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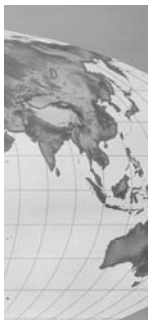
Part I

# Global Burden of Disease and Risk Factors

Chapter **2**



# Demographic and Epidemiological Characteristics of Major Regions, 1990–2001

Alan D. Lopez, Stephen Begg, and Ed Bos

Health status is both a determinant of population change, largely through population aging, and a consequence of population growth, with smaller family size associated with lower mortality, and of economic and social development. Studies of the interrelationship between demographic trends and health have typically focused on health as the independent or determining variable. Indeed, a population's health status influences all components of population change. In addition to the obvious direct effect of individual health status on mortality and morbidity, it has a direct impact on fertility, largely through improved child survival, but also through the biological capability of a sick woman to bear children. Processes such as screening potential migrants for disease are also mechanisms whereby health status exerts a direct impact on population change, and thus on population size and composition.

In contrast, demographic variables influence health through two interrelated phenomena. First, a population's size, composition by age and sex, and geographical distribution have a direct influence on overall health status. Age has a particularly marked effect on the pattern and extent of ill-health in populations because of the strong relationship between age and mortality and morbidity. Second, each of the dynamic processes influencing population size and growth, structure, and distribution, namely, fertility, mortality, and migration, will also affect health status. Thus, any discussion of disease control priorities and of the health system for delivering interventions requires an understanding of the demographic context and how it is changing.

This chapter begins by providing an overview of global population trends in each major region of the world and the current size and composition of the population. Given this volume's focus on the descriptive epidemiology of diseases, injuries, and risk factors, we then examine trends in mortality over the past decade in more detail as background against which the current assessment of the disease burden might be more usefully interpreted. This includes both an assessment of trends in age-specific mortality and summary measures of the age schedule of mortality, such as life expectancy and the probability of dying within certain age ranges, as well as a specific discussion of trends in the main causes of child mortality. The focus on child mortality is entirely appropriate because (a) the fact that at the end of

the 20th century, we remained woefully ignorant of its levels, let alone its causes, is highlighted; (b) the reduction of child mortality should remain a priority for global health development efforts, and the moral imperative to do so remains as relevant today as it was 30 years ago, when efforts to improve child survival became increasingly organized and focused; and (c) the resulting emphasis by the global public health community on reducing child mortality has yielded vastly more epidemiological information that can be used to assess trends in levels and causes. Nevertheless, we argue later in the chapter that large and unacceptable uncertainties about trends in cause-specific child mortality rates persist, with important implications for program planning and evaluation.

## REGIONAL DEMOGRAPHIC CHARACTERISTICS

The key characteristics of regional demography of concern for health services provision include the size, age structure, and sex structure of the population and its rate of growth and comparative measures of fertility and mortality.

### Sources of Population Data and Methodology

The population and mortality estimates for various regions summarized here are based on different data sources and methods, and thus are not strictly comparable. This primarily concerns the impact of different estimates of deaths by age and sex on population size and structure. Because the effect of mortality on population size and structure is generally modest, such differences have little impact on the findings reported in this chapter. The population estimates are based on data the United Nations (UN) Population Division compiled and analyzed for its biennial assessment of global population trends and regional demographic patterns (United Nations 2003). The UN Population Division estimates population size and vital rates (births and deaths) from censuses, vital registration, and demographic and health surveys and evaluates the data for completeness, accuracy, and consistency. Where necessary, it adjusts the data to achieve internal consistency and cross-country comparability. The baseline from which the UN projections are made is mid-2003. Because the 2002 revision was produced without complete data for 2001 for all countries, the baseline estimates are also projections, and the population figures in this chapter are therefore a mixture of both observed and projected data.[1]

The UN Population Division assesses a number of demographic parameters to produce country projections. In addition to total population, the baseline assessment includes a breakdown of population by sex and age (in five-year aggregates). Fertility is specified as age-specific fertility rates for females and mortality rates are based on survival probabilities from life tables. Age-specific patterns of migration are also incorporated for countries in which migration flows are observed or are thought to occur. When these inputs are not available from any of the sources listed earlier, the UN uses demographic models, such as model life tables or indirect mortality estimation techniques, to generate the information. Additional modeling is applied to estimate mortality patterns in countries with significant HIV/AIDS prevalence levels.

The UN Population Division provides a limited amount of information about the data in its reports, including the dates of censuses, the adjustment factors applied to total census populations, and the type and year of the latest surveys that contained mortality and fertility estimates. It does not provide information about the adjustments made to reported fertility rates, age and sex structures, or mortality rates. Basic information on population size and composition is available for most countries for 1990, and with the exception of Sub-Saharan Africa, for 2000 (or thereabouts) as well (table 2.1). Around both dates, censuses covered more than 90 percent of populations in all the regions except Sub-Saharan Africa. Thus, the basic population estimates developed by the UN Population Division and summarized in this chapter have a reasonable evidence base.

The UN projections of population size and vital rates are based on assumptions about levels and trends in vital rates. Fertility is assumed to follow a path modeled on the experience of countries with declining fertility, except when a country's recent fertility trend deviates considerably from

**Table 2.1** Percentage of Regional Population Covered by Censuses, circa 1990 and 2000

| Region | 1990 | 2000 |
|---|---|---|
| East Asia and Pacific | 95.7 | 96.2 |
| Europe and Central Asia | 100.0 | 93.9 |
| Latin America and the Caribbean | 95.2 | 91.9 |
| Middle East and North Africa | 96.9 | 98.6 |
| South Asia | 87.0 | 98.1 |
| Sub-Saharan Africa | 81.6 | 53.4 |
| High-income countries | 90.2 | 99.0 |

*Source:* U.S. Census Bureau, Population Division, International Programs Center (July 7, 2004).

the model pattern, in which case the country-specific pattern is followed (United Nations 2003).

