HUMAN DEVELOPMENT NETWORK
Health Nutrition and Population

The Burden of Disease among the Global Poor

Current Situation, Future Trends, and Implications for Strategy

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Foreword

The World Bank and the Global Forum for Health Research share a central concern for improving the health of the world's poor. At present, of the US$ 60 billion spent worldwide annually on health research by both the public and private sectors, only about 10 percent is devoted to 90 percent of the world's health problems (as measured by DALYs or similar indicators). The economic and social costs to society as a whole of such misallocation of resources are enormous, both directly and indirectly. The direct costs are particularly high for the poorer population, given the vicious circle between poverty and poor health.

This so-called 10/90 Gap is, at least in part, due to the fact that decisionmakers do not have enough information. One important type of information which is lacking concerns the pattern of diseases from which the poor suffer the most. Not until we have this information can we be certain that our efforts to deal with diseases are focused correctly on those ailments that are most important among those most in need. The objective of the present study is to contribute to shedding more light on this key topic so that decisions can be based on more and better information.

The past decade has seen a promising beginning in the collation of this critical information, with increasingly sophisticated estimates of the burden of disease in the world as a whole and in its major geographic regions. The material presented here takes the next step: to build on that beginning in order to provide estimates of the disease burden among the global poor, wherever they may live.

The importance of this step will become apparent from the findings put forward in these pages. These findings show that the pattern of diseases experienced by the poor differs significantly from the pattern shown by the global averages that have attracted the most attention of researchers and policymakers. It must be concluded from these findings that the development of interventions suited to the needs of the poor cannot rely on societal averages, but should instead draw upon information based on research and data specifically of the disadvantaged population groups those interventions would address.

The work presented here is intended only as a start in this direction. Much more research will be required to produce an understanding of the disease burden among the poor that is fully adequate for policy and program development purposes. We hope that readers of this paper will join with the Global Forum for Health Research and the World Bank in working toward this end.

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Abstract

This paper provides information about the burden of disease among the poor members of society. It is designed to complement the data about society as a whole that have been the principal focus of most burden of disease work to date. The information presented here deals with the 1990 situation and with projected trends between 1990 and 2020.

The 1990 Situation. Communicable diseases are considerably more important for the world's poor than global averages suggest. Noncommunicable diseases are correspondingly less important. For example:

- Communicable diseases cause 59 percent of deaths and 64 percent of DALY (disability-adjusted life year) loss among the 20 percent of the global population living in countries with the lowest per capita incomes, compared with 34 percent of deaths and 44 percent of DALY loss among the entire global population.

- Communicable diseases are responsible for 77 percent of the mortality gap and 79 percent of the DALY gap between the world's poorest and richest 20 percent, compared with 15 percent and 9 percent attributable to noncommunicable diseases.

The Projected 1990–2020 Trend. An accelerated overall decline in communicable diseases would benefit the world's poor more than a faster global reduction in noncommunicable disorders. A faster reduction in deaths from communicable diseases would also benefit the poor much more than it would the rich, and would thereby reduce global poor-rich differences in longevity. In contrast, the leading beneficiaries of a faster global reduction in deaths from noncommunicable disorders would be the rich. For instance:

- A doubling in the currently projected 1990–2020 rate of decline in mortality from communicable diseases, distributed evenly across all social classes, would produce a year 2020 life expectancy among the global poor that would be 4.1 years higher than under the baseline projection. A doubling of the rate of decline in mortality from noncommunicable diseases would produce a comparable figure of 1.4 years for the same group.

- The 4.1-year gain that the global poor would achieve from a doubled, evenly distributed rate of progress against communicable diseases would be more than 10 times greater than the 0.4-year increment that would be produced among the global rich. A doubled rate of decline in mortality from noncommunicable conditions, in contrast, would benefit the rich nearly four times as much as it would the poor.

- A doubling of the rate of progress against communicable diseases would reduce the currently projected year 2020 poor-rich life expectancy gap by 3.7 years. The same acceleration in progress against noncommunicable conditions would achieve the opposite effect, widening the gap by 3.9 years.

Implications. Such findings illustrate the importance of giving high priority to communicable diseases in strategies to improve the health of the poor and lessen poor-rich health differences.

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The authors accept sole responsibility for any flaws that may exist in the figures and arguments presented.

Overview

This paper deals with the burden of disease among the global poor, as distinct from the burden of disease in the global population as a whole, which has been the principal focus of most burden of disease work to date. The purpose of the paper is to provide estimates of disease levels and trends, in order to assist in identifying the diseases that are most important for the needy.

The paper consists of four parts:

Introduction.

Examination of the global situation in 1990. This section presents a series of estimates of the burden of disease among the global poor and, for comparative purposes, among the global rich.

Projection of global trends between 1990 and 2020. This section opens with a presentation of a baseline scenario for the poor and the rich, then examines the implications for the poor of altering that scenario by pursuing reductions in different types of disease.

Summary of the paper's findings and their implications for those concerned with the health dimension of poverty alleviation.

1 Introduction: The Importance of Burden of Disease Information Specific to the Poor

The recent estimates of the global disease burden that have attracted the attention of epidemiological researchers and policy makers represent a quantum leap in both the sophistication and the coverage of earlier work on disease patterns. The newer estimates also have a different focus: the population of the world as a whole, rich as well as poor, rather than the global poor alone.

This shift in focus has produced a lack of congruity between burden of disease estimates and the global health policy statements that they are intended to support. While the focus of epidemiological analysis is shifting toward the population of the world as a whole, most prominent global health policy statements continue to emphasize the importance of improving the health of the global poor.

This lack of congruity is of much more than simply academic interest, because, as will be seen, disease patterns vary systematically across social class. The pattern of diseases prevalent among the global poor differs from that of the population of the world as a whole, and global averages are therefore unreliable guides for programs directed at this specific sector of the population. Instead of relying on global averages, policy makers wishing to undertake programs oriented toward the needs of the global poor need information specific to the poor.

The Earlier Focus of Research and Policy on Disease Conditions among the Poor

The lack of congruity just described is relatively recent. From the 1970s until the late 1980s, a concern for the health of the world's poor dominated both the policy and research domains. International health policies were oriented primarily toward improving the health of the disadvantaged, and the focus of research into the causes of death and disability was congruent with this orientation.

The prevailing policy climate was typified by initiatives developed at the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF). For example, participants in a 1978 international conference organized by these two agencies in Alma-Ata, USSR (now Almaty, Kazakhstan) made clear their concern for poverty by beginning their report with a declaration that " . . . the health status of hundreds of millions in the world today is unacceptable, especially in developing countries."[1] To deal with this, the participants advocated "a new approach to health care, to close the gap between the 'haves' and 'have-nots.'"[2] Similarly, the first major UNICEF "State of the World's Children" report for 1981–82 started by advocating more and wiser spending on activities to help the poorest 500 million mothers and young children in the world.[3]

The principal epidemiological assessments of that era were also oriented toward poor countries and people. A noted 1979 work focused primarily on infectious diseases "because these infections tend to flourish at the poverty level."[4] The 1980 policy paper that announced the World Bank's decision to begin lending to health programs indicated a particular concern for fecally related diseases, airborne diseases, and malnutrition, because "these three major disease groups account for the majority of deaths among the poorest people in poor countries."[5] And a classic 1968 study of the synergy between malnutrition and infection was undertaken because the authors felt that this synergy "is responsible for much of the excess mortality among infants and preschool children in less developed regions."[6]

These and other studies identified a complex of gastrointestinal infections, ailments of the lower respiratory tract, and malnutrition as the principal causes of death and disability among the poor. Their conclusions triggered a concerted effort to find cost-effective means of dealing with these and related problems, such as immunization against major infectious diseases, oral rehydration therapy for diarrhea, and growth monitoring to counter malnutrition. These interventions became the principal components of the leading international health initiatives of the time, such as the WHO-led primary health care movement and the UNICEF child survival revolution. Along with the many similar movements of the time, they were developed as a response to empirical assessments of the principal disease problems of the target population—that is, assessments of the disease problems of the world's poor.

The Recent Shift of Research Attention to Global Disease Conditions

This emphasis on the problems of the world's poor has continued to figure prominently in leading public documents dealing with international health. For example, a concern about equity and poverty is central to the major reports of the 1990s. The 1990 report by the Commission of Health Research for Development states its concern clearly, in its title, "Health Research: Essential Link to Equity in Development."[7] The World Bank's 1993 World Development Report[8] makes numerous references to the health problems of the poor, and prominently includes a package of clinical services designed explicitly for the poor.[9] A third major report, the 1996 WHO Ad Hoc Committee Report,[10] resulted in the establishment of the Global Forum for Health Research, whose letterhead describes it as an "Initiative for Health Research and Development for the Poor."

However, the focus of the epidemiological evidence gathered in connection with these reports has been shifting away from the global poor toward the entire global population, which includes people of all income levels, high as well as low. The beginning of this trend can be seen in the 1990 Commission Report, which incorporated the first in the current generation of disease burden estimates. These estimates provided information about the causes of death in the world as a whole, and separately for industrialized and developing countries.[11] The 1993 *World Development Report* contained more refined versions of the 1990 disease data, covering disability as well as death.[12] While it included a careful discussion of regional variations, it also gave the data a global flavor by introducing and frequently employing the expression "global burden of disease." In the 1996 Ad Hoc Committee report, the data were still more refined, and included projections to 2020 as well as figures for 1990.[13] Again, regional as well as global data were presented in the report itself; but the expression "global burden" appeared even more prominently than in 1993, and the overall global conditions dominated the Committee's media outreach and the extensive press coverage that it received.[14]

Such movement toward an overall global outlook in the epidemiological data, implicitly including high- as well as low-income people, means that the data have begun to refer increasingly to a population group that differs from the global poor who merit such high priority in the report texts. The magnitude of this difference will obviously vary according to the definition of poverty used, but is potentially quite significant. For example, under the current World Bank definition of the international poverty line, 1.3 billion or around 24 percent of the world's population is classified as poor.[15] Acceptance of this definition would mean that the remaining 76 percent of the world's people—over three-quarters of the total—included in global burden of disease estimates lie outside the poverty group that is of concern.

Implications of the Resulting Lack of Congruity

The resulting lack of congruence between the focus of the reports and the epidemiological analysis underlying them would not matter if disease patterns were distributed equally across different socioeconomic groups, but they almost certainly are not. A long tradition of empirical analysis has shown a systematic relationship between a population group's overall longevity or mortality level and the pattern of diseases prevailing within it.[16]

Specifically, empirical research has indicated clearly that, in general, the lower the overall level of mortality in a society, the greater the importance of noncommunicable diseases relative to communicable ailments. Conversely, the higher the level of all-cause mortality, the more important are communicable disorders relative to noncommunicable illnesses.

Of the several implications that flow from this generalization, one has attracted particular attention. This implication follows from the generalization's temporal dimension—that is, from an appreciation of what happens to disease patterns within a society over time. Since mortality in almost all societies has been falling, the generalization provides strong support for what has become known as the "epidemiological transition,"[17] during which the importance of communicable illness recedes in importance relative to noncommunicable disease. This transition, frequently cited in the recent global epidemiological analyses and policy reports referred to earlier, is typically invoked to call attention to the rising importance of noncommunicable ailments in the world as a whole and in the great majority of countries.

Less frequently recognized, at least in print, is the fact that the generalization also has an important cross-sectional dimension. That is, just as the generalization can be employed to describe trends over time within a society as a whole, so too can it be applied to assess differences among groups within a society at a single point in time.

When used for this latter purpose, the generalization suggests that the higher the overall mortality level prevailing among any group, the greater the importance of communicable ailments. Conversely, the lower a group's overall mortality, the higher the proportion of that group's mortality that is attributable to noncommunicable illness.

Given the clear existence of a strong direct relationship between income level and health status,[18] the generalization can also be readily reformulated in economic terms to state that communicable diseases matter much more than noncommunicable conditions for poor groups within society. Conversely, the groups for whom noncommunicable disorders matter most tend to be rich.

To the extent that this is the case, any shift in attention from communicable diseases toward noncommunicable ailments would have important distributional implications. Although such a shift might well be justifiable on the basis of trends in a society as a whole, it would work to the detriment of the poor, for whom communicable diseases are relatively more important than they are for richer groups. The shift's principal beneficiaries would be the rich, who would therefore gain at the expense of the poor.

This is obviously a disconcerting possibility. But identification of a possibility on the basis of general considerations is not an adequate basis for policy formulation. Policy makers are much better served by empirical evidence as directly and immediately relevant as possible to the particular situations with which they are dealing. Thus the need for the assessment of disease conditions specific to the poor that follow.

2 The Burden of Disease among the Poor and Rich in 1990

Method of Assessment

Starting Point
The starting point for assessing the burden of disease among the poor is the well-known set of global estimates prepared by Christopher Murray and Alan Lopez.[19] These estimates provide information about the cause of death and disability for the world as a whole, for the developing world as a whole, for each of eight geographical regions, for each of seven age groups, and for each gender. The Murray-Lopez compilations do not, however, break down the data in the manner that would have greatest relevance for the poor—that is, by socioeconomic status.

The work presented here is designed to begin extending the work of Murray and Lopez in this direction, by applying their techniques and data to estimate the burden of disease among the world's poorest and richest population groups. The Murray-Lopez technique and data were not designed for such a disaggregation, however, and cannot support precise estimation of the burden of disease in any particular socioeconomic group; nor are the data necessary for this purpose available from any other known source. This clearly constrains the development of accurate estimates for the poor. It is nonetheless possible to produce crude estimates that at least provide a notably better basis for developing poverty- and equity-oriented health strategies than do the global averages that are in current widespread use.

The estimate produced is of the burden of disease prevalent among the 20 percent of the global population living in countries that have the world's lowest average per capita incomes. For comparative purposes, an estimate was also prepared for a group representing the 20 percent of the global population living in the richest countries. The estimates permit a comparison of the high and low quintiles, a measure commonly used by poverty analysts.[20]

Estimation Procedure
The procedure used to develop the estimates for these two groups is described fully in Annex A1. It consists of six steps:

Step One: Identification of the poor and rich population groups of interest. This was done through a country-based approach. Countries were listed in ascending order on the basis of their average per capita incomes, adjusted for purchasing power, and a line was drawn at that point on the list above which the cumulative population of the countries listed equaled 20 percent of the world's population. The rich population group of interest was identified through an analogous procedure, starting at the bottom of the list and working upward.[21,22]

For convenience, the population groups thus identified are henceforth referred to as the global poor and the global rich. Because not everybody in a poor country is poor and rich countries contain some people who are poor, the global poorest and richest 20 percent as defined in the manner just described differ to at least some degree from groups consisting of the poorest and richest 20 percent of the world's individuals. Given the limitations of the available data, however, any attempt to develop an approximation of the poorest and richest 20 percent of the world's individuals would have required so many additional assumptions that the results would have had dubious validity.

Also, as will be seen later, statistical considerations make it almost certain that findings of a study based on the poorest and richest 20 percent of individuals would simply reinforce the findings made with the definition used here. This being the case, the extra benefit of working with population groups defined in terms of the poorest and richest individuals, rather than in terms of inhabitants of the poorest and richest countries, was deemed not worth the additional cost of producing the necessary figures.

