Index
HEI	Health insurance experiment
HICs	High-income countries
HIV	Human immunodeficiency virus
IDA	Iron deficient anemia
IFLS	Indonesian Family Life Survey
INCAP	Institute of Nutrition of Central America and Panama
IBN	Insecticide-impregnated bednet
LDCs	Least-developed countries
LMICs	Low- and middle-income countries
MDR-TB	Multi-drug resistant tuberculosis
MOH	Ministry of Health
OECD	Organisation for Economic Co-operation and Development
ORT	Oral rehydration therapy
SPS agreement	World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary measures, known as the SPS agreement
TB	Tuberculosis
TfR	Transferrin receptor
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNDP	United Nations Development Programme (UNDP) Human Poverty Index
VO ₂ max	Maximum aerobic capacity

ANNEX 2 BACKGROUND PAPERS PREPARED FOR WORKING GROUP I

- Paper 1:** HIV/AIDS in the Caribbean: Economic Issues-Impact and Investment Response (**Theodore K**)
- Paper 2:** Modeling the Effects of Health Status and the Educational Infrastructure on the Cognitive Development of Tanzanian School Children (**Bhargava A**)
- Paper 3:** Health, Inequality, and Economic Development (**Deaton A**)
- Paper 4:** Why Have Infant Mortality Rates Declined So Rapidly (and at Such Different Rates in Different Countries)? (**Jamison DT, Sandbu M, Wang J**)
- Paper 5:** Poverty and Health (**Wagstaff A**)
- Paper 6:** Mental Illness and the Labour Market in Developing Nations (**Frank RG**)
- Paper 7:** Health, Nutrition and Economic Prosperity: A Microeconomic Perspective (**Thomas D**)
- Paper 8:** Health, Human Capital, and Economic Growth (**Bloom DE, Canning D**)
- Paper 9:** Health, Longevity and Life-Cycle Savings (**Bloom DE, Canning D**)
- Paper 10:** The Economic Burden of Malaria (**Gallup JL, Sachs JD**)
- Paper 11:** The Effects of Early Nutritional Intervention on Human Capital Formation Institute of Nutrition of Central America and Panama (**INCAP**)
- Paper 12:** Responding to the Burden of Mental Illness (**Whiteford H, Teeson M, Scheurer R**)
- Paper 13:** The Effect of the AIDS Epidemic on Economic Welfare in Sub-Saharan Africa (**Jamison DT, Sachs JD, Wang J**)
- Paper 14:** Nutrition, Health, and Economic Development: Some Policy Priorities (**Bhargava A**)
- Paper 15:** AIDS and Economics (**Bloom DE, Mahal A, Sevilla J, River Path Associates**)

ANNEX 3 LIST OF FIGURES

Figure 2.1 The demographic transition

Figure 3.1a Wages, education, and height of males in Brazil and the United States

Figure 3.1b Wages, education, and height of males in Brazil and the United States

Figure 4.1 Under-five mortality: gaps between and within countries

Figure 7.1 HIV and income, Africa

Figure 7.2 HIV and income, world

Figure 7.3 HIV and Gini index, world

Figure 7.4 HIV and the US\$ 1/day absolute poverty rate, world

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