Our 2001 estimates and future projections are generated on the basis of the cohort component methodology. This approach applies estimated trends in birth and death rates and migration by age and sex to a baseline age and sex structure. Population growth rates are determined by the levels of age-specific fertility and mortality rates and migration and the size of the initial age groups (base year population) against which these levels are applied. We constructed demographic estimates for the aggregate regional and income groupings used for the second edition of *Disease Control Priorities in Developing Countries* (Jamison and others 2006) from the UN Population Division country-level estimates by aggregating populations in specific age and sex groups and age-specific fertility rates. The aggregates are thus weighted by the different population sizes of individual countries.

The mortality estimates presented in this chapter are developed from other sources using methods different than those the UN employed, as described later. As a result, the age and sex structures reported here, as well as any indicators derived from them (such as crude birth and death rates) are not strictly internally consistent. In particular, the mortality rates estimated for this chapter would, in some cases, have produced different age and sex population structures than those estimated by the UN, as well as different numbers of births and deaths. These differences are unlikely to be large, however, as the estimated age-specific mortality rates reported later in this chapter agree quite closely with those of the UN, except for Sub-Saharan Africa.

### Population Size and Growth

Between 1990 and 2001, global population increased from about 5.3 billion to 6.1 billion people, an average rate of increase of 1.4 percent per year, equivalent to about 220,000 people per day (table 2.2). During the decade, the growth rate in developing regions ranged from 0.2 percent in Europe and Central Asia to 2.6 percent in Sub-Saharan Africa.

Estimates at the global level conceal large differences in population growth among regions, which in turn consist of countries that may have quite different demographic trends. For example, Europe and Central Asia added just 1 million people per year between 1990 and 2001, whereas South Asia added 25 million people each year.

The World Bank regions (see map 1 inside the front cover of this volume) vary substantially in terms of population size, with East Asia and the Pacific accounting for about 30 percent of the global population and South Asia for roughly another 20 percent. Thus, about half the world's population live in the low- and middle-income countries of these two regions. The smallest region in terms of population size is the Middle East and North Africa, with just 5 percent of the world's population. Just over 10 percent of the world's population live in Sub-Saharan Africa. Another 15 percent live in high-income countries, a proportion that is declining.

### Distribution by Age, Sex, and Location

How populations are distributed by age matters a great deal for public health, because many aspects of risk behavior, as well as disease and injury outcomes, are strongly associated with age. While many other factors contribute to mortality and fertility levels, the age distribution of a population is an important factor in explaining differences in demographic and epidemiological indicators. Regions differ significantly in how their populations are distributed across age groups, with almost 45 percent of the population of Sub-Saharan Africa being younger than 15, compared with 20 percent of the population in high-income countries, where fertility has been low for decades. Nevertheless, the trends during 1990–2001 show a great deal of similarity: in all regions the proportion of the population in the youngest age groups was lower in 2001 than in 1990, with most of the increase occurring in the 15 through 69 age group. As a result, the median age of the population has increased in all regions. At the same time, the population aged 70 and older has been increasing in most regions as mortality has declined, and this age group now represents more than 10 percent of the population in the high-income countries.

These changes in the relative age distribution of populations since 1990 reflect changes in the growth rates of different age groups (figure 2.1). In three of the six regions (East Asia and Pacific, Europe and Central Asia, and the Middle East and North Africa), as well as the world as a whole, the number of children under five was smaller in absolute terms in 2001 than in 1990. The highest growth rates during this period were in the 40- through 55-year-old age group and among those over 70. The irregularities in growth rates of different age groups reflect past trends in the initial size of each cohort and its subsequent mortality and migration experiences. This is particularly evident for Europe and Central Asia, where the impact of the regional conflicts in the early 1990s on demographic structure is particularly evident.

**Table 2.2** Population Size and Composition, Fertility, and GNP, by World Bank Region, 1990 and 2001

| | Low- and middle-income countries | | East Asia and Pacific | | Europe and Central Asia | | Latin America and the Caribbean | |
|---|---|---|---|---|---|---|---|---|
| **Population Characteristic** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** |
| *Size* | | | | | | | | |
| Total population (thousands) | 4,398,401 | 5,216,587 | 1,625,868 | 1,848,388 | 467,797 | 477,116 | 439,709 | 525,864 |
| Proportion of world population (%) | 83.6 | 84.9 | 30.9 | 30.1 | 8.9 | 7.8 | 8.4 | 8.6 |
| Annual average growth rate, 1990–2001 (%) | 1.6 | | 1.2 | | 0.2 | | 1.6 | |
| *Composition (%)* | | | | | | | | |
| Age | | | | | | | | |
| 0–14 | 34.8 | 31.8 | 30.2 | 26.5 | 26.5 | 21.8 | 36.2 | 31.5 |
| 15–59 | 57.6 | 59.8 | 61.8 | 64.1 | 59.5 | 62.6 | 56.8 | 60.4 |
| 60–69 | 4.7 | 5.0 | 4.9 | 5.6 | 8.3 | 8.5 | 4.2 | 4.5 |
| 70+ | 2.9 | 3.4 | 3.0 | 3.8 | 5.6 | 7.2 | 2.9 | 3.6 |
| Urban | 36.9 | 41.6 | 28.8 | 37.0 | 63.2 | 63.5 | 71.1 | 75.4 |
| Female | 49.4 | 49.5 | 48.9 | 49.0 | 51.9 | 51.9 | 50.3 | 50.5 |
| *Fertility* | | | | | | | | |
| Total fertility rate | 3.5 | 2.9 | 2.6 | 2.1 | 2.3 | 1.6 | 3.2 | 2.6 |
| Total no. of births (thousands) | 123,400 | 122,400 | 36,200 | 31,500 | 8,300 | 6,300 | 11,700 | 11,600 |
| Crude birth rate per 1,000 | 28.2 | 23.4 | 22.3 | 17.0 | 16.7 | 12.7 | 26.6 | 22.0 |
| *GNP (exchange rate dollars)* | | | | | | | | |
| GNP per capita | 870 | 1,170 | 420 | 890 | 39,737 | 54,933 | 2,260 | 3,570 |

*Source:* UN Population Division 2002 revision estimates.
*Note:* GNP = gross national product.