Step Two: Estimation of the total number of deaths from all causes, for each population group of interest. This was done by obtaining, for each country above and below the lines described in the preceding paragraph, information from standard United Nations and World Bank data sources about (a) the number of people in each age/gender group, and (b) the overall, all-causes death rates applicable to those age/gender groups.[23] Multiplying the number of people in each group by the death rate applicable to that group yielded a figure for the number of deaths in the group. These group-specific numbers were then aggregated to produce total numbers of deaths for the poorest and richest 20 percent of the global population.

Step Three: Disaggregation of the total number of deaths from all causes by each of the three principal disease groups employed by Murray and Lopez:

Group I (communicable, maternal, perinatal, and nutritional)
Group II (noncommunicable)
Group III (accidents and injuries)[24]

This was achieved using the same technique applied by Murray and Lopez for this purpose, whereby initial estimates were established by using the observed relationship between total and disease-specific mortality in those countries with reliable data; these estimates were then refined through careful examination of the results and adjustment of the data as necessary.

Step Four: Conversion of the data for deaths into combined figures for death and disability, expressed in terms of the disability-adjusted life year (DALY) index developed by Murray and Lopez.[25] This was done through proration: The number of deaths in each age/gender group for the countries identified in step one and located in a given region was multiplied by the ratio of deaths to DALYs in that region as calculated in the previously cited Murray-Lopez volume, and the results aggregated.

Steps Five and Six: Disaggregation of the death information (step five) and the DALY information (step six) for the three principal disease groups to provide illustrative estimates for 25 specific diseases and conditions, 22 that are the leading causes of global death and disability and three that are of special interest to particular audiences. The procedure used was analogous to that of step four: The number of deaths or DALY loss attributable to a specific disease in each poor or rich age/gender-specific group for a given region was multiplied by the ratio of deaths caused by the specific disease to total deaths caused by the larger group (I, II, or III, as described in step three) to which the disease in question belongs. The resulting group-specific figures were then aggregated.

Taken together, the 22 leading causes covered in step five are responsible for around 90 percent of deaths and disability among the global rich and poor, as well as among the population of the world as a whole. As greater specificity reduces the reliability of estimates, no attempt was made to prepare comparable figures for the additional 75 to 80 disease conditions identified by Murray and Lopez as being responsible for the remaining 10 percent of deaths and disability.

Types of Assessment

The resulting estimates were organized in a manner designed to permit two types of assessment:

The health of the poor alone. This involves intrapopulation group disease comparisons: in this case, assessment of the relative importance of different diseases among the people within the global poor group. This assessment is of greatest relevance for improving the health of the people within a specific population group, independently of any other population group. It is thus the approach most relevant to a poverty alleviation strategy—that is, a strategy concerned with improving the health status of the poor alone, without regard to the impact that such an improvement might have on the differences between poor and rich.[26]

Differences between the health of the poor and the health of others. This involves interpopulation group comparisons; that is, comparisons of the importance of a given disease between one population group and another—between the global poor and the global rich, for example, or between the global poor and the rest of the world. This is the approach employed in what is sometimes called an equity enhancement strategy, or more precisely, an inequality reduction strategy,[27] which focuses primarily upon the reduction of differences between groups rather than on the conditions prevailing in any one group.[28,29]

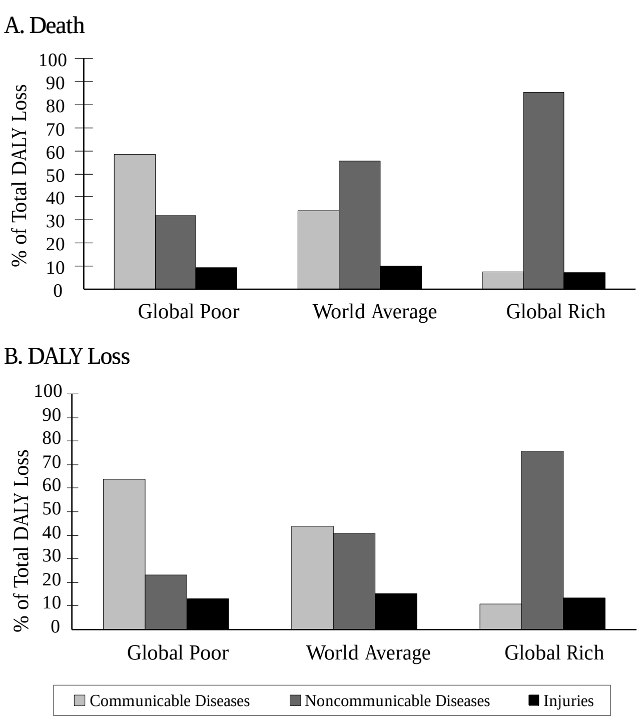
Findings

Health of the Poor Alone

Overview. Figure 1 provides a summary of the burden of disease among the global poor, the global rich, and the entire global population. Part A presents figures for the numbers of deaths; Part B provides comparable information for DALY loss.

The most notable features of Figure 1 are the inverse relationship between economic status and communicable diseases, and the opposite relationship between economic status and noncommunicable conditions. The lower one's economic status, in other words, the greater the significance of communicable diseases but lesser the significance of noncommunicable conditions. Specifically:

Figure 1 Causes of Death and Disability, 1990



- Communicable diseases are concentrated among and are thus most important for the global poor. Among this group, communicable illnesses are responsible for a clear majority of deaths (58.6 percent) and DALY loss (63.6 percent). This is a notably higher percentage than for the population of the world as a whole, in which communicable diseases cause 34.2 percent of all deaths and 43.9 percent of DALY loss, and higher still than for the global rich, among whom communicable diseases result in 7.7 percent of all deaths and 10.9 percent of DALY loss.

- Noncommunicable conditions are distinctly less important for the global poor than are communicable conditions. They are also much less important for the global poor than for the global rich. Among the poor, noncommunicable conditions cause 32.0 percent of deaths and 23.3 percent of DALY loss, compared with the 58.6 percent and 63.6 percent attributable to communicable conditions. In the world as a whole, noncommunicable diseases are considerably more important, being responsible for more than half of all deaths (55.7 percent) and almost half of DALY loss (41.0 percent). Among the global rich, noncommunicable ailments are more important still, causing more than three-quarters of deaths (85.2 percent) and DALY loss (75.8 percent).

- Injuries are less important for the global poor than either communicable or noncommunicable diseases. They are also more evenly distributed across social class. Among the poor, injuries cause 9.4 percent of all deaths and 13.1 percent of DALY loss—slightly less than in the world as a whole, where injuries are responsible for 10.1 percent of deaths and 15.1 percent of DALY loss. Among the global rich, 7.1 percent of deaths and 13.3 percent of DALY loss are attributable to injuries.

Specific Diseases. Table 1 provides figures for the five leading causes of poor health: Section A deals with deaths, and Section B with DALYs. Annex B1 provides a fuller list, covering all 25 of the specific diseases for which estimates have been prepared. These figures are far from precise and should be interpreted with caution, but the general orders of magnitude presented are nonetheless of interest.

In light of what was said in the preceding section, Table 1 contains few surprises. The figures in it show that:

- Among the global poor, the leading causes of death are communicable diseases. Respiratory infections and diarrheal diseases each cause more than 10 percent of total deaths, and perinatal conditions and the childhood cluster of diseases[30] are each responsible for almost 8 percent of deaths. A noncommunicable disease, ischaemic heart disease, is in fifth place, and is responsible for 7.3 percent of deaths.

Respiratory infections and diarrhea remain the leading problems when ill health is assessed in terms of DALY loss instead of death. Ischaemic heart disease drops out of the top five causes and is replaced by unintentional injuries, which occupies third place.

- Among the global rich, all of the top five causes of death and of DALY loss are noncommunicable diseases, with ischaemic heart disease and malignant neoplasms at or near the top. The principal difference when using DALY loss rather than deaths as the metric of health status occurs with respect to neuropsychiatric conditions, which are responsible for only about around 1 percent of deaths but constitute the leading cause of DALY loss, accountable for nearly one-fourth of the total.

Gender Differences. Figure 2 provides estimates of the relative importance of the three principal groups of diseases for men and for women. As in the previous fig-

Table 1A. Leading Causes of Death in Different Population Groups, 1990

Global poor		*Global rich*		*Entire global population*	
Cause	*Percent of total deaths*	*Cause*	*Percent of total deaths*	*Cause*	*Percent of total deaths*
Respiratory Infections (Group I)	13.4	Ischaemic Heart Disease (Group II)	23.4	Ischaemic Heart Disease (Group II)	12.4
Diarrheal Diseases (Group I)	11.3	Malignant Neoplasms (Group II)	22.6	Malignant Neoplasms (Group II)	11.9
Perinatal Conditions (Group I)	7.9	Cerebrovascular Diseases (Group II)	12.0	Cerebrovascular Diseases (Group II)	8.7
Childhood Cluster Diseases (Group I)	7.8	Other Cardiovascular Diseases (Group II)	10.2	Respiratory Infections (Group I)	8.7
Ischaemic Heart Disease (Group II)	7.3	Respiratory Diseases (Group II)	4.8	Other Cardiovascular Diseases (Group II)	7.3

Table 1B. Leading Causes of DALY Loss in Different Population Groups, 1990

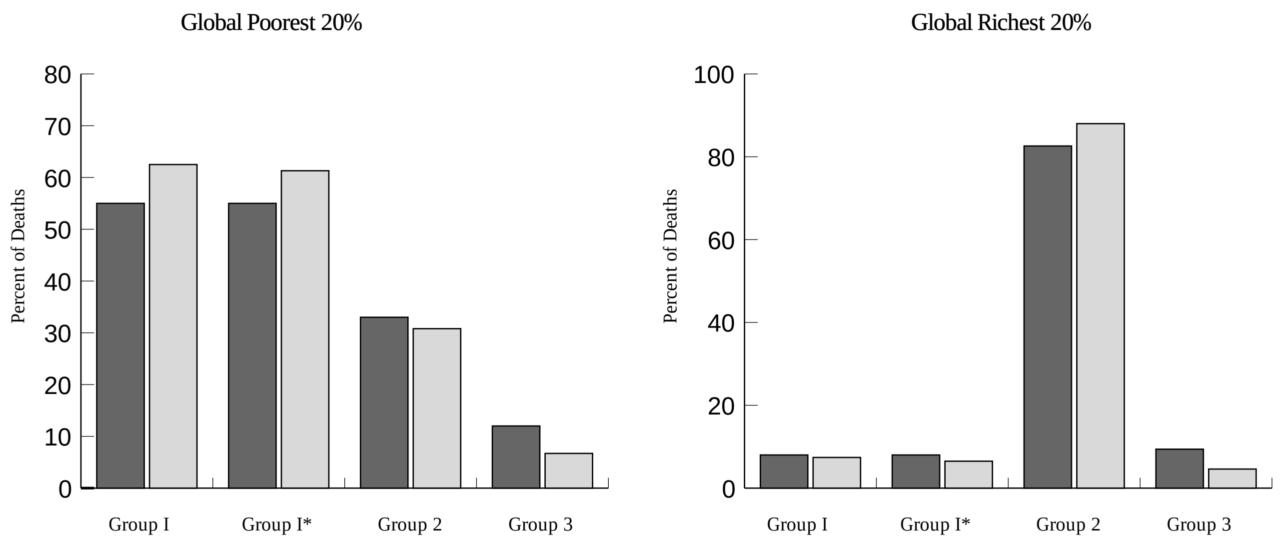
Global poor		*Global rich*		*Entire global population*	
Cause	*Percent of total deaths*	*Cause*	*Percent of total deaths*	*Cause*	*Percent of total deaths*
Respiratory Infections (Group I)	11.8	Neuropsychiatric Conditions (Group II)	22.1	Unintentional Injuries (Group III)	11.0
Diarrheal Diseases (Group I)	11.0	Malignant Neoplasms (Group II)	13.2	Neuropsychiatric Conditions (Group II)	10.5
Unintentional Injuries (Group III)	10.0	Unintentional Injuries (Group III)	9.5	Respiratory Infections (Group I)	8.5
Perinatal Conditions (Group I)	8.8	Ischaemic Heart Disease (Group II)	8.8	Diarrheal Disease (Group I)	7.2
Childhood Cluster Diseases (Group I)	8.1	Cerebrovascular Disease (Group II)	5.2	Perinatal Conditions (Group I)	6.7

ures and tables, Section A deals with deaths, Section B with DALY loss.

Two patterns emerge:

First, ailments in the communicable diseases group are relatively more important for poor women than for poor men. Part of the reason is that, as noted earlier, the communicable diseases group includes maternal health, which obviously affects women only. But there is more to the story than this, since communicable diseases account for a higher proportion of death and disability among poor women than among poor men even after maternal conditions are removed from consideration.

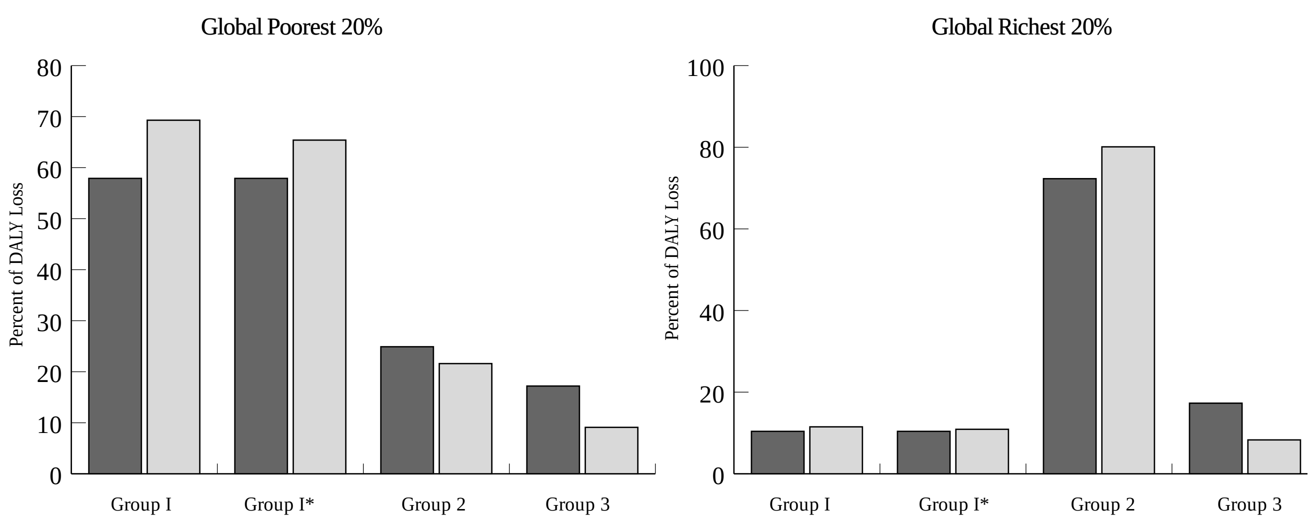
Figure 2A Causes of Death by Gender, 1990



Group I: Communicable, Maternal, Perinatal Nutritional Conditions
Group I* (Less Maternal Conditions): Communicable, Perinatal, Nutritional Conditions
Group II: Noncommunicable Diseases
Group III: Injuries

Male
Female

Figure 2B Causes of DALY Loss by Gender, 1990



Group I: Communicable, Maternal, Perinatal Nutritional Conditions
Group I* (Less Maternal Conditions): Communicable, Perinatal, Nutritional Conditions
Group II: Noncommunicable Diseases
Group III: Injuries

Male
Female

Among the rich, these differences disappear. If anything, communicable diseases appear to cause a somewhat lower percentage of female than of male deaths and disability, while noncommunicable conditions become more important for women than for men.