Along with the progressive aging of the population, the relentless trend toward increasing urbanization has continued, with consequences for health in terms of both health service provision, which, in principle, is better with urbanization, and risk of exposure to chronic disease, which is, on balance, worse (Ezzati and others 2005). Almost half the world's population lived in urban areas in 2001, up 4 percentage points from 1990. The increase in urbanization was particularly marked in East Asia and the Pacific (increase from 29 to 37 percent of the population) and in Sub-Saharan Africa (from 28 to 34 percent). Overall, 42 percent of the population in low- and middle-income countries now live in urban areas.

In general, more boys than girls are born, with sex ratios at birth of between 1.03 and 1.06 in most countries, though in some Asian countries, sex-selective abortions have skewed this ratio to more than 1.10. Differential mortality and, to a limited extent, migration, shape the sex ratio at other ages (figure 2.2). In South Asia, higher mortality for girls and for women during their childbearing years leads at first to an increasing and then to a constant sex ratio to about age 45, after which male mortality is higher. Excess mortality of adult males in Europe and Central Asia explains the particularly low sex ratio observed there (Lopez and others 2002). In all regions, the higher mortality of males relative to females accounts for the sharp decline in the population sex ratio after age 50 or thereabouts.

The overall effects of the age-specific mortality differences between the sexes are relatively minor in terms of total population sex ratios. All regions have roughly equal numbers of males and females in the population, with the proportion of males being slightly higher in Europe and Central Asia and in the high-income regions (51 to 52 percent) than in East Asia and the Pacific and South Asia (49 percent).

## Fertility

Table 2.2 shows recent trends in fertility, as indicated by the total fertility rate for the period, that is, the average number of children a woman could expect to have if she were subject indefinitely to current age-specific fertility rates. Even though fertility levels vary a good deal among regions, all low- and middle-income regions witnessed large declines in fertility levels during the 1990s. Overall fertility levels in low- and middle-income countries fell by almost 20 percent over the decade, a remarkable decline, with levels falling by as much as 33 percent in the Middle East and North Africa, and even by 10 percent in Sub-Saharan Africa. However, fertility rates in Sub-Saharan Africa remain high, with the total fertility rate of 5.6 being about twice as high as that for any other region.

**Table 2.2** Continued

| Middle East and North Africa | | South Asia | | Sub-Saharan Africa | | High-income | | World | |
|---|---|---|---|---|---|---|---|---|---|
| 1990 | 2001 | 1990 | 2001 | 1990 | 2001 | 1990 | 2001 | 1990 | 2001 |
| 243,973 | 309,762 | 1,117,887 | 1,387,873 | 503,166 | 667,583 | 862,342 | 928,110 | 5,260,742 | 6,144,696 |
| 4.6 | 5.0 | 21.2 | 22.6 | 9.6 | 10.9 | 16.4 | 15.1 | 100.0 | 100.0 |
| 2.2 | | 2.0 | | 2.6 | | 0.7 | | 1.4 | |
| 43.1 | 36.4 | 37.8 | 35.3 | 45.7 | 44.3 | 20.0 | 18.5 | 32.4 | 29.8 |
| 51.5 | 57.7 | 55.7 | 57.6 | 49.7 | 51.0 | 62.5 | 62.2 | 58.4 | 60.2 |
| 3.5 | 3.6 | 4.2 | 4.4 | 3.0 | 3.0 | 9.0 | 9.1 | 5.4 | 5.6 |
| 1.9 | 2.4 | 2.3 | 2.7 | 1.6 | 1.7 | 8.5 | 10.2 | 3.8 | 4.5 |
| 53.5 | 57.5 | 25.0 | 27.4 | 27.9 | 34.0 | 74.4 | 77.1 | 43.0 | 46.9 |
| 49.0 | 49.3 | 48.4 | 48.5 | 50.4 | 50.4 | 51.0 | 50.8 | 49.6 | 49.7 |
| 5.0 | 3.6 | 4.3 | 3.4 | 6.3 | 5.6 | 1.7 | 1.7 | 3.2 | 2.7 |
| 9,300 | 9,400 | 36,500 | 37,300 | 21,400 | 26,300 | 11,300 | 10,800 | 134,700 | 133,200 |
| 34.8 | 27.3 | 32.7 | 26.7 | 44.6 | 40.8 | 13.4 | 11.9 | 25.7 | 21.6 |
| 1,770 | 3,570 | 380 | 450 | 470 | 550 | 19,760 | 26,760 | 4,060 | 5,180 |

Few low- and middle-income countries experienced increasing fertility during 1990–2001,[2] though a few high-income countries have seen small upturns from previously low levels. Fertility is below replacement levels (about two children) in all but five high-income countries (Brunei Darussalam, Israel, Kuwait, Qatar, and the United Arab Emirates), as well as in most countries in Europe and Central Asia. When fertility drops to below replacement levels, population growth often continues for several decades, as the number of births exceeds the number of deaths because of the high proportion of women of childbearing age.

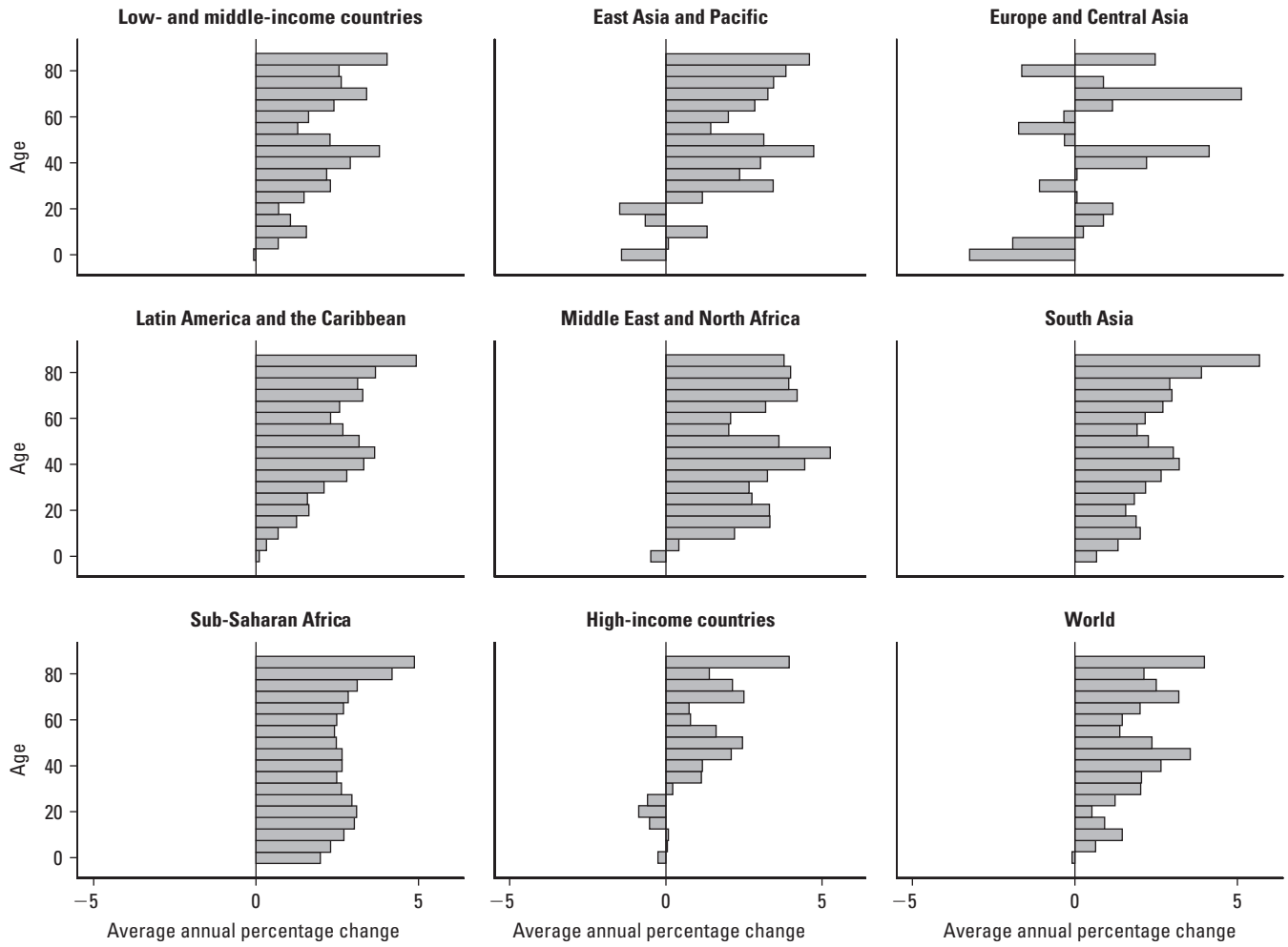
## CHANGES IN MORTALITY, 1990–2001

Change in patterns of mortality is a major determinant of the demography of populations and underlies important population differentials. For example, the differences in mortality by sex across regions contribute to the variable pattern of population sex ratios described earlier. The theory of demographic transition suggests that the rapid declines in fertility observed during the 1990s in most regions would be preceded, and perhaps accompanied, by a similarly rapid decline in child mortality. To help interpret the broad regional demographic patterns described earlier, a review of trends in mortality and the causes underlying such trends is useful.

### Estimating Mortality

Various methods are available to estimate age patterns and levels of mortality in populations. These fall into three broad categories depending on the available data: direct estimation from complete vital registration, estimates from vital registration corrected for undercounting, and estimates derived from models based on child mortality levels. Mathers and others (2005) review the availability and quality of mortality data and group the 192 member states of the World Health Organization into broad categories according to criteria pertaining to the coverage, completeness, and quality of cause of death data. Their findings indicate that only about 33 percent (64) of World Health Organization member states, mostly high-income countries, have complete mortality data and that another 26 percent (50 countries) have data that can be used for mortality estimation purposes. The approximately 40 percent of remaining countries either have no recent data or no data at all that can be used to estimate causes of death or the level of adult mortality directly.

The situation is somewhat different for levels of child mortality, where decades of interest in monitoring child survival by the global public health community have yielded either direct or indirect estimates of child mortality for all but a handful of countries (Hill and others 1999; Lopez and others 2002). Based on a careful review of the time trend of