Specifically, when maternal conditions are included, diseases in the communicable conditions group are responsible for about 7.5 percentage points more of total deaths and 11.4 percentage points more of DALY loss among poor women than among poor men. When maternal conditions are excluded, those figures fall to 6.3 percentage points more for deaths and 7.5 percentage points for DALY loss. Among the rich, communicable diseases cause less death and disability among women than among men, by 0.6 percentage points for deaths and 0.9 percentage points for DALY loss. Noncommunicable diseases, in contrast, are responsible for more deaths and disability among women than men, by 5.4 percentage points for deaths and 7.8 percentage points for DALY loss.

Second, injuries are much less important for women than for men among both the global poor and the global rich. In each group, the percentage of deaths and of DALY loss among women attributable to injuries is only of the order of one-half of the figure for men. Specifically, 6.7 percent of deaths and 9.1 percent of DALY loss among poor women are attributable to injuries, compared to 12.0 percent of deaths and 17.2 percent of DALY loss among poor men. For the global rich, the figures are 4.6 percent of deaths and 8.3 percent of DALY loss among women, compared to 9.4 percent of deaths and 17.3 percent of DALY loss among men.

Differences between the Health of the Poor and the Health of Others

Introduction. The differences between the health of the poor and the health of others in society have been presented in two different ways:

- Poor-Rich Gap: The health of the global poor compared with that of the global rich. This comparison is expressed in terms of excess death and disability, where excess is defined as the difference between the number of deaths (or amount of DALY loss) experienced by the poor and the number of deaths (or amount of DALY loss) that they would have experienced had they suffered from the same rate of death (or DALY loss) as the rich in each age and gender group. The number of excess deaths (or amount of excess DALY loss) can be seen a measure of the gap in health status between poor and rich.

- Concentration among the Poor: The health of the global poor compared with that of the entire global population. This comparison is expressed as the percentage of total global deaths (or DALY loss) that is experienced by the global poor, and indicates the extent to which the effects of a given disease are concentrated among the poor. If a given disease were evenly distributed across all population groups, the world's poorest 20 percent would suffer 20 percent of the death and disability caused by that disease. Should the poor suffer more than 20 percent of all the worldwide deaths and disability caused by the disease, the disease can be said to be disproportionately concentrated in that poor population group.

The Poor-Rich Gap. Table 2 records the amount of excess death and disability suffered by the world's poorest 20 percent, illustrating the poor-rich gap.

Section A of Table 2 deals with deaths; section B covers DALY loss. Each section presents the findings in two different ways:

Column 5 indicates the excess deaths/DALY loss suffered by the global poor that is attributable to a given group of diseases, expressed as a percentage of the total loss caused among the poor by that group of diseases. This percentage represents the extent to which mortality or morbidity from the disease could be reduced by lowering the age/gender-specific rates suffered by the poor to those suffered by the rich.

Column 6 indicates the percentage of total excess deaths/DALY loss suffered by the global poor that is attributable to each disease group—i.e., the percentage of the total poor-rich gap that is attributable to that disease. Data from this column are summarized graphically in Figure 3.

The numbers given in Table 2 and Figure 3 show that:

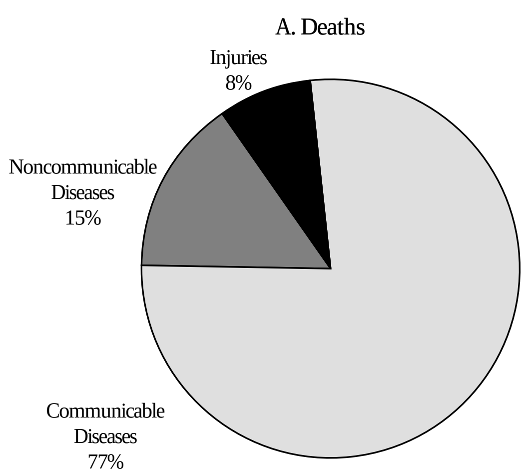
Table 2A. Mortality Gap between the Global Poor and the Global Rich, 1990

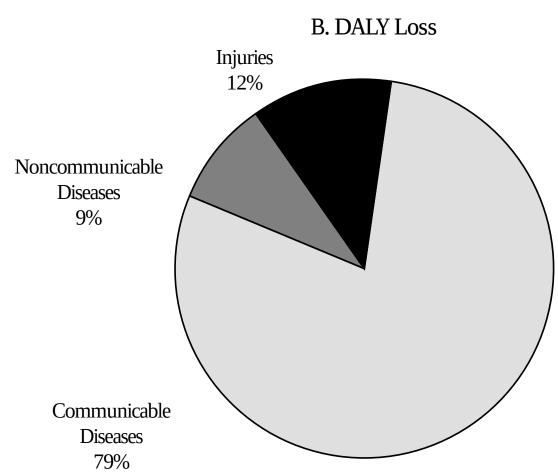
(1) Cause	*(2)* Actual number of deaths (000)	*(3)* Number of deaths at death rates of global rich (000)	*(4)* Number of excess deaths (col. 2–col. 3, 000)	*(5)* Percentage reduction needed to eliminate excess deaths (col. 4/col. 2 x 100)	*(6)* Percentage of total poor-rich gap
Communicable diseases	8,159	642	7,517	92.1 %	77.0 %
Noncommunicable diseaeses	4,449	3,011	1,438	32.3 %	14.7 %
Injuries	1,315	510	805	61.2 %	8.3 %
Total	13,923	4,163	9,760	70.1 %	100.0 %

Table 2B. DALY Gap between the Global Poor and the Global Rich, 1990

(1) Cause	*(2)* Actual number of DALYs lost (000)	*(3)* Number of DALYs lost at rates of global rich (000)	*(4)* Number of excess DALYs lost (col. 2–col. 3, 000)	*(5)* Proportion of DALYs lost that is excessive (col. 4/col. 2 x 100)	*(6)* Percentage of total poor-rich gap
Communicable diseases	301.719	23,920	277,799	92.1 %	78.9 %
Noncommunicable diseaeses	110,486	31,750	78,736	28.7 %	9.0 %
Injuries	62,301	42,635	19,666	68.4 %	12.1 %
Total	474,506	122,322	352,184	74.2 %	100.0 %

Figure 3 Causes of Poor-Rich Health Status Gap, 1990



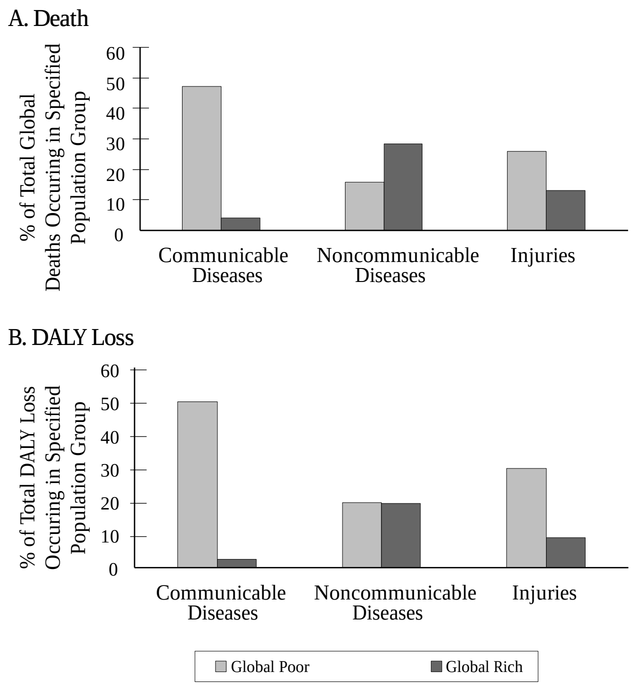


The great majority of deaths and disability caused by communicable disease—92.1 percent of deaths and 92.1 percent of DALY loss—among the poor is excessive, or directly attributable to differences between rich and poor.

Noncommunicable diseases also cause excess death and disability among the poor, reflecting the fact that age/gender-specific death/disability rates from noncommunicable as well as from communicable diseases are higher for the poor than for the rich. Compared to communicable diseases, however, the proportion of total loss from noncommunicable diseases among the poor that is excessive is relatively small, at 32.3 percent of deaths and 28.7 percent of DALY loss.

Excess death and disability from communicable diseases among the poor is responsible for nearly four-fifths of the total poor-rich gap in health status (77.0 percent with respect to deaths and 78.9 percent with respect to DALYs). Noncommunicable diseases account for less than one-fifth of the gap (14.7 percent with respect to deaths, 9.0 percent with respect to DALY loss).

Figure 4 Concentration of Deaths and Disability, 1990



Concentration among the Poor. Figure 4 shows the percentage of global death and disability attributable to each of the three disease groups that is suffered by the world's poorest 20 percent. Section A indicates deaths and Section B DALY loss. Comparable figures for the world's richest 20 percent are also provided.

The principal findings of this assessment are that:

Communicable diseases are heavily concentrated among the poor. Almost half of all worldwide death and disability caused by communicable disease occurs among the global poor (47.3 percent of deaths and 49.8 percent of DALY loss). In contrast, the rich bear only 4.2 percent of the global burden of death caused by communicable disease, and 2.6 percent of the DALY loss.

Injuries also affect the poor disproportionately, although to a lesser degree. The world's poor suffer 25.9 percent of the deaths and 29.8 percent of the DALY loss attributable to injuries worldwide. The richest 20 percent bears 13.1 percent of the global burden of death to injuries, and 9.1 percent of the burden of DALY loss.

The burden of noncommunicable diseases, by contrast, is somewhat more concentrated among the rich than among the poor. The global richest 20 percent experiences 28.5 percent of all deaths and 19.2 percent of total global DALY loss from noncommunicable disease. The poor suffer notably fewer deaths (15.8 percent of the global total), but slightly more DALY loss (19.6 percent).

Interpretation

These findings suggest that global averages significantly understate the importance of communicable diseases and overstate the role of noncommunicable diseases among the world's poor. It is important to recognize, however, that while the estimates presented here represent closer approximations of the burden of disease on the poor than do the global averages in current use, they are far from precise. In addition to the uncertainties inherent in the Murray-Lopez data on which the estimates are based, there are two technical considerations that deserve careful attention:

Country Basis of Estimates

As noted earlier, the estimates for the global poorest and richest 20 percent are constructed from the 20 percent of the world's people who live in those countries with the world's lowest and highest average per capita incomes, as distinct from the poorest and richest 20 percent of individuals in the world. This means both that some rich people are included in the estimates of the global poor and that some poor people are counted among the global rich.

The population groups identified through a country-based procedure are therefore less purely poor or rich than would be the case were it feasible to identify the groups individual by individual. This raises the question of how much difference there might be between a country-based and an individual-based group, and of how that difference would affect the results that have been reported.

Assessment of the likely magnitude of the difference lies far beyond the scope of this paper. However, the direction of the difference can be confidently assessed: Individual-based estimates of the global poor and rich would almost certainly reveal larger poor-rich differences in disease patterns than the country-based approximations presented here.

One way of demonstrating this is by noting that a shift from a country to an individual basis for defining the global poor would involve transferring out of the group people who are relatively rich but living in poor countries. Their places would be taken by individuals who are poorer than they, but who reside in places where average incomes are higher. The result of this process would be to reduce the average income of people in the group of global poor.

As shown in the technical literature cited earlier (en. 16) and in the country-based estimates presented earlier, there is a systematic relationship between income and disease patterns. The poorer a population group is, the more important are communicable diseases and the less significant are noncommunicable conditions as a proportion of the total disease burden. A reduction in the average income of the group of global poor would therefore be likely to raise the significance of communicable ailments and lower the importance of noncommunicable conditions in that group.

In other words, communicable diseases could be expected to figure even more prominently in individual-based definitions of the global poor than they do when that population group is defined in terms of countries, as in the example provided here. The role of noncommunicable conditions would be comparably reduced. The reverse would be true for the global rich: that is, noncommunicable conditions would be even more important and communicable ailments less important when that group is determined with reference to individuals.

Comprehensiveness of Approach

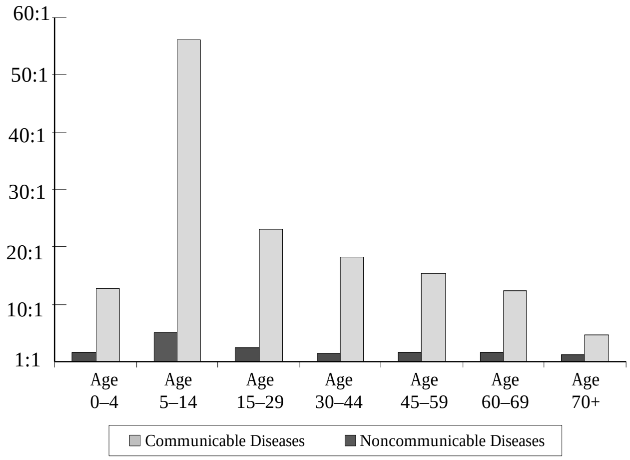
The findings reported here, showing that noncommunicable diseases are less important for the poor than for the rich, differ from those of earlier studies based on similar data. The reason for the difference lies in the comprehensiveness of the approach taken.

The earlier findings were based primarily on poor-rich comparisons of age-specific death rates from noncommunicable diseases among adults, which showed the existence of higher rates among the poor than among the rich. The approach used here goes beyond such comparisons by incorporating two additional considerations. One is a focus not on the simple existence of a higher death rate among the poor for a single type of disease, but rather on a comparison of the size of the poor-rich differences associated with different types of disease. The objective is to identify those diseases where the poor-rich differences are greatest—from which the poor suffer the greatest comparative disadvantage. The second additional consideration is the difference in the age structure of the poor and rich population groups.

The Principle of Comparative Disadvantage. When the Murray-Lopez data used here are examined with respect only to age-specific death rates of noncommunicable diseases, they, like data from other sources, show that noncommunicable diseases are more important for the poor than for the rich. This is true at all ages, as can be seen from Figure 5. At ages 0–4, the death rate from noncommunicable diseases among the world's poor is 1.7 times as high as among the global rich; this ratio peaks at 5.0 for the age group 5–14, then declines more or less steadily toward a value of 1.2 for people over 70 years of age.

While such figures are important, they tell only part of the story. There is also need to compare the magnitude of the poor-rich differences that they reveal with the size of the poor-rich differences in suffering from other types of disease.

Figure 5 Poor-Rich Differences in Death Rates from Communicable and Noncommunicable Diseases, 1990



Application of this comparative approach to the Murray-Lopez data presented in Figure 5 indicate that the global poor suffer a higher death rate than the global rich not only from noncommunicable diseases, but also from communicable diseases. In every case, the poor-rich gaps are larger for these other causes of death than for noncommunicable diseases.

In general, the poor-rich differences in the rate of death from communicable diseases are from four to 12 times as great as they are for noncommunicable diseases. For example, in the 5–14 age category, as cited above, the death rate from noncommunicable diseases among the global poor is 5.0 times as high as it is among the global rich. In that same age category, the death rate from communicable diseases is 56.2 times as high for the poor as for the rich. This being the case, it makes most sense from a poverty and burden of disease perspective to focus health strategies on communicable diseases, since it is the disease group for which the poor-rich gap is greatest.

As such figures illustrate, the establishment of "pro-poor" health policies requires the application of what might be called the "principle of comparative disadvantage."[31] In a setting where, on an age/gender-specific basis, every disease represents more of a problem for the poor than for the rich, the mere fact that a specific disease displays this characteristic is insufficient grounds for singling it out for attention. What matters from a poverty perspective is the magnitude of the disadvantage associated with that disease relative to the magnitude of the disadvantage associated with other diseases.