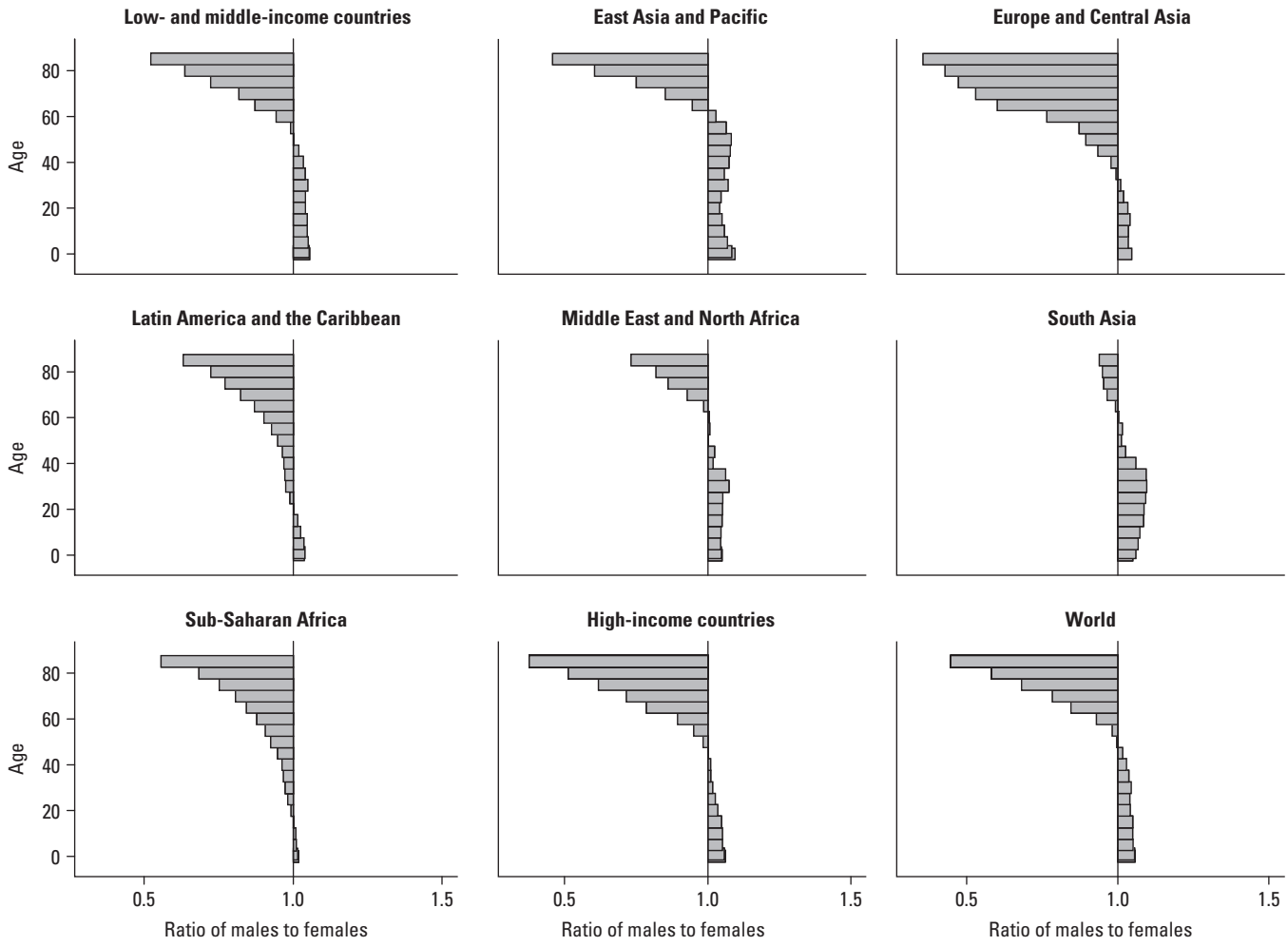

*Source:* Calculated from United Nations 2003.

**Figure 2.1** Changes in Population Age Distribution, 1990–2001

these estimates of child deaths, which come primarily from censuses and surveys, estimating child mortality levels in 1990 and 2001 is possible for virtually all countries with an acceptable level of uncertainty. Levels of child mortality are unavailable for only about 10 countries that together account for about 2 percent of child deaths (Lopez and others 2002). Formal curve-fitting procedures to estimate time trends in child mortality can be applied to all the data, but given the subjective assessments that are required to judge which data points are plausible and which are not, simple averaging of all plausible observations at any given point in time is likely to be sufficient, and this was the procedure used to estimate child mortality levels for this chapter.

For those countries with complete vital registration data, age-specific and cause-specific death rates are easily derived directly from the registration data and from population censuses. For those countries where registration data are incomplete, demographers have developed indirect demographic methods to correct for underreporting of deaths before estimating age-specific mortality (Bennett and Horiuchi 1984; Hill 1987). These countries include China and India, where application of such methods suggest that data from the disease surveillance points system in China and the sample registration system in India are 85 to 90 percent complete (Mari Bhat 2002; Rao and others 2005).

For countries with no usable data on adult mortality levels, age-specific death rates were predicted from the modified logit life table system (Murray and others 2003). The median level of adult mortality was predicted based on a modeled relationship between adult and child mortality as determined from a historical data set of more than 1,800 life tables judged to be reasonably complete. Uncertainty about these predicted mean values of adult mortality is considerable given the few observations with comparatively




*Source:* Calculated from United Nations 2003.

**Figure 2.2** Population Sex Ratios at Different Ages, 2001

high levels of child and adult mortality. The estimated and predicted levels of child and adult mortality, respectively, were then applied to the modified life table system by selecting the best match from among 50,000 life tables to estimate a complete, smoothed set of age-specific death rates (Murray and others 2003). This method was applied for all but about 70 countries.

Obvious uncertainties are associated with this procedure. Hence, the life tables for East Asia and the Pacific, the Middle East and North Africa, and Sub-Saharan Africa (where HIV/AIDS mortality was added to the predicted adult mortality rates) in particular need to be viewed with caution, because the rates for many countries in these regions have been modeled using these methods.

Identical methods were applied to estimate national age-specific mortality rates for both 1990 and 2001; thus, the two sets of estimates are, in principle at least, comparable. Annex 2A provides detailed estimates of summary measures of mortality by country for the two years based on these methods. The annex also shows the percentage decline in child mortality during the period.

Whether these methods correctly describe levels and patterns of mortality is difficult to ascertain given the substantial uncertainties in the data, particularly for adult mortality. The only other systematic attempt to estimate national and global death rates in 1990 is that of the UN Population Division (United Nations 2003). Figure 2.3 presents estimated mortality parameters for 1990 by region. For a comparison of mortality estimates for 2001, see Lopez and others (2002).

Despite the UN's different model life table approach for estimating age-specific death rates based on child mortality, the two sets of estimates shown in figure 2.3 are remarkably congruent. Regional estimates of child mortality ${}_5q_0$ (the

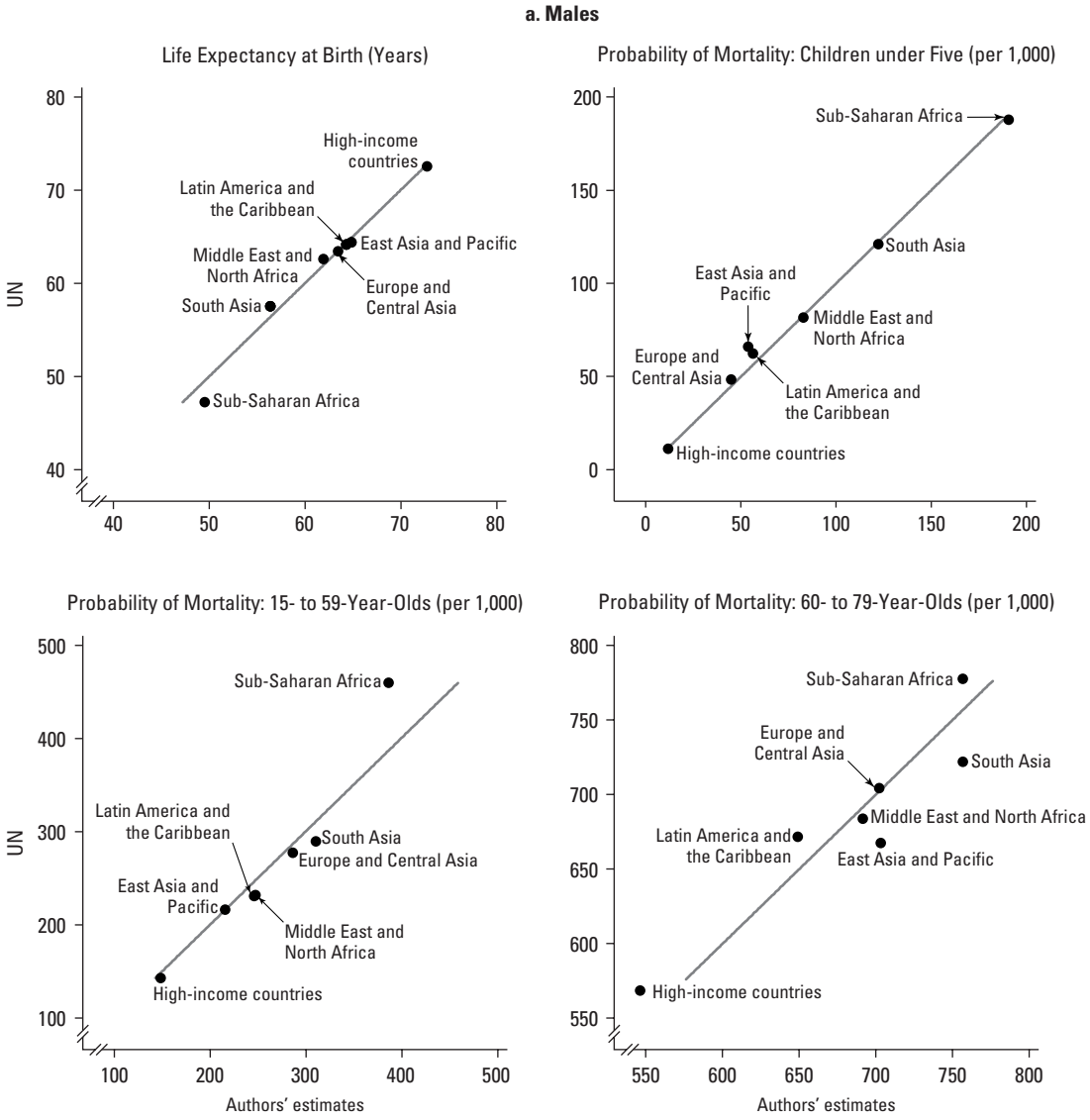
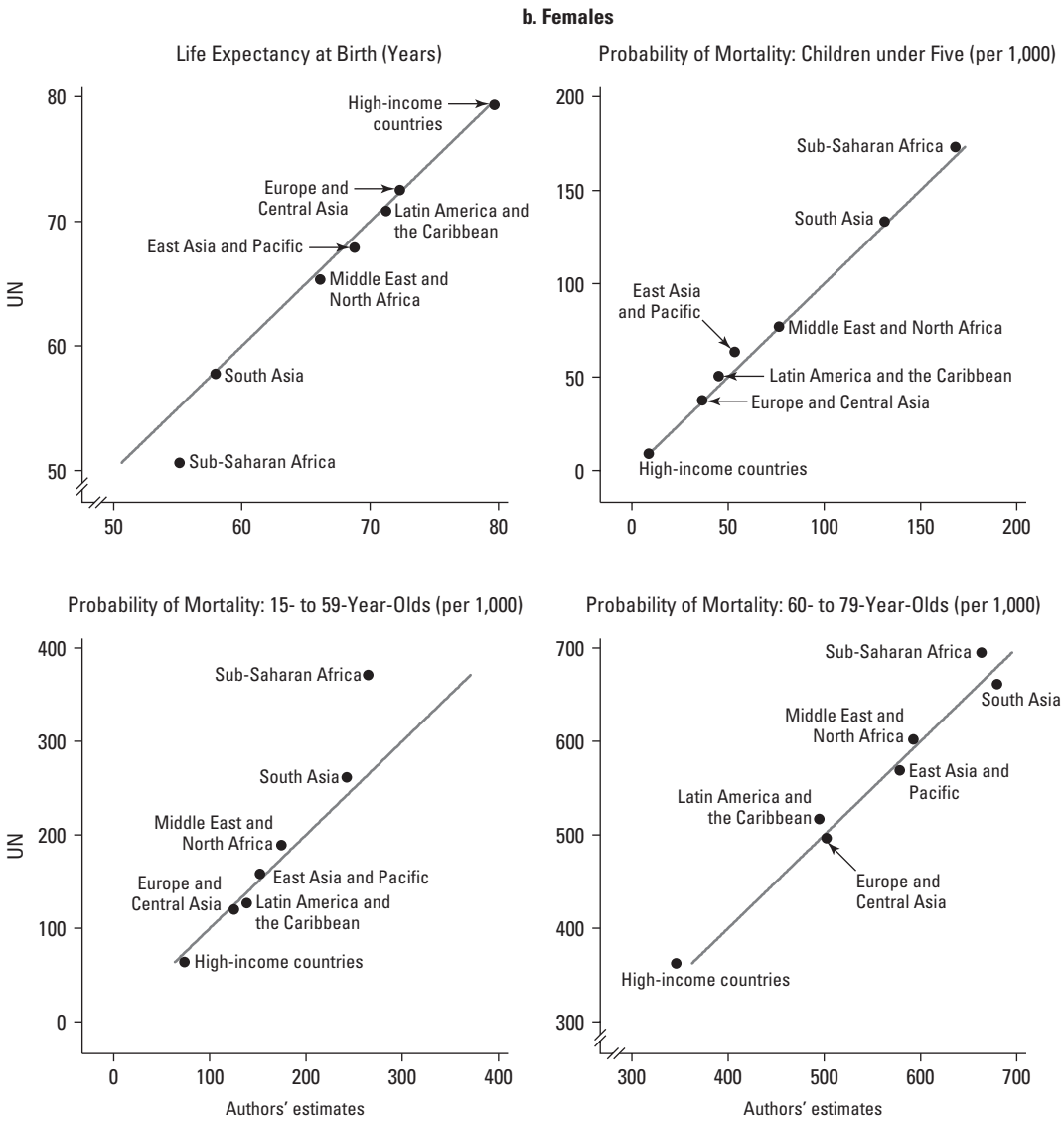