The Magnifying Influence of Age Structure. The difference in the composition of the global poor and global rich by age is also important, because of the tendency of communicable diseases to congregate in the younger age categories. For example, nearly 70 percent of all deaths from communicable diseases in the world occur to people younger than 14 years of age; less than 10 percent of deaths from noncommunicable diseases are suffered by the same age group. The corresponding DALY figures are more than 75 percent for communicable diseases and less than 20 percent for noncommunicable diseases. Death and disability from communicable diseases can therefore be expected to play a much more important role in a younger than in an older population, even when cause/age-specific death rates in both populations are the same.

This factor is significant here because the global poor are on average far younger than the global rich, primarily because of the higher fertility that poor groups experience. For instance, 41.2 percent of the poor population is under 15 years of age, compared with only 20.9 percent of the rich population. For some analytical purposes, it is useful to even out such differences by standardizing for age—but not for public policy. Standardization in the public policy context would lead to a policy suitable for a population in which the age structures of poor and rich groups are similar, when in fact the age structure of the groups is very different. The importance of grounding public policy in reality means these differences in age structure must be taken fully into account.[32]

Summary

The two technical considerations discussed here are clearly important for an understanding of the results, but they also reinforce the basic conclusions drawn from those results. The first consideration, concerning the estimation bias, suggests that the conclusions if anything understate the degree to which reliance on global averages misrepresents the problems of the poor. The second consideration, of the comprehensiveness of the approach used, increases in the conclusions' validity made by explaining how they can be reconciled with the seemingly contradictory findings reported in other studies.

3 Changes in the Burden of Disease among the Poor and Rich between 1990 and 2020

As instructive as the discussion of the 1990 situation may be, it provides only part of the story. Of at least equal interest are the projected changes in the global burden of disease situation between 1990 and 2020. According to the Murray-Lopez baseline scenario, during that 30-year period:

- Deaths from communicable diseases will fall from 34 percent to 15 percent of the global total, and DALY loss will decline from 44 percent to 20 percent.

- Death and disability from noncommunicable diseases will rise; in relative terms, deaths increasing from 56 percent to 73 percent of the worldwide total and DALY loss from 41 percent to 60 percent.

Should this scenario prove accurate, by 2020 there would be nearly five deaths from noncommunicable diseases for every death from communicable diseases. DALY loss from noncommunicable diseases would be nearly three times as great as that attributable to communicable ailments.

These figures, of course, refer to the world as a whole. What would they mean for the global poor? And to what extent would the global poor share in the benefits from changes in the baseline scenario with respect to different types of disease?

These are the questions that the current section will address. It will do so through a series of projections of life expectancy gain between 1990 and 2020 under varying assumptions about progress against different disease groups.

Method of Assessment

Principal Features

As with the 1990 estimates presented in Chapter 2, the principal source of data for the 1990–2020 projections is the Murray-Lopez analysis of the global disease burden. However, the approach to data assessment differs from that of Murray and Lopez in two ways:

- As in Chapter 2, the emphasis is not on global or regional trends, but rather on trends affecting the poor and rich—defined, as before, as the global poorest and richest 20 percent.

- The focus of the assessment is on the potential consequences for the poor of efforts to influence those trends, rather than on the trends themselves. The trends, rather than being portrayed as unalterable, are seen as potentially amenable to change through policy intervention. Of special interest is the potential impact of two alternative courses of action:

  (a) a commitment to producing the fastest possible decline in death and disability from communicable diseases, and
  (b) a shift in attention from communicable to noncommunicable diseases.

The projection method features a two-stage approach. The first stage is the construction of a baseline scenario for the global poor and rich in the year 2020. The second stage is a set of simple simulations, consisting of modifications to the baseline scenario that are designed to illustrate how the benefits of accelerated progress with respect to a particular disease group might affect the poor, the rich, and the gap between them.

Estimation Procedure

The procedure used in constructing the baseline scenario is described more fully in Annex A2. It resembles closely the method employed to construct the 1990 estimates for the global poor and rich, and consists of three steps:

- Step One: Identification of the poorest and richest global 20 percent in the year 2020. This was done by projecting the income and the population of each country in 2020 by applying the annual rates of 1990–2020 population and per capita income growth used by Murray and Lopez in constructing their baseline scenario. Countries (or, in the cases of China and India, provinces and states) were listed in ascending order of year 2020 per capita income, and a line was drawn at that point below the top of the list at which the cumulative population represented 20 percent of the global total, in order to define the poorest 20 percent. An analogous procedure, working from the bottom of the list, was applied to identify the richest 20 percent. As explained earlier, the resulting population groups approximate but do not equal the poorest and richest 20 percent of individuals in the world.

- Step Two: Calculation of the total number of deaths for the poorest and richest global 20 percent. This was achieved using data from standard United Nations and World Bank sources about projected year 2020 age/gender-specific death rates and age/gender population distributions. Multiplying the number of people in each age/gender group by the death rate for that group yielded a set of figures representing the number of deaths in each group from all causes; and these figures were added together.

- Step Three: Disaggregation of the total number of deaths according to the three principal groups as defined by Murray and Lopez. The technique applied by Murray and Lopez for their 1990 disease-specific estimates was again used, as described previously. The number of DALYs for each of the principal groups was estimated through proration.[33]

The technique applied in the second stage—the creation of simulated scenarios—is also presented more fully in Annex A2.[34] This technique consisted of several steps:

- Step One: Selection of two alternative scenarios for presentation:

  Scenario I was designed to illustrate the potential impact of renewed attention to communicable diseases. The baseline rate of decline in deaths from noncommunicable diseases and injuries was held constant, while the pace of decline in deaths from communicable diseases was accelerated.

  Scenario II was intended to demonstrate the result of shifting attention to noncommunicable diseases. The baseline rates of decline in deaths from communicable disease and injury reduction were retained, and the projected baseline rate of decline of deaths from noncommunicable diseases was increased.

  Variants of each scenario were developed, involving rates of decline ranging from 1.1 to 2.5 times that of the baseline rate in each population group. The rate used obviously affected the size of the differences between the baseline and alternative scenarios, but it had only a marginal impact on the relative poor-rich differences that are of principal interest. For ease of comprehension, findings from only one of these variants are therefore presented below: those from the variant involving a doubling in the baseline rate of decline, for the disease concerned, in every age/gender category within the global poor and rich.

- Step Two: Determination of the annual rate of decline in age/gender-specific mortality rates implied by the Murray-Lopez 1990–2020 baseline scenario. This was done for the global poor and rich, and for each major disease group. The sets of age/gender/cause-specific mortality rates for 1990 that were developed during the work for Chapter 2 were used, along with the rates for 2020 that were calculated while preparing the baseline scenario just described.

- Step Three: Derivation of the alternative year 2020 mortality rates from communicable diseases and from noncommunicable diseases. This was achieved simply by doubling the annual average pace of decline estimated in step two.

- Step Four: Aggregation of the baseline and alternative 2020 sets of age/gender-specific mortality rates from the different disease groups. This was done in a manner that produced three sets of all-cause age/gender-specific death rates:

  (a) rates for the baseline scenario, being the sum of the baseline 2020 rates for each of the three disease groups;
  (b) rates for scenario I, being the total of the baseline rates for noncommunicable diseases and injuries and the alternative rates for communicable diseases; and
  (c) rates for scenario II, being the sum of the baseline rates for communicable diseases and injuries and the alternative rates for noncommunicable diseases.

- Step Five: Translation of the three resulting sets of all-causes age/gender-specific mortality rates into life expectancies. The life expectancy figures for scenarios I and II were then compared with those of the baseline in order to assess the implications of the two alternative scenarios for the poor and the rich.

Types of Assessment
The impact of altering future disease trends was assessed in two ways:

- Effect on the global poor alone. The central question is how much the poor would benefit from a faster decline in communicable diseases, relative to a comparably faster reduction in noncommunicable ailments. As noted earlier, this is the question that matters if one's interest is improving the health of the poor, as distinct from reducing poor-rich differences.
- Effect on poor-rich differences. Here, the focus is on how much a given reduction in one particular type of disease—whether communicable or noncommunicable—would benefit the poor relative to the rich and thus increase or decrease the global poor-rich health gap. This is the matter of greatest concern for those who look primarily at poor-rich health disparities, rather than at the health of the poor alone, as a major source of health inequity.

Findings

Change in Disease Burden under the Baseline Scenario
According to the baseline scenario, a worldwide demographic-epidemiological advance between 1990 and 2020 would benefit the global poor as well as other population groups. Communicable diseases would decline substantially in importance among the poor and, in relative terms, the significance of noncommunicable ailments would increase. As a result, noncommunicable diseases would in 2020 cause almost as much death and disability among the world's poor as communicable illnesses. Communicable diseases would nonetheless remain the more important of the two for the poor, and even in 2020, communicable diseases would continue to be far more important for the poor than for the world as a whole or for the rich.

Specifically, should the baseline scenario prove correct:

Among the global poor, the percentage of deaths attributable to communicable disease would decline from 59 percent in 1990 to 44 percent in 2020. During the same period, the percentage of deaths caused by noncommunicable diseases would rise from 32 percent to 42 percent. DALY loss from communicable diseases would fall from 64 percent to 43 percent; DALY loss from noncommunicable diseases would increase from 23 percent to 40 percent. By the end of the projection period, communicable diseases would therefore continue to be responsible for slightly more disease and disability than noncommunicable ailments, although the gap would largely have closed.

Since the importance of communicable diseases would also be declining in other population groups, communicable conditions would continue to be much more important for the poor than for the better-off—despite the reduction in the importance of communicable diseases among the poor just described. As indicated, in 2020 communicable diseases would cause 44 percent of deaths and 43 percent of DALY loss among the global poor, compared to about 15 percent of deaths and 20 percent of DALY loss in the world as a whole, and 7 percent of deaths and 8 percent of DALY loss among the global rich.

For the same reason, noncommunicable ailments would remain much less important for the poor than for other population groups, despite their rise in importance among the poor. Among the poor, noncommunicable diseases would cause 42 percent of deaths and 40 percent of DALY loss in 2020. But in the world as a whole, such diseases would be responsible for 73 percent of deaths and 60 percent of DALY loss; among the global rich, they would cause 82 percent of deaths and 81 percent of DALY loss.

Injuries would account for an increased proportion of total deaths for all the population groups covered. The percentage of total deaths attributable to injury would increase from 9 to 14 percent among the poor, from 10 to 12 percent in the world as a whole, and from 7 to 10 percent among the rich. DALY losses would increase from 13 to 17 percent for the poor and from 15 to 20 percent for the population as a whole, but would decline from 13 to 11 percent for the rich.

Changed Life Expectancy under the Baseline and Alternative Scenarios

Introduction. On the surface, the evidence of the baseline scenario just presented might appear to argue for a shift in priorities toward treatment of noncommunicable diseases—for the global poor as well as for the world's population as a whole. For, according to this scenario, the relative importance of noncommunicable diseases is rising among the poor as well as among other segments of the population, and communicable diseases are continuing their decline.

However, the projected baseline trend is notably less relevant for policy formulation than what economists call a "marginal" approach—that is, an approach based on an assessment of the potential impact that policy-induced changes in the projected baseline trend make on the future situation. Application of this approach means investigating the impact on people at different economic levels of accelerated progress against different types of illness.

In other words, suppose that the world's leaders were to intervene and bring about a faster rate of decline in a particular disease group than is currently projected. How much of the resulting incremental reduction in death and disability would accrue to the poor? How much to the rich? Addressing questions like this is the best way to measure the impact of alternative strategies to disease reduction, and thus to provide the guidance that policymakers need.

Table 3 provides answers to some of these questions. The table shows, for the global poor and for the global rich, the life expectancy at birth that prevailed in 1990 and that would prevail in 2020 under the baseline scenario and under the two alternative scenarios that are under consideration.

1990-2020 Life Expectancy Increase under the Baseline Scenario. The life expectancy figures for the baseline scenario presented in Table 3 are constructed from the sum of cause-specific mortality data presented in the previous chapter, and are consistent with these data. The table shows that in 1990, the global poor had a life expectancy of about 54 years, more than 20 years less than that of the global rich. Under the baseline scenario, the life expectancy of the poor would increase by almost 9 years between 1990 and 2020, compared with 5 years for the rich. The result would be a noticeable diminution in the poor-rich gap.

The table also shows, however, that either of the two alternative scenarios (i.e., faster reductions in communicable or in noncommunicable diseases) would produce a larger life expectancy gain for each population group than would the baseline scenario. These gains would range from 10.0 to 12.7 years for the global poor, compared with the 8.6 years of the baseline. For the global rich, the gain would be 5.7 to 10.6 years, rather than the 5.3-year increase that the baseline would produce.

Both poor and rich, in other words, would gain to at least some degree from an acceleration in progress against disease, whether those diseases are communicable or noncommunicable. However, the amount of benefit that the poor and rich would gain differs sig-

Table 3. Impact of Alternative Global Disease-Reduction Scenarios on the Health of the Poor and Rich

(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
	Global poor			*Global rich*		
Scenario	*1990 Life Expectancy*	*2020 Life Expectancy*	*1990–2020 Gain in Life Expectancy (col. 3 – col. 2)*	*1990 Life Expectancy*	*2020 Life Expectancy*	*1990–2020 Gain in Life Expectancy (col. 6 – col. 5)*
Baseline Scenario: • Baseline Global Burden of Disease Project projection	53.6 years	62.2 years	8.6 years	75.3 years	80.6 years	5.3 years
Alternative Scenario I *(faster communicable disease decline)*: • Doubled Pace in Decline in Death Rates from Communicable Diseases • Baseline Pace of Decline in Death Rates from Other Causes of Death	53.6 years	66.3 years	12.7 years	75.3 years	81.0 years	5.7 years
Alternative Scenario II *(faster noncommunicable disease decline)*: • Doubled Pace in Decline in Death Rates from Noncommunicable Diseases • Baseline Pace of Decline in Death Rates from Other Causes of Death	53.6 years	63.6 years	10.0 years	75.3 years	85.9 years	10.6 years

nificantly under the two alternative scenarios. It is the size of these differences that is of particular interest from a poverty or equity perspective, and is thus the focus of what follows.

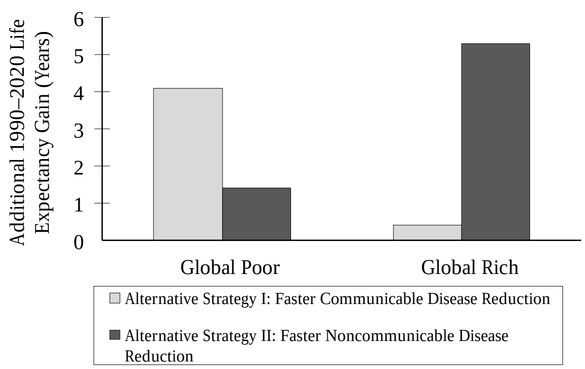
Impact of Accelerated Improvement on the Health of the Poor. If the objective is to improve the health of the poor to the maximum possible extent, as distinct from reducing the poor-rich gap, the comparison of greatest interest is between communicable and non-communicable diseases and their effect on the poor alone. Looking at Table 3, this means comparing the increase in life expectancy among the poor produced by alternative scenario I (an accelerated decline in communicable illnesses) with that resulting from alternative scenario II (a comparably faster reduction in death and disability from noncommunicable diseases).