**Figure 2.3** UN's versus Authors' Life Table Parameters, 1990

mortality risk for children under five years of age) are virtually identical, with a possible exception being the UN's slightly higher levels of child mortality for East Asia and the Pacific (which is dominated by China). This congruence is not unexpected given the intense collaborative efforts of the past five years or so by the World Health Organization, the United Nations Children's Fund, the United Nations, and the World Bank to agree upon a common interpretation of the extensive data available on trends in child mortality in low- and middle-income countries.

Somewhat surprisingly given the quite different methodological approaches, regional estimates of adult mortality ${}_{45}q_{15}$ (the mortality risk for adults between the ages of 15 and 60) are remarkably similar, with our estimates tending to be slightly higher in the Middle East and North Africa and South Asia for males and slightly lower in the same regions for females. That is, we have estimated larger sex mortality differentials among adults than the UN on the basis of observed patterns of mortality where data were available (as in the Arab Republic of Egypt and India), and where not, on the basis of observed differences in child mortality for boys and girls. Some investigators expect male excess mortality to increase with social development and economic growth (Bhatia 1983), but whether this is better reflected in our estimates or those of the UN is not clear. In any case, the differences are minor. Significantly more disagreement is apparent for Sub-Saharan Africa, with the UN estimates of adult mortality in 1990 being one-quarter to one-third higher than ours. This is obviously




*Sources:* UN parameters are from United Nations 2005b; authors' estimates are from this chapter.

**Figure 2.3** Continued

uncertain given the sparse data available on adult mortality in the region and the fact that the HIV epidemic in Sub-Saharan Africa was well established by then, and hence a higher estimate may be justified. Recent evidence, however, has suggested that basing mortality estimates on prenatal clinic data may well lead to an overestimation of death rates due to HIV.

Differences in methodology and adjustment criteria appear to have the greatest effect at older ages, especially for males. The UN estimates indicate significantly higher mortality in high-income countries at ages 60 to 79 even though complete vital registration data are available for virtually all the countries except some of the small Gulf states. Differences in estimated mortality for the Sub-Saharan Africa region are not unexpected given the differences reported for younger adults, and are less extreme than at ages 15 to 59, as one might expect given that HIV/AIDS mortality is not of major consequence for older ages. Otherwise, estimates for females at older ages agree quite closely, but the UN's are significantly higher than ours for Latin America and the Caribbean and significantly lower for East Asia and the Pacific and South Asia. These differences arise because the model life table methods used by the UN tend to shift deaths from younger to older adult ages at lower levels of child mortality (Latin America and the Caribbean) and the converse at higher levels of child death rates (East Asia and the Pacific and South Asia).

**Table 2.3** Selected Mortality Characteristics by Sex and World Bank Region, 1990 and 2001

| | | Male | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | % of deaths | | Probability of dying per 1,000 | | | | Expectation of life at |
| Sex and region | Year | Deaths (millions) | Crude death rate per 1,000 | Under age 5 | Over age 60 | Ages 0–5[a] | Ages 15–60 | Ages 0–60 | Ages 60–80 | birth (years) |
| Low- and middle-income countries | 1990 | 22.5 | 10.1 | 27.9 | 39.5 | 98 | 269 | 351 | 712 | 59.9 |
| | 2001 | 25.5 | 9.7 | 21.2 | 42.2 | 86 | 269 | 341 | 667 | 61.2 |
| East Asia and Pacific | 1990 | 6.6 | 8.0 | 16.3 | 50.6 | 54 | 215 | 265 | 699 | 64.9 |
| | 2001 | 6.9 | 7.4 | 10.2 | 56.2 | 41 | 189 | 228 | 623 | 67.8 |
| Europe and Central Asia | 1990 | 2.5 | 11.1 | 7.9 | 55.9 | 45 | 286 | 323 | 696 | 63.6 |
| | 2001 | 3.0 | 13.0 | 3.2 | 59.6 | 32 | 328 | 353 | 711 | 63.0 |
| Latin America and the Caribbean | 1990 | 1.7 | 7.8 | 19.5 | 44.7 | 56 | 245 | 294 | 640 | 64.5 |
| | 2001 | 1.8 | 7.0 | 12.4 | 49.1 | 38 | 218 | 252 | 572 | 67.6 |
| Middle East and North Africa | 1990 | 1.0 | 8.2 | 34.9 | 34.2 | 83 | 247 | 318 | 688 | 62.0 |
| | 2001 | 1.1 | 6.8 | 21.6 | 45.2 | 56 | 216 | 267 | 674 | 65.2 |
| South Asia | 1990 | 6.8 | 11.7 | 32.4 | 35.0 | 122 | 310 | 407 | 754 | 56.4 |
| | 2001 | 7.1 | 9.9 | 25.1 | 39.2 | 94 | 285 | 362 | 710 | 59.9 |
| Sub-Saharan Africa | 1990 | 3.9 | 15.6 | 54.1 | 17.0 | 191 | 386 | 517 | 758 | 49.6 |
| | 2001 | 5.6 | 16.9 | 42.2 | 16.9 | 178 | 518 | 616 | 760 | 46.0 |
| High-income countries | 1990 | 3.9 | 9.1 | 1.7 | 76.2 | 12 | 148 | 160 | 542 | 72.9 |
| | 2001 | 4.0 | 8.8 | 1.0 | 78.7 | 7 | 124 | 132 | 469 | 75.5 |
| World | 1990 | 26.4 | 10.0 | 24.0 | 44.8 | 91 | 245 | 323 | 667 | 61.7 |
| | 2001 | 29.5 | 9.6 | 18.5 | 47.2 | 80 | 243 | 312 | 618 | 63.1 |