This comparison is illustrated in the left-hand panel of Figure 6, which represents graphically the data contained in Table 3. This figure shows that an acceleration in the rate of decline of death and disability from communicable diseases would result in a 1990–2020 life expectancy gain among the global poor that is 4.1 years greater than under the baseline projection.[35] A comparably accelerated decline in noncommunicable diseases among the global poor over the same period would result in a year 2020 life expectancy gain 1.4 years greater than under the baseline projection.

Such calculations indicate that an acceleration in overall progress against communicable diseases would bring about a significantly larger gain for the global poor than would an acceleration of comparable magnitude achieved against noncommunicable conditions. The additional 4.1 years of life expectancy that faster progress against communicable ailments would generate (compared to the baseline scenario) is almost three times as great as the 1.4-year increase that faster declines in noncommunicable diseases would produce.

The reverse is true for the global rich. As shown in the right-hand panel of Figure 6, alternative scenario I

Figure 6 Additional 1990–2020 Life Expectancy Gain Produced in a Given Population Group by Different Disease-Reduction Strategies



would lead only to an additional 0.4 years of life expectancy among the rich in 2020. Scenario II, in contrast, would produce 5.3 additional years of life expectancy. In other words, while faster reductions in communicable diseases are most important for the global poor, the global rich have more to gain from accelerated progress against noncommunicable conditions.

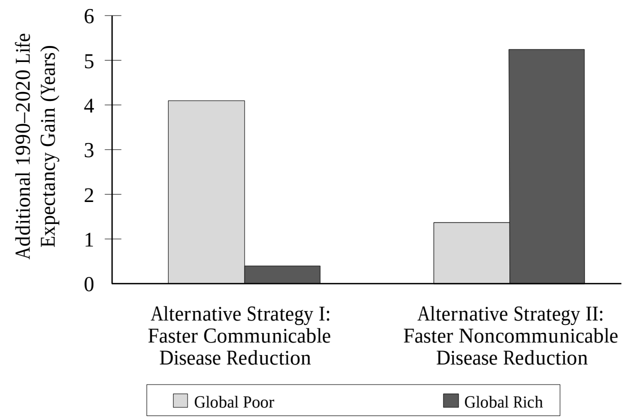
Impact of Accelerated Improvement on Poor-Rich Health Differences. Measuring the impact of the alternative strategies on the poor-rich difference requires a further type of comparison. In dealing with the poor alone, the relevant comparison was between the effects of different strategies on the same population group. To gauge the impact on poor-rich differences, the relevant comparison concerns the effects of the same strategy on different population groups—i.e., on the poor and on the rich.

This type of comparison is presented in Figure 7, which again draws on the data contained in Table 3.

The Figure 7 data show that:

Doubling the rate of decline in communicable disease (alternative strategy I) would be much more beneficial for the poor than for the rich. For the poor, alternative strategy I would lead to a year 2020 life expectancy 4.1 years greater than the baseline year 2020 life expectancy. The benefit of this strategy for the rich would be only 0.4 years. The life expectancy gain for the poor would be 3.7 years more than for the rich—or greater by a factor of more than 10.

Figure 7 Additional 1990–2020 Life Expectancy Gain Produced by a Given Disease-Reduction Strategy in Different Population Groups

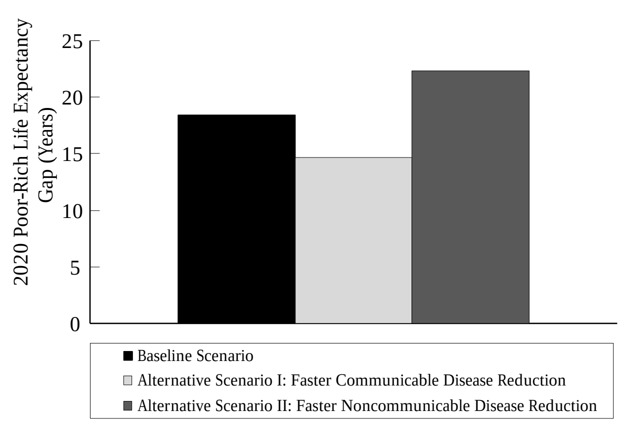


Conversely, the rich would gain more than the poor would from a doubled rate of reduction of noncommunicable disease (alternative scenario II). Under this scenario, the year 2020 life expectancy of the rich would be 5.3 years more than it would be under the baseline scenario; for the poor, it would be only 1.4 years more. The gain for the rich, in other words, would be 2.9 years more than it would be for the poor, or nearly four times as much.[36]

The impact of these different strategies on the life expectancy difference between the global richest and poorest 20 percent is shown in Figure 8. Again, the data are drawn from Table 3.

Under the baseline scenario, the global rich would in 2020 have a life expectancy 18.4 years longer than

Figure 8 Life Expectancy Difference Between Global Rich and Global Poor in 2020 Under Different Disease-Reduction Scenarios



would the poor (80.6 years versus 62.2 years). Under alternative strategy I, which projects an accelerated decline in deaths from communicable diseases evenly spread across all economic classes, this gap would be reduced by 3.7 years, to 14.7 years (81.0 years versus 66.3 years). If declines in mortality from noncommunicable diseases in all economic levels were to be accelerated instead (alternative scenario II), the gap would actually rise, by 3.9 years to 22.3 years (85.9 years versus 63.6 years)

In brief, overall accelerated declines in communicable diseases would benefit the poor more than the rich and would thus reduce the future poor-rich life expectancy gap. Faster overall reductions in death from noncommunicable diseases would have the opposite effect.

Interpretation

Explanation of Findings

This conclusion is perhaps surprising in light of the earlier projection that, even among the poor, communicable illness would decline and noncommunicable diseases would rise in relative importance between 1990 and 2020. However, there is a ready explanation for why the accelerated reduction of communicable disease should be of continuing central importance for the global poor; and, more generally, for why accelerated declines in the different disease groups have the distributional consequences that they do:

- Communicable diseases. Even in 1990, communicable diseases were of little concern to the rich. As was shown in Figure 1, communicable diseases were responsible for only 10 percent or less of all death and disability among the global rich. Even if such diseases were completely eliminated from the earth, the impact on this rich population group would be minimal. Not so, however, for the global poor. Among the poor, communicable diseases caused well over half of all death and disability in 1990. Given the predominance of communicable diseases in the overall burden of disease, the faster reduction of this group of diseases would inevitably significantly benefit the poor.
- Noncommunicable diseases. The converse is true for noncommunicable diseases. In 1990, this group of diseases played a significantly smaller role in the health of the global poor than in that of the rich, being responsible for only 25–35 percent of all death and disability among the former compared with 75–85 percent among the latter. The rich thus stand to gain a great deal more than the poor from reduced noncommunicable disease.

The conclusions reported here concerning the impacts on poor and rich of the faster reduction of communicable and noncommunicable diseases are therefore intuitively plausible, as well as statistically straightforward. The difference between these conclusions and the seemingly contrary findings of earlier reports is the result simply of the application of an analytical perspective that is different from, and, as argued earlier, more relevant for policy development than that which went before.

Role of Cost-Effectiveness Considerations

However, there remain other, important ways in which even the calculations just presented are removed from the realities of the world in which policymakers work. One of these is the lack of explicit consideration of the relative cost-effectiveness of the different interventions available to address each type of disease and each population group. Cost information is obviously important: to tell a policymaker that an accelerated decline in disease category A would benefit the poor twice as much as the same decline in disease category B would be quite misleading should it cost 10 times as much to produce that degree of acceleration in A as opposed to B.

The absence of information about intervention and cost-effectiveness in Table 3 and Figures 6, 7, and 8 therefore means that the conclusions based on these data are directly applicable for policy formulation only if the interventions available to deal with communicable and noncommunicable diseases among the global poor and rich are equally cost-effective. How likely is this to be the case?

The available information is too general and imprecise to permit a confident response to this question. It is also inadequate to justify the preparation of a quantitative adjustment to the data in Figures 6, 7, and 8 that could account for any systematic differences in the cost-effectiveness of the interventions available to address specific disease or population groups.

Despite such limitations, however, the existing information is sufficient to indicate that in general:

- Currently available intervention options appear capable of reducing death and disability from communicable diseases at considerably less cost than would be incurred in reducing mortality and morbidity caused by noncommunicable conditions.

  The evidence most directly relevant to this point comes from a prominent, careful investigation into the cost-effectiveness of a wide range of interventions in developing countries.[37] The data cover 54 interventions, 30 of which can produce a unit of DALY loss for $75 or less, and 24 of which cost more than $75 per unit of DALY loss. Of the 30 less expensive interventions, 28, or 93 percent, are interventions against communicable or related diseases.[38] Of the 24 more expensive interventions, the majority (15, or 63 percent) are directed toward noncommunicable conditions.

  Such highly aggregated findings cannot be reliably applied to a specific intervention undertaken with respect to a particular group in a particular place at a particular time. In general, however, the findings clearly suggest that interventions against communicable diseases tend to be less expensive, relative to impact.

- While no known empirical basis exists for directly assessing the cost of a unit of death/disability reduction among the global poor relative to that among the global rich, economic/epidemiological logic and indirect evidence suggest that it is likely to cost less to improve the health of the poor than to improve the health of the rich.

  This conclusion is based in part on the concept of diminishing returns, wherein the tendency is for further progress to be increasingly difficult as the level of accomplishment increases. Since the rich have progressed further along the road to better health than have the poor, the presence of diminishing returns would mean that any given amount of health progress would generally be more difficult and expensive for the rich than for the poor, who are not so far along.

  Diminishing returns have long been known to exist in health. For example, numerous studies have shown that the health improvement brought by a given increase in per capita income diminishes progressively as income rises[39] and as health status begins to become more difficult to improve further.[40] Similar indications come from time series data, which typically show that the rate at which life expectancy increases declines as progressively higher levels of life expectancy are attained.[41]

  No such clear determination is readily available for the impact of health interventions on health status at progressively improving levels of health. But the clear demonstration that a situation of diminishing returns exists in the income-health relationship, and in the progress of health improvement over time can only strengthen the basis for believing that diminishing returns prevail with respect to the intervention-health relationship as well—a pattern of relationship that would seem intuitively probable in any event.

In brief, there are both empirical and conceptual reasons for believing that interventions against communicable diseases and interventions applied in poor population groups have more favorable cost-effectiveness ratios than interventions against noncommunicable ailments, or those applied to better-off populations. This implies that, were cost-effectiveness considerations incorporated in the calculations presented here, the result would be a stronger rather than a weaker case for a focus on communicable diseases among the poor.

Targeting Possibilities

A second way in which the calculations made here depart from the realities of the policy world is through the universal application of equally large degrees of acceleration to all disease, age, and gender groups in the alternative scenarios. This hypothetical approach ignores the option of targeting that is available to policymakers—that is, the ability to focus a program initiative on one population group or another, rather than to allow the initiative's benefits to be spread equally across the population as a whole.

How much of a limitation this represents will depend upon the level of inquiry—whether global or country-specific, for example—and the type of intervention under consideration. The point can be illustrated with a pair of examples, one from near each end of the broad spectrum of possibilities.

Close to one end of the spectrum might be, say, a global research effort to develop an inexpensive, easily administered vaccine against respiratory or other widely distributed infections. Such an innovation could, in theory at least, be delivered with relative ease to all population groups worldwide, regardless of income. In this case, the intervention could be plausibly expected to have the potential to bring roughly the same degree of health advancement to all segments of the population.

As an example lying near the spectrum's other end, take the case of a tertiary care initiative to treat noncommunicable diseases in a typical developing country, where, as has been seen, noncommunicable diseases are much more important among the rich than among the poor. According to the scenarios discussed here, the benefits of such an initiative could be expected to flow principally to the rich, should the initiative be introduced on a society-wide basis. In practice, however, it lies within the power of those responsible for an initiative of this sort to reach out to the poor by locating facilities only in areas that the rich would prefer to avoid, for example, or by providing the poor with free services while charging the rich the full service cost. Use of such measures could quite conceivably produce a tertiary care program for noncommunicable disease that serves primarily the poor. It is highly unlikely that such a program could be cost-effective or financially sustainable without massive outside subsidies, but it could nonetheless constitute a noncommunicable disease program producing a poor-rich benefit ratio quite different from that suggested by Figure 7.

Summary

Taken together, the points raised in this section suggest that the conclusions derived from the alternative scenarios discussed are plausible, but no more than partial guides to policy. In light of the role of cost-effectiveness and the potential for targeting that have been discussed, it would obviously be an error to consider the figures presented in Tables 6 and 7 as fully reflecting the reality that policymakers and researchers face. But what those figures can legitimately claim nonetheless remains significant: That is, by illustrating the likely impact of policy interventions to modify future disease trends, they represent a far more suitable basis for policy development than simple projections of those trends.

4 Implications for Strategy

The principal findings of the exercises presented here can be simply summarized:

At present, while noncommunicable diseases cause more death and disability than communicable diseases in the world as a whole, communicable and related diseases remain the leading cause of death and disability among the global poor. The population group for which noncommunicable diseases matter most is the rich, among whom such diseases are overwhelmingly dominant.

In the future, the global poor would benefit much more from faster progress against communicable than against noncommunicable conditions, despite the growing prominence of the latter. The poor would also gain much more than the rich from faster progress against communicable diseases, with the result that poor-rich differences would decrease. The principal beneficiaries from any comparable acceleration in the progress against noncommunicable ailments would be the rich.

For all the reasons indicated earlier, the estimates on which the above conclusions are based, like the global burden of disease figures from which they have been derived, are far from exact. In interpreting and applying the estimates, there are several additional considerations that also deserve to be kept in mind. For example:

What may be true of communicable diseases and noncommunicable diseases as a whole is not necessarily so for each and every communicable and noncommunicable disease. Annex B contains several instances of noncommunicable diseases that are more important among the poor than communicable diseases.[42]

What may be true of the world as a whole is not necessarily so for each and every country within it. There are almost certainly advanced developing countries in which noncommunicable diseases are more important than communicable diseases, even for the country's poorest 20 percent. For decisions made at the country level, this would argue for giving a high priority to noncommunicable diseases. It would not, however, obviate the point that communicable diseases, even if causing a minority of death and disability among the poor, may well be more important for the poor than for the rich or than suggested by national averages.[43]

Even if the generalizations presented here are correct, they do not constitute nearly the only factor that deserves consideration in establishing effective evidence-based priorities. One of many other relevant factors—the cost-effectiveness of the interventions available to deal with a particular disease condition—has already been noted. Another, of particular relevance in establishing priorities for research, concerns the likelihood that expensive time and effort devoted to research of a particular disease will produce a cost-effective approach to dealing with it. The inclusion of such factors could well result in priorities that differ significantly from a list produced on the basis of burden of disease estimates alone.

Despite the importance of considerations such as these, however, the estimates presented here clearly represent much more accurate approximations of disease patterns among the global poor than do the global averages currently in widespread use. The significant differences that exist between estimates specific to the poor and global averages illustrate the dangers of continuing to rely on global averages for the development of poverty-oriented health strategies. These differences also indicate a pressing need for future estimations of the burden of disease to focus on the conditions prevailing among the groups that are of greatest concern from a poverty or equity perspective.

The conclusions also point to a significantly different way of responding to the epidemiological transition than that suggested by assessments based on global averages and trends. As has been seen, those global figures indicate that what are sometimes called the "emerging problems"[44] or "neglected epidemics"[45] of noncommunicable conditions spawned by the transition have already become dominant, and are destined to become even more so in the future. From a global perspective, it would be quite logical for the health community to turn its attention and apply its resources progressively to those emerging problems. Equally reasonable would be a concomitant reduction in the energy and resources allocated to what is frequently termed the "unfinished agenda"[46] of communicable conditions, as that agenda continues to diminish in importance in the years ahead.

Sensible as such a strategy might be from a global perspective, however, it would overlook the uneven distribution of different diseases across social class that has been the focus of concern here. The use of a distributional perspective shows that the noncommunicable conditions that represent emerging problems, while far from unimportant for the global poor, tend to cluster among those who enjoy higher living standards. The communicable diseases of the unfinished agenda, on the other hand, are concentrated primarily among the poor. As a result, any shift of emphasis in global disease priorities from the unfinished to the emerging agenda would represent a move away from the problems that are most important for the poor toward those that are of greater importance for the better off.

What matters most for the global poor is finishing the unfinished agenda, dealing effectively with such associated conditions as maternal health and malnutrition, and combating those reemerging diseases, like tuberculosis, which spread particularly among the needy. Diseases like these may not loom large in the thinking about the epidemiological transition that is focused on the future of the world as a whole. They are, however, the conditions whose continued reduction would bring the greatest benefit to the world's most disadvantaged groups, and would do the most to reduce global poor-rich differences in health status.

Notes

1. Primary Health Care. 1978. Report of the International Conference on Primary Health Care, Alma-Ata, USSR, 6–12 September 1978. Geneva: World Health Organization: p. 16.

2. Ibid.

3. Grant, James P. 1981. *The State of The World's Children*, 1981–82. New York and Geneva: UNICEF: p. 9.

4. Walsh, Julia A., and Kenneth S. Warren. 1979. "Selective Primary Health Care: An Interim Strategy for Disease Control in Developing Countries." *New England Journal of Medicine* 301 (November): p. 967.

5. The World Bank. 1980. *Health Sector Policy Paper.* Washington: The World Bank: p. 14.

6. Scrimshaw, N.S., C.E. Taylor, and J.E. Gordon. 1968. *Interactions of Nutrition and Infection*. Geneva: World Health Organization: p. 265.

7. Commission on Health Research for Development. 1993. *Health Research: Essential Link to Equity in Development*. New York and elsewhere: Oxford University Press.

8. The World Bank. 1993. *World Development Report 1993: Investing in Health*. Oxford and elsewhere: Oxford University Press for the World Bank.

9. Ibid., p. 108.

10. World Health Organization. 1996. "Investing in Health Research and Development." Report of the Ad Hoc Committee on Health Research Relating to Future Intervention Options. Geneva: World Health Organization.

11. Commission on Health Research for Development, p. 38.

12. "The Global Burden of Disease," Appendix B, World Bank, *World Development Report 1993*, pp. 213-35.

13. Christopher J. L. Murray and Alan D. Lopez, "Global Patterns of Cause of Death and Burden of Disease in 1990, with Projections to 2020," Annex 1, *Report of the Ad Hoc Committee on Health Research Relating to Future Intervention Options*, pp. 133-85.

14. For example, the press release for the *Ad Hoc Committee Report* featured the report's global data in its headline ("Non-Communicable Diseases to Become Leading Global Cause of Death") and in its opening passage ("Worldwide deaths… will jump…" (*Ad Hoc Committee on Health Research Relating to Future Intervention Options*, Press Release, September 15, 1996) And the global situation, or the situation of the developing countries as a whole, is what attracted particular press attention. The *New York Times* article, for example, began by noting that "noncommunicable diseases and accidents are quickly replacing infectious diseases and malnutrition as leading causes of premature death and disability worldwide." (Barbara Crossette, "Noncommunicable Diseases Seen as Growing Health Problem," The *New York Times*, September 16, 1996. The *Washington Post* report referred to the likely path of illness that "most of the world's population will retrace" and was accompanied by a prominent table listing the most prominent diseases in the world as a whole (David Brown, "In Changing Face of Illness, An Optimisic Prognosis Emerges," The *Washington Post*, September 16, 1996).

15. This refers to people who earn less than US$ 1.00 per day in 1985 dollars, adjusted for inter-country differences in the dollar's purchasing power. The definition is based on

the minimum income required to purchase a diet adequate in calories.

16. Preston, Samuel H. 1976. *Mortality Patterns in National Populations*. New York: Academic Press. Hakulinen, T., H. Hansluwka, A.D. Lopez, and T. Nakada. 1986. "National and Regional Mortality Patterns by Cause of Death in 1980." *International Journal of Epidemiology* 15: pp. 226–233. Rodolfo A. Bulatao. 1993. "Mortality by Cause, 1970 to 2015," in James N. Gribble and Samuel H. Preston, eds., *The Epidemiological Transition: Policy and Planning Implications for Developing Countries*. Washington: National Academy Press: pp. 42–68.

17. A lucid introduction to the transition appears in a prescient, seminal article prepared before the availability of the empirical evidence just cited: Omran, Abdel R. 1971. "The Epidemiological Transition: A Theory of the Epidemiology of Population Change" in *The Milbank Memorial Fund Quarterly* 49, no. 4: pp. 509–38.

18. Among the ample evidence in support of this relationship is that cited in the World Bank's *1993 World Development Report* fig. 1.9: p. 38.

19. Murray, Christopher J.L., and Alan D. Lopez, eds. *The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries, and Risk Factors in 1990 and Projected to 2020* (Global Burden of Disease and Injury Series, Volume I). Cambridge, Mass.: Harvard School of Public Health on behalf of the World Health Organization and the World Bank.

20. Resource limitations prevented preparation of the comparable estimates for groups at other, intermediate socioeconomic levels that would be required for calculation of other inequality indicators.

21. For the purposes of this exercise, the two most populous countries, China and India, were divided into provinces/states, and each province/state was treated as a separate country.

22. Further information about the location of the poor and rich population groups produced through this procedure appears in Annex A1, footnote one.

23. In many cases, step (b) involved the application of a model life table to life expectancy and/or infant/child mortality data available at the country level.

24. For ease of expression, group I conditions will often be referred to simply as communicable diseases. This is done at the cost of omitting explicit reference to the noncommunicable conditions also included in group I: perinatal conditions, maternal conditions, and nutritional deficiencies. These three noncommunicable conditions/deficiencies together are responsible for around 6 percent of deaths and 13 percent of DALY loss in the world as a whole, 11 percent of deaths and 17 percent of DALY loss among the global poor, and 1 percent of deaths and 5 percent of DALY loss among the global rich.

25. For more on the DALY index, see: Murray, C.J.L. 1994. "Quantifying the Burden of Disease: The Technical Basis for Disability-Adjusted Life Years." *Bulletin of the World Health Organization* 72: pp. 429–45; and Murray, C.J.L. "Rethinking DALYs," in Murray and Lopez, eds. op.cit., pp. 1–98.

26. This is the approach featured in most anti-poverty work thus far undertaken by the World Bank, which has focused especially on improving conditions among the 1.3 billion people below the international poverty line.

27. A full discussion of the equity-equality distinction lies far beyond the scope of this presentation. Suffice it for present purposes to say that equity is a normative concept, equality an empirical one, and that there are perspectives from which the two are not necessarily congruent.

28. A concern for equity enhancement or inequality reduction has tended to dominate the thinking of the NGO community, the medical profession, and the World Health Organization. For example, the 1978 WHO/UNICEF Alma-Ata declaration referred explicitly to a need to reduce poor-rich differences in health status. The latest, 1996 WHO publication on this topic (Equity in Health and Health Care) contains the word "equity" in its title, and also contains explicit reference to the need to reduce poor-rich differentials.

29. While a full discussion of the issue cannot be accommodated within the space available here, it is worth noting

the existence of many circumstances in which the policy implications of a poverty-alleviation approach can differ significantly from those of an inequality-reduction strategy. One obvious illustration, drawn from general economic literature, is the case of those who advocate faster overall economic growth as an effective way to reduce poverty. There is considerable empirical evidence in support of this proposition, which is often referred to as the thesis that "a rising tide raises all boats." That is, if incomes rise at the same level for people at every level, the number of people below the poverty line will decline even though there will be no improvement in the pattern of income inequality. Such a result brings about poverty alleviation without any reduction in inequality.

30. This cluster consists of pertussis, polio, diphtheria, measles, and tetanus.

31. Readers who are economists will recognize that this expression draws on the analogy between the current situation and that posited by David Ricardo in developing his well-known "comparative advantage" argument relating to international trade. Ricardo showed that, in a setting where one party enjoyed an absolute advantage in producing all goods, relative to another party, the superior party would be best advised to specialize in the production of those goods in which its advantage is greatest.

32. Standardized estimates have nonetheless been prepared for illustrative purposes. If the global poor were to have the same age structure as the entire global population, communicable diseases would account for 49.5 percent, noncommunicable diseases for 41.6 percent, and injuries for 8.9 percent of deaths among them. If the world's rich had the same global average age structure, in that group communicable diseases would cause 11.3 percent, noncommunicable diseases 78.8 percent, and injuries 9.9 percent of all deaths. The differences are predictably narrower than without standardization, but the basic conclusion remains: Communicable diseases are still notably more important for the poor than for the population as a whole, and noncommunicable diseases are markedly less important. The converse remains true for the rich.

33. No effort was made to produce 2020 estimates for detailed disease categories comparable to those for 1990 presented in Annex B because of the unduly speculative nature of any such figures.

34. Thus far, this part of the approach has been applied only to mortality data. No effort has yet been made adapt it for the assessment of mortality-morbidity indicators like DALYs. One reason has been the resource limitations mentioned earlier. A second factor has been doubt, based on preliminary informal estimates, about whether the results of a DALY projection would be sufficiently different from those of the mortality exercise to justify the considerable effort and expense involved in developing what would have to be a significantly different procedure.

35. The 1990–2020 life expectancy gain would be 12.7 years under alternative scenario I, compared with the 8.6 year 1990–2020 increase under the baseline scenario. In a similar manner, the other figures from Figures 6 and 7 presented below also refer to the amount of 1990–2020 life expectancy gain under the scenario being considered minus the 1990–2020 baseline life expectancy increase.

36. As noted earlier (Chapter 3) the findings presented here are insensitive to the particular rate of acceleration used. For example, the ratio of poor to rich benefit from alternative strategy I (faster decline for communicable diseases) is greater than 10:1 for every value of acceleration from 1.1 through 2.5 when the same degree of acceleration is applied to every disease, age, and gender group. The effect on poor-rich differences of modifying the acceleration rate for alternative strategy II (more rapid reduction in noncommunicable disease) is also quite small: the poor benefit less than 30 percent as much as the rich at every rate of acceleration within the range mentioned.

37. Jamison, Dean T., et al., eds. 1993. *Disease Control Priorities in Developing Countries*. Oxford and elsewhere: Oxford University Press for the World Bank: table 1A-6, pp. 28–29.

38. The expression "or related" is added to the reference to communicable diseases to acknowledge the several highly cost-effective interventions listed that address nutritional conditions. As noted earlier, these conditions are grouped alongside communicable illnesses in the Murray-Lopez disease classification system adopted here, and they are thus

included implicitly even if not explicitly in the numerous references to communicable diseases appearing throughout this paper.

39. See, for example, the presentations of country data for per capita income and life expectancy that appear in the World Bank's 1993 *World Development Report*, fig. 1.9, p. 38

40. The 1993 *World Development Report* also provides a ready illustration of this tendency, in the time trends for life expectancy in the established market economies and the formerly socialist economies of Europe. Figure 1.2, p. 23.

41. To some extent, any greater cost of improving the health of the rich relative to the poor could be explained simply by the greater importance of communicable diseases among the poor and the lower cost of dealing with communicable relative to noncommunicable ailments. But this is possibly only part of the story. As shown in Chapter 2, death rates for both noncommunicable and communicable diseases are lower among the rich than among the poor at all ages. This indicates that the rich are closer to the limit of achievable progress with respect to both types of disease, rather than with respect to communicable ailments alone; in such a case, the presence of diminishing returns would produce a higher cost per unit of progress among the rich than among the poor, regardless of the type of disease in question.

42. The limited information available on intra-country health differentials suggests that noncommunicable diseases will almost always be more important for the rich than for the poor, even when they constitute the principal problem even for the poor. This would be the case in an advanced developing country where non-communicable diseases cause, say, 65 percent of death and disability among the poor but 90 percent among the rich. In situations like this, any evenly distributed reduction in noncommunicable diseases would obviously be of great benefit to the poor—but it would normally be of still greater benefit to the rich and would thus increase poor-rich disparities. (For a summary of the available intra-country data, see Davidson R. Gwatkin, op. cit.)

43. Jamison et al., eds. *Disease Control Priorities in the Developing World*.

44. World Health Organization. "Investing in Health Research and Development." *Report of the Ad Hoc Committee on Health Research Relating to Future Intervention Options*.

45. Jamison et al., eds. *Disease Control Priorities in the Developing World*; World Health Organization, "Investing in Health Research and Development." *Report of the Ad Hoc Committee on Health Research Relating to Future Intervention Options*.

Annex A
Summary of Methodology

Annex A1

Estimating the Burden of Disease among the Poorest and Richest 20 Percent of the Global Population in 1990

Summary of Methodology

Step I: Identifying the Poorest and Richest 20 Percent of the Global Population

A. The world's countries were listed in ascending order in terms of income adjusted to achieve purchasing power parity. (China and India, the two most populous countries, were divided into provinces/states, and each province/state was treated as a separate country.)

B. The population size of each country was entered alongside its name.

C. A line was drawn on the list at that point where the cumulative population of the countries above it equaled 20 percent of the total world population. The peoples of the countries above the line were defined as constituting the global poorest 20 percent. The global richest 20 percent was identified through an analogous procedure, working from the bottom of the list.[1]

Step II: Estimating the Total Number of Deaths from All Causes in the Poorest and Richest Global 20 Percent

A. For each country with a population belonging to the poorest or richest 20 percent, the number of people at each age level and in each gender group was determined through reference to standard United Nations and/or World Bank sources. In the cases of Chinese provinces and Indian states, this was achieved using national data sources.

B. The death rates for people in each age/gender category in each country were determined by:

1. obtaining the country's life expectancy from a standard United Nations or World Bank data source;
2. adjusting the life expectancy as necessary to ensure that the average life expectancy for all countries in a given Murray-Lopez region corresponded with the life expectancy for that region as presented in Murray-Lopez;
3. choosing the most appropriate of nine available model life tables, on the basis of the model table's congruence with the age distribution of mortality provided in Murray-Lopez for the region in which the country concerned was located; and
4. taking the death rates for each age/gender category from that level of the model pattern that corresponded to the country's adjusted life expectancy.

C. The number of people in each country/age/gender category as determined in Step II.A was multiplied by the corresponding death rate as estimated in Step II.B, and the resulting numbers of deaths for each country/age/gender category were aggregated.

Step III: Disaggregating the Total Number of Deaths in the Global Poorest and Richest 20 Percent into the Number Caused by Each of the Three Principal Murray-Lopez Disease Groups.

A. For each country/age/gender category, a preliminary estimate of the percentage of deaths attributable to each principal disease group was made using the values predicted by the Murray-Lopez statistical exercise, based on cross-country data, that estimated the distribution of mortality by principal cause as a function of the level of overall mortality.

B. The preliminary percentage estimates produced in Step III.A were adjusted to take into account region-specific differences from the predicted values, by applying to each country/age/gender category the correction factors developed by Murray and Lopez for the region in which the category was located.

C. The adjusted percentages of total mortality attributable to each principal disease group in each country/age/gender category, as estimated in step III.B, were multiplied by the number of total deaths in the corresponding categories as estimated in step II.C, and the resulting numbers of deaths for each principal disease group were aggregated.

Step IV: Estimating the Number of DALYs in the Global Poorest and Richest 20 Percent for Each of the Three Principal Murray-Lopez Disease Groups.

A. For each principal Murray-Lopez disease group and region, the DALY/death ratio for each age/gender category was calculated by dividing the figures published in the Murray-Lopez DALY tables by those appearing in the Murray-Lopez death tables.

B. The ratios produced in Step IV.A were multiplied by the number of deaths caused by the corresponding Murray-Lopez disease group in each country/age/gender category within the regions concerned, as estimated in step III.C, and the results were aggregated.

Step V: Further Disaggregating the Number of Deaths Caused in the Global Poorest and Richest 20 Percent into the Number of Deaths Caused by Each Disease Subgroup.

A. The proportion of deaths caused by each disease subgroup was calculated for each age/gender category in each region. This was achieved by dividing the Murray-Lopez figures for the number of deaths caused by the subgroup in question in the region concerned by the number of deaths in that region caused by the disease group concerned, as presented in Murray and Lopez.

B. The proportions calculated in Step V.A were multiplied by the total number of deaths in each country/age/gender category caused by the disease group and in the regions concerned, as estimated in Step II.C, and the results were aggregated.

Step VI: Estimating the Number of DALYs in the Global Poorest Richest 20 Percent Attributable to Each Disease Subgroup.

A. For each region and for each age/gender category, the proportion of DALYs within each of the three Murray-Lopez principal disease groups attributable to each disease subgroup was calculated by dividing the subgroup DALY figures, as published by Murray and Lopez, by Murray-Lopez data for the total DALYs in the principal disease group concerned.

B. The proportions resulting from Step VI.A were multiplied by the number of DALYs in the corresponding age/gender/principal disease categories, as derived in Step IV.B, and the results were aggregated.

Note

1. Using this procedure, 51.7 percent of the global poorest 20 percent were found to live in India; 26.6 percent in Sub-Saharan Africa; 16.6 percent in other Asia countries and islands; 3.1 percent in China; 1.4 percent in the Middle Eastern crescent; and 0.6 percent in Latin America and the Caribbean. Of the global richest 20 percent, 75.7 percent were found to live in the established market economies; 14.7 percent in the former Soviet Union; 5.0 percent in other Asian countries and islands; 3.1 percent in the Middle Eastern crescent; 1.3 percent in China; and 0.3 percent in Latin America and the Caribbean.

Annex A2

Estimating the Burden of Disease and the Life Expectancy of the Poorest and Richest 20 Percent of the Global Population in 2020

Summary of Methodology

Stage One: Establishing the Baseline 2020 Burden of Disease Pattern

Step I: Identifying the Poorest and Richest 20 Percent of the Global Population

A. The year 2020 per capita income of each country (and, for China and India, each province/state) was estimated. The starting point was the 1990 per capita income, adjusted to achieve purchasing power parity, as described in Annex A1, Step I.A. For each country, this figure was increased by applying the 1990–2020 per capita income growth rates used by Murray and Lopez (as presented in Figure 7.1, page 340) for the region in which the country is located. For China and India, it was assumed that the per capita income of each province/state would grow at the same rate as the country as a whole.

B. The projected year 2020 population size of each country was identified, using published United Nations projections. Where necessary, the population size of each country was then adjusted through proration to ensure that the total for each region corresponded to the regional totals indicated in Murray-Lopez.

C. The world's countries (and Chinese and Indian provinces/states) were listed in ascending order in terms of year 2020 per capita income, as estimated in Step I.A, and the year 2020 population size of each country/province/state, as identified in Step I.B, was entered alongside its name.

D. A line was drawn on the list at that point where the cumulative population of the countries above it equaled 20 percent of the total world population. The peoples of these countries were defined as constituting the global poorest 20 percent. The global richest 20 percent was identified through an analogous procedure, working from the bottom of the list.[1]

Step II: Estimating the Total Number of Deaths from All Causes in the Poorest and Richest Global 20 Percent.

A. For each country with a population belonging to the poorest or richest 20 percent, the projected number of people at each age level and in each gender group in the year 2020 was determined through reference to standard United Nations and/or World Bank sources. In the cases of Chinese provinces and Indian states, national data sources were used.

B. The death rates for people in each age/gender category in each country were determined by:

1. identifying the country's year 2020 life expectancy from a standard United Nations or World Bank data source;
2. adjusting the life expectancy as necessary to ensure that the average life expectancy for all countries in a given Murray-Lopez region corresponded with the life expectancy for that region as presented in Murray-Lopez;
3. choosing the most appropriate of nine available model life tables, on the basis of the model table's congruence with the age distribution of mortality provided in Murray-Lopez for the region in which the country concerned was located; and
4. taking the death rates for each age/gender category from that level of the model pattern that

corresponds to the country's adjusted life expectancy.

C. The number of people in each country/age/gender category as determined in Step II.A was multiplied by the corresponding death rate as estimated in Step II.B, and the resulting numbers of deaths for each country/age/gender category were aggregated.

Step III: Disaggregating the Total Number of Deaths in the Global Poorest and Richest 20 Percent into the Number Caused by Each of the Three Principal Murray-Lopez Disease Groups.

A. For each country/age/gender category, a preliminary estimate of the percentage of deaths attributable to each principal disease group was made using the values predicted by the Murray-Lopez econometric exercise, based on cross-country data, that estimated the distribution of mortality by principal cause as a function of the level of overall mortality.[2]

B. The preliminary percentage estimates produced in Step III.A were adjusted to take into account region-specific differences from the predicted values, by applying to each country/age/gender category the correction factors developed by Murray and Lopez for the region in which the category was located.

C. The adjusted percentages of total mortality attributable to each principal disease group in each country/age/gender category, as estimated in Step III.B, were multiplied by the number of total deaths in the corresponding categories as estimated in Step II.C, and the resulting numbers of deaths for each principal disease group were aggregated.[3]

Step IV: Estimating the Number of DALYs in the Global Poorest and Richest 20 Percent for Each of the Three Principal Murray-Lopez Disease Groups

A. For each principal Murray-Lopez disease group and region, the DALY/death ratio for each age/gender category was calculated by dividing the figures published in the Murray-Lopez DALY tables by those appearing in the Murray-Lopez death tables.

B. The ratios produced in Step IV.A were multiplied by the number of deaths caused by the corresponding Murray-Lopez disease group in each country/age/gender category within the regions concerned, as estimated in Step III.C, and the results were aggregated.

Stage Two: Estimating the 1990–2020 Change in Life Expectancy under the Baseline and Alternative Scenarios

Step One: Determining the Year 2020 Life Expectancy for the Poorest and Richest 20 Percent of the World's Population under the Baseline Scenario

A. The year 2020 life expectancy of the global poorest and richest 20 percent was calculated from the set of age/gender-specific mortality rates produced under Step II.B of Stage One, above.

Step Two: Establishing the Year 2020 Life Expectancy for the Poorest and Richest 20 Percent of the World's Population under the Alternative Scenarios

A. For each of the three principal disease groups, the year 2020 mortality rate for each age/gender category, as estimated in Step III.B of Stage One, was divided by the year 1990 mortality rate for the same age/gender category, as calculated in Step III.B of the 1990 procedure described in Annex A1.

B. The resulting sets of 2020–1990 age/gender/disease-specific ratios were translated into average 1990–2020 annual rates of decline.[4]

C. The average 1990–2020 annual rates of decline for communicable and for noncommunicable diseases were doubled, and applied to the corresponding 1990 age/gender/disease-specific mortality rates to produce alternative 2020 sets of age/gender-specific mortality rates for communicable and noncommunicable diseases.

D. The different sets of age/gender/disease-rates were combined as follows:

1. For alternative scenario I, the baseline Year 2020 rates for noncommunicable diseases and injuries, as developed in Step III.B of Stage One, were combined with the alternative Year 2020 rates for communicable diseases produced under Step II.C of the current stage.
2. For alternative scenario II, the baseline Year 2020 rates for communicable diseases and injuries, as developed in Step III.B of Stage One, were combined with the alternative Year 2020 rates for noncommunicable diseases produced under Step II.C of the current stage.

E. The Year 2020 life expectancy for the poorest and richest 20 percent of the world's population in 2020 was calculated from the all-causes age/gender-specific rates developed in Steps II.D.1 and II.D.2 of the current stage for alternative scenarios I and II, respectively.

Notes

1. Of the poorest 20 percent of the world's population in 2020, as estimated through this procedure, 67.6 percent live in Sub-Saharan Africa; 18.6 percent in other Asian countries and islands; 8.3 percent in India; 4.7 percent in the Middle Eastern crescent; and 0.8 percent in Latin America or the Caribbean. Of the global richest 20 percent, 57.7 percent live in established market economies; 23.1 percent in China; 9.7 percent in the former socialist economies of Europe; 5.9 percent in other Asia countries and islands; and 3.6 percent in the Middle Eastern crescent.

2. This step of the procedure assumes that the relationship between age/gender-specific mortality is stable over time. To some extent, this assumption is also implicit in the work of Murray and Lopez, who used observed relationships between 1950 and 1991 in establishing the functional relationship that they used in preparing their 1990 estimates. The assumption of a stable future relationship is adopted here in the absence of any known basis for predicting trends in health technology or of any other factors that might influence the result.

3. This procedure, directly analogous to that used in preparing the 1990 estimates, differs from the 2020 projection procedure of Murray and Lopez. Murray and Lopez based their 2020 figures on a series of independent projections for each of nine disease groups, which were subsequently aggregated into the three principal disease groups covered by the projections presented here. The method used here was selected in the absence of adequate information in the Murray-Lopez volume to permit use of their approach. Informal examination suggests that the results produced by the two methods are likely to be similar.

4. This element of the procedure involves defining the population group of interest in relational terms, rather than in the geographic terms more common in demographic practice. That is, the population group of interest is defined not as those people living in a particular country or region, but rather as those people belonging to the poorest (or richest) 20 percent of the global population, wherever they may be located at a particular time. The individuals covered in 1990 are thus not necessarily the same individuals (or descendents of the same individuals) as those included in the 2020 definition of poverty—as illustrated, for example, by the fact that people living in Sub-Saharan Africa constitute more than two-thirds of the global poorest 20 percent in 2020, compared with only slightly more than a quarter of that group in 1990.

Annex B
1990 Statistical Tables

Introductory Note to Annex B

Annex B presents 1990 data for the 22 diseases or conditions that are the principal causes of global death and disability, and for three other causes that are of special interest to particular audiences. All figures are approximations and subject to the limitations noted in the text.

Selection of Principal Causes

The 22 principal causes were selected following the Murray-Lopez categorization, modified to achieve two purposes. One of these was to provide information about an adequately large number of causes to be of interest. The other was to avoid cluttering the tables with information about a myriad of quantitatively less significant causes—information which, in addition to being distracting, is likely to be of dubious statistical validity given the crude nature of the estimation procedure used.

To achieve these purposes, the 22 principal causes were selected by:

- Adopting, as a starting point, the second of the four levels of disaggregation used by Murray and Lopez. At this level, the three principal causal groups of level one are disaggregated into 21 subgroups.

- Further disaggregating the two largest of the second-level cause groups: infectious and parasitic diseases, and cardiovascular diseases. Each of these two causal groups is responsible for more than one-quarter of 1990 total global deaths, and for more than twice as many deaths in 1990 as any other second-level cause group. In each of these two cases, the figures from the second-level cause groups were replaced by data from the third-level cause groups that constitute them.

- Omitting data for small causal groups. No figures are presented for causal groups that were responsible for fewer than 240,000 deaths in 1990 or that had been combined with other causes and presented in a Murray and Lopez subcategory labeled "other" diseases in the causal group concerned.

The 22 causes produced by this procedure were responsible for approximately 90 percent of all 1990 deaths and DALY loss worldwide, and for approximately 90 percent in the groups constituting the poorest and richest 20 percent of the world's population.

Selection of Other Causes

The three additional causes selected consist of diseases/conditions that, while not adequately significant in quantitative terms to qualify for selection under the procedure described, are of sufficient interest to particular audiences to justify special tabulation. One of the three additional causes (TDR diseases other than malaria) comprises diseases not covered in the list of principal causes. The other two (violence and war) are subcategories of a larger causal category (intentional injuries) on the list.

B1. Distribution of Deaths by Cause in Different Population Groups, 1990

Poorest 20 Percent of Global Population		*Richest 20 Percent of Global Population*		*Entire Global Population*	
Cause	*% of Deaths*	*Cause*	*% of Deaths*	*Cause*	*% of Deaths*
Principal Causes					
Respiratory Infections (Group I)	13.4	Ischaemic Heart Disease (Group II)	23.4	Ischaemic Heart Disease (Group II)	12.4
Diarrheal Diseases (Group I)	11.3	Malignant Neoplasms (Group II)	22.6	Malignant Neoplasms (Group II)	11.9
Perinatal Conditions (Group I)	7.9	Cerebrovascular Disease (Group II)	12.0	Cerebrovascular Diseases (Group II)	8.7
Childhood Cluster Diseases (Group I)	7.8	Respiratory Diseases (Group II)	4.8	Respiratory Infections (Group I)	8.7
Ischaemic Heart Disease (Group II)	7.3	Unintentional Injuries (Group III)	4.7	Unintentional Injuries (Group III)	6.4
Unintentional Injuries (Group III)	6.3	Digestive Diseases (Group II)	4.1	Diarrheal Diseases (Group I)	5.8
Tuberculosis (Group I)	6.2	Respiratory Infections (Group I)	4.0	Respiratory Diseases (Group II)	5.8
Malignant Neoplasms (Group II)	5.6	Neuropsychiatric Conditions (Group II)	2.6	Perinatal Conditions (Group I)	4.8
Cerebrovascular Disease (Group II)	4.6	Intentional Injuries (Group III)	2.4	Childhood Cluster Diseases (Group I)	3.9
Malaria (Group I)	3.6	Diabetes Mellitus (Group II)	1.8	Tuberculosis (Group I)	3.9
Intentional Injuries (Group III)	3.1	Genito-Urinary Diseases (Group II)	1.6	Digestive Diseases (Group II)	3.7
Respiratory Diseases (Group II)	2.7	Perinatal Conditions (Group I)	1.1	Intentional Injuries (Group III)	3.7
Digestive Diseases (Group II)	2.5	Inflammatory Heart Disease (Group II)	1.0	Malaria (Group I)	1.7
Nutritional Deficiencies (Group I)	1.8	Congenital Anomalies (Group II)	0.7	Genito-Urinary Conditions (Group II)	1.5
Maternal Conditions (Group I)	1.4	Tuberculosis (Group II)	0.5	Neuropsychiatric Conditions (Group II)	1.4
Congenital Anomalies (Group II)	1.3	HIV/AIDS (Group I)	0.4	Nutritional Deficiencies (Group I)	1.3
Genito-Urinary Diseases (Group II)	1.1	Rheumatic Heart Disease (Group II)	0.4	Congenital Anomalies (Group II)	1.2
HIV/AIDS (Group I)	0.9	Diarrhoeal Diseases (Group I)	0.3	Diabetes Mellitus (Group II)	1.1
Inflammatory Heart Disease (Group II)	0.8	Nutritional Deficiencies (Group I)	0.3	Inflammatory Heart Disease (Group II)	1.0
Neuropsychiatric Conditions (Group II)	0.8	Childhood Cluster Diseases (Group I)	0.1	Maternal Conditions (Group I)	0.9
Diabetes Mellitus (Group II)	0.7	Maternal Conditions (Group I)	0.0	Rheumatic Heart Disease (Group II)	0.7
Rheumatic Heart Disease (Group II)	0.4	Malaria (Group I)	0.0	HIV/AIDS (Group I)	0.6
Other (All Groups)	8.5	Other (All Groups)	11.2	Other (All Groups)	8.9
Total:	100.0	Total:	100.0	Total:	100.0
Other Causes of Interest					
Violence (Group III)	1.2	Violence (Group III)	0.5	Violence (Group III)	1.1
War (Group III)	1.1	War (Group III)	0.3	War (Group III)	1.0
TDR Diseases other than Malaria (Group I)	0.4	TDR Diseases other than Malaria (Group I)	0.0	TDR Diseases other than Malaria (Group I)	0.3

B2. Distribution of DALY Loss by Cause in Different Population Groups, 1990

Poorest 20 Percent of Global Population		*Richest 20 Percent of Global Population*		*Entire Global Population*	
Cause	*% of DALYS*	*Cause*	*% of DALYS*	*Cause*	*% of DALYS*
Principal Causes					
Respiratory Infections (Group I)	11.8	Neuropsychiatric Conditions (Group II)	22.1	Unintentional Injuries (Group III)	11.0
Diarrheal Diseases (Group I)	11.0	Malignant Neoplasms (Group II)	13.2	Neuropsychiatric Conditions (Group II)	10.5
Unintentional Injuries (Group III)	10.0	Unintentional Injuries (Group III)	9.6	Respiratory Infections (Group I)	8.5
Perinatal Conditions (Group I)	8.8	Ischaemic Heart Disease (Group II)	8.8	Diarrheal Diseases (Group I)	7.2
Childhood Cluster Diseases (Group I)	8.1	Cerebrovascular Disease (Group II)	5.2	Perinatal Conditions (Group I)	6.7
Neuropsychiatric Conditions (Group II)	5.4	Respiratory Diseases (Group II)	4.8	Childhood Cluster Diseases (Group I)	5.2
Nutritional Deficiencies (Group I)	4.5	Digestive Diseases (Group II)	4.5	Malignant Neoplasms (Group II)	5.1
Maternal Conditions (Group I)	3.9	Intentional Injuries (Group III)	3.8	Respiratory Disease (Group II)	4.4
Malaria (Group I)	3.9	Perinatal Conditions (Group I)	2.7	Intentional Injuries (Group III)	4.1
Tuberculosis (Group I)	3.8	Congenital Anomalies (Group II)	2.3	Nutritional Deficiencies (Group I)	3.7
Intentional Injuries (Group III)	3.1	Respiratory Infections (Group I)	2.2	Digestive Diseases (Group II)	3.4
Respiratory Diseases (Group II)	2.4	Diabetes Mellitus (Group II)	2.0	Ischaemic Heart Disease (Group II)	3.4
Malignant Neoplasms (Group II)	2.3	Genito-Urinary Diseases (Group II)	1.3	Cerebrovascular Diseases (Group II)	2.8
Digestive Diseases (Group II)	2.1	Nutritional Deficiencies (Group I)	1.2	Tuberculosis (Group I)	2.8
Congenital Anomalies (Group II)	2.0	HIV/AIDS (Group I)	0.9	Congenital Anomalies (Group II)	2.4
Ischaemic Heart Disease (Group II)	1.9	Diarrheal Diseases (Group I)	0.9	Malaria (Group I)	2.3
Cerebrovascular Disease (Group II)	1.5	Inflammatory Heart Disease (Group II)	0.8	Maternal Conditions (Group I)	2.2
HIV/AIDS (Group I)	1.0	Maternal Conditions (Group I)	0.6	Genito-Urinary Diseases (Group II)	1.1
Genito-Urinary Diseases (Group II)	0.7	Tuberculosis (Group II)	0.4	HIV/AIDS (Group I)	0.8
Inflammatory Heart Disease (Group II)	0.6	Childhood Cluster Diseases (Group I)	0.4	Diabetes Mellitus (Group II)	0.8
Diabetes Mellitus (Group II)	0.5	Rheumatic Heart Disease (Group II)	0.3	Inflammatory Heart Disease (Group II)	0.7
Rheumatic Heart Disease (Group II)	0.3	Malaria (Group I)	0.0	Rheumatic Heart Disease (Group II)	0.4
Other (All Groups)	10.4	Other (All Groups)	12.0	Other (All Groups)	10.5
Total:	100.0	Total:	100.0	Total:	100.0
Other Causes of Interest					
War (Group III)	1.3	Violence (Group III)	1.0	War (Group III)	1.5
TDR Diseases other than Malaria (Group I)	1.2	War (Group III)	0.6	Violence (Group III)	1.3
Violence (Group III)	1.1	TDR Diseases other than Malaria (Group I)	0.0	TDR Diseases other than Malaria (Group I)	0.8

B3. Mortality Gap between the Poorest and Richest 20 Percent of the Global Population, 1990

Cause of Death	*Percentage Reduction Needed To Eliminate Excess Deaths*	*Percentage of Total Poor-Rich Mortality Gap*
	Principal Causes	
Respiratory Infections (Group I)	89.5	17.1
Diarrheal Diseases (Group I)	96.2	15.5
Childhood Cluster Diseases (Group I)	97.5	10.9
Perinatal Conditions (Group I)	79.2	8.9
Tuberculosis (Group I)	97.5	8.7
Unintentional Injuries (Group III)	61.8	5.6
Malaria (Group I)	99.6	5.1
Ischaemic Heart Disease (Group II)	28.7	3.0
Cerebrovascular Disease (Group II)	43.7	2.9
Intentional Injuries (Group III)	59.8	2.7
Nutritional Deficiencies (Group I)	93.1	2.4
Respiratory Diseases (Group II)	56.7	2.2
Maternal Conditions (Group I)	98.6	2.0
Digestive Diseases (Group II)	52.9	1.9
Genito-Urinary Diseases (Group II)	65.0	1.0
HIV/AIDS (Group I)	75.6	1.0
Inflammatory Heart Disease (Group II)	66.5	0.8
Congenital Anomalies (Group II)	31.2	0.6
Rheumatic Heart Disease Group II)	75.7	0.5
Diabetes Mellitus (Group II)	42.0	0.4
Neuropsychiatric Conditions (Group II)	5.1	0.1
Malignant Neoplasms (Group II)	-9.5	-0.8
Other (All Groups)	70.8	7.5
Total	70.1	100.0
	Other Causes of Interest	
Violence (Group III)	75.5	1.3
War (Group III)	79.1	1.3
TDR Diseases other than Malaria (Group I)	99.9	0.6

Note: Figures in column labeled "Percentage Reduction Needed To Eliminate Excess Deaths" refer to the percentage by which the number of deaths in the global poorest 20 percent would decline if all age/gender-specific death rates in that population group for the disease concerned were to equal the corresponding rates of the global richest 20 percent. See text accompanying table 2 for a fuller explanation.

B4. DALY Gap between the Poorest and Richest 20 Percent of the Global Population, 1990

Cause of DALY Loss	*Percentage Reduction Needed To Eliminate Excess DALYs*	*Percentage of Total Poor-Rich DALY Gap*
	Principal Causes	
Respiratory Infections (Group I)	92.3	14.7
Diarrheal Diseases (Group I)	95.3	14.4
Childhood Cluster Diseases (Group I)	97.0	10.6
Perinatal Conditions (Group I)	79.9	9.5
Unintentional Injuries (Group III)	68.4	9.4
Nutritional Deficiencies (Group I)	90.0	5.4
Malaria (Group I)	99.6	5.2
Maternal Conditions (Group I)	95.5	5.1
Tuberculosis (Group I)	97.6	4.9
Intentional Injuries (Group III)	64.6	2.7
Respiratory Diseases (Group II)	56.1	1.8
Digestive Diseases (Group II)	53.9	1.6
HIV/AIDS (Group I)	74.4	1.0
Ischaemic Heart Disease (Group II)	37.2	1.0
Cerebrovascular Disease (Group II)	46.4	0.9
Congenital Anomalies (Group II)	28.2	0.8
Genito-Urinary Diseases (Group II)	67.0	0.7
Inflammatory Heart Disease (Group II)	68.2	0.5
Rheumatic Heart Disease Group II)	82.1	0.3
Diabetes Mellitus (Group II)	28.7	0.2
Malignant Neoplasms (Group II)	5.0	0.2
Neuropsychiatric Conditions (Group II)	-7.6	-0.6
Other	76.7	9.7
Total:	74.3	100.0
	Other Causes of Interest	
TDR Diseases other than Malaria (Group I)	99.4	1.6
War (Group III)	81.5	1.5
Violence (Group III)	71.2	1.1

Note: Figures in column labeled "Percentage Reduction Needed To Eliminate Excess Deaths" refer to the percentage by which the number of deaths in the global poorest 20 percent would decline if all age/gender-specific death rates in that population group for the disease concerned were to equal the corresponding rates of the global richest 20 percent. See text accompanying table 2 for a fuller explanation.

B5 Concentration of Global Deaths among Different Population Groups, 1990

Deaths among the Global Poorest 20 Percent		*Deaths among the Global Richest 20 Percent*	
Cause	*% of Total Global Deaths*	*Cause*	*% of Total Global Deaths*
Principal Causes			
Malaria (Group I)	57.9	Malignant Neoplasms (Group II)	35.3
Childhood Cluster Diseases (Group I)	55.0	Ischaemic Heart Disease (Group II)	35.2
Diarrheal Diseases (Group II)	53.2	Neuropsychiatric Conditions (Group II)	35.0
Perinatal Conditions (Group I)	45.0	Diabetes Mellitus (Group II)	28.9
Tuberculosis (Group I)	44.4	Cerebrovascular Diseases (Group II)	25.7
Maternal Conditions (Group I)	43.2	Digestive Diseases (Group II)	21.0
Respiratory Infections (Group I)	42.6	Genito-Urinary Diseases (Group II)	21.0
HIV/AIDS (Group I)	41.8	Inflammatory Heart Disease (Group II)	18.2
Nutritional Deficiencies (Group I)	39.1	Respiratory Diseases (Group II)	15.4
Congenital Anomalies (Group II)	30.0	Unintentional Injuries (Group III)	13.7
Unintentional Injuries (Group III)	27.2	HIV/AIDS (Group II)	13.2
Inflammatory Heart Disease (Group II)	23.8	Intentional Injuries (Group III)	12.1
Intentional Injuries (Group III)	23.6	Congenital Anomalies (Group II)	11.0
Genito-Urinary Diseases (Group II)	21.0	Rheumatic Heart Disease (Group II)	10.1
Digestive Diseases (Group II)	19.0	Respiratory Infections (Group I)	8.6
Rheumatic Heart Disease (Group II)	18.2	Nutritional Deficiencies (Group I)	4.5
Diabetes Mellitus (Group II)	17.2	Perinatal Conditions (Group I)	4.3
Neuropsychiatric Conditions (Group II)	16.6	Tuberculosis (Group I)	2.3
Ischaemic Heart Disease (Group II)	16.3	Diarrheal Diseases (Group I)	1.1
Cerebrovascular Disease (Group II)	14.6	Maternal Conditions (Group I)	0.7
Malignant Neoplasms (Group II)	12.9	Childhood Cluster Diseases (Group I)	0.7
Respiratory Diseases (Group II)	12.7	Malaria (Group I)	0.2
Other (All Groups)	37.6	Other (All Groups)	12.5
Total	27.6	Total	18.6
Other Causes of Interest			
TDR Diseases other than Malaria (Group I)	46.5	Violence (Group III)	7.8
War (Group III)	31.3	War (Group III)	5.0
Violence (Group III)	29.6	TDR Diseases other than Malaria (Group I)	0.1

Note: Figures refer to the percentage of total global deaths from the disease concerned that occur in the specified population group. For example, the figure “57.9” in the uppermost cell of the second column indicates that 57.9 percent of all deaths from malaria in the world occur among the poorest 20 percent of the world’s population.

B6 Concentration of DALY Loss among Different Population Groups, 1990

DALY Loss among the Global Poorest 20 Percent		*DALY Loss among the Global Richest 20 Percent*	
Cause	*% of Total Global DALYs*	*Cause*	*% of Total Global DALYs*
Principal Causes			
Maternal Conditions (Group I)	62.8	Ischaemic Heart Disease (Group II)	26.9
Malaria (Group I)	58.0	Malignant Neoplasms (Group II)	26.8
Childhood Cluster Diseases (Group I)	54.2	Diabetes Mellitus (Group II)	25.4
Diarrheal Diseases (Group II)	52.4	Neuropsychiatric Conditions (Group II)	21.8
Respiratory Infections (Group I)	47.9	Cerebrovascular Diseases (Group II)	19.3
Tuberculosis (Group I)	46.3	Digestive Diseases (Group II)	13.5
Perinatal Conditions (Group I)	45.4	Genito-Urinary Diseases (Group II)	11.9
HIV/AIDS (Group I)	43.1	HIV/AIDS (Group I)	11.7
Nutritional Deficiencies (Group I)	42.1	Respiratory Diseases (Group II)	11.4
Unintentional Injuries (Group III)	31.2	Inflammatory Heart Disease (Group II)	10.5
Congenital Anomalies (Group II)	29.0	Congenital Anomalies (Group II)	10.0
Inflammatory Heart Disease (Group II)	26.8	Intentional Injuries (Group III)	9.6
Intentional Injuries (Group III)	26.1	Unintentional Injuries (Group III)	9.0
Genito-Urinary Diseases (Group II)	23.2	Rheumatic Heart Disease (Group II)	6.3
Rheumatic Heart Disease (Group II)	23.1	Perinatal Conditions (Group I)	4.2
Digestive Diseases (Group II)	21.4	Nutritional Deficiencies (Group I)	3.4
Diabetes Mellitus (Group II)	19.9	Maternal Conditions (Group I)	3.0
Ischaemic Heart Disease (Group II)	19.6	Respiratory Infections (Group I)	2.7
Respiratory Diseases (Group II)	19.0	Tuberculosis (Group I)	1.5
Cerebrovascular Disease (Group II)	17.9	Diarrheal Diseases (Group I)	1.3
Neuropsychiatric Conditions (Group II)	17.6	Childhood Cluster Diseases (Group I)	0.8
Malignant Neoplasms (Group II)	15.8	Malaria (Group I)	0.2
Other (All Groups)	37.3	Other (All Groups)	10.0
Total:	34.4	Total:	10.4
Other Causes of Interest			
TDR Diseases other than Malaria (Group I)	50.5	Violence (Group III)	8.6
War (Group III)	31.5	War (Group III)	4.5
Violence (Group III)	29.9	TDR Diseases other than Malaria (Group I)	0.3

Note: Figures refer to the percentage of total global DALY loss from the disease concerned that occur in the specified population group. For example, the figure "62.8" in the uppermost cell of the second column indicates that 62.8 percent of all DALY loss from malaria in the world occurs among the poorest 20 percent of the world's population.