*Sources:* Estimates for 1990 are authors' calculations, based on country-level life tables (see annex 2A). Estimates for 2001 are derived from Lopez and others 2002.
a. Estimates of child mortality are rounded to the nearest whole number.

Overall, as figure 2.3 demonstrates, the age patterns are largely compensatory, with the result that estimates of life expectancy at birth for the two series are remarkably similar for both males and females, with the notable exception being Sub-Saharan Africa, where the higher adult mortality assumptions favored by the UN result in life expectancies at birth that are about 2.5 years lower than ours for males and 5.0 years lower for females.

### Trends in Mortality Levels

The 1990s were characterized by significant economic gains in most regions, with growth in gross national product per capita ranging from 18 percent in South Asia and Sub-Saharan Africa to more than 100 percent in East Asia and the Pacific and the Middle East and North Africa (table 2.2). Overall, gross national product per capita grew by about 35 percent in low- and middle-income countries during the decade. One would expect this to have led to a significant improvement in life expectancy, and this indeed occurred in most regions with the notable exception of Europe and Central Asia and, in particular, Sub-Saharan Africa (table 2.3). In the former region, life expectancy was largely unchanged over the decade, primarily because of the massive rise in adult mortality in countries such as the Russian Federation and its neighbors during the first part of the decade, which negated the declines in child mortality. Much of this extraordinary increase in adult mortality, which rose by about 50 percent between 1987 and 1994, has been attributed to alcohol abuse, particularly among men (Leon and others 1997; Shkolnikov, McKee, and Leon 2001).

Economic development and better coverage of the population with essential child health services have ensured continued declines in levels of child mortality, as measured by the risk of death from birth to age five, in all regions. The notable exception is Sub-Saharan Africa, where child mortality among girls remained unchanged at around 165 per 1,000, with only a modest decline (5 percent) in the risk of death for boys. The absence of significant declines in child mortality in the 1990s in Sub-Saharan Africa is most likely largely due to the impact of HIV/AIDS. Overall, the risk of child death declined from 90 per 1,000 in 1990 to 80 per 1,000 in 2001, with the risk being remarkably similar for males and females (table 2.3); however, the differential in child mortality between the world's richest and poorest populations is stark, with a newborn in Sub-Saharan Africa

**Table 2.3** Continued

| Female | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Deaths (millions) | Crude death rate per 1,000 | % of deaths | | Probability of dying per 1,000 | | | | Expectation of life at birth (years) |
| | | Under age 5 | Over age 60 | Ages 0–5[a] | Ages 15–60 | Ages 0–60 | Ages 60–80 | |
| 19.4 | 8.9 | 29.7 | 44.6 | 95 | 182 | 270 | 585 | 64.2 |
| 22.8 | 8.8 | 22.5 | 48.3 | 86 | 191 | 271 | 554 | 64.9 |
| 5.5 | 7.0 | 17.8 | 56.2 | 53 | 152 | 204 | 577 | 68.8 |
| 6.1 | 6.8 | 11.4 | 64.6 | 44 | 127 | 171 | 519 | 71.3 |
| 2.4 | 9.9 | 6.4 | 77.5 | 37 | 125 | 162 | 503 | 72.3 |
| 2.7 | 10.8 | 2.9 | 81.5 | 26 | 133 | 159 | 511 | 72.8 |
| 1.3 | 5.7 | 20.1 | 53.9 | 45 | 138 | 182 | 493 | 71.3 |
| 1.4 | 5.4 | 12.5 | 61.3 | 32 | 124 | 155 | 434 | 73.9 |
| 0.8 | 6.9 | 37.7 | 36.1 | 76 | 174 | 245 | 593 | 66.1 |
| 0.8 | 5.5 | 23.5 | 49.7 | 51 | 144 | 193 | 562 | 69.5 |
| 6.1 | 11.2 | 37.0 | 33.7 | 131 | 243 | 357 | 680 | 57.9 |
| 6.5 | 9.6 | 28.3 | 40.2 | 101 | 226 | 317 | 645 | 61.5 |
| 3.3 | 12.9 | 54.8 | 19.6 | 168 | 265 | 403 | 664 | 55.1 |
| 5.2 | 15.5 | 40.9 | 18.3 | 166 | 437 | 545 | 680 | 48.9 |
| 3.6 | 8.2 | 1.3 | 87.3 | 9 | 74 | 83 | 346 | 79.7 |
| 3.9 | 8.2 | 0.8 | 88.3 | 6 | 65 | 73 | 297 | 81.6 |
| 23.0 | 8.8 | 25.2 | 51.3 | 88 | 161 | 244 | 516 | 66.6 |
| 26.7 | 8.7 | 19.3 | 54.1 | 80 | 168 | 244 | 487 | 67.3 |

facing 25 times the risk of death before the age of five than a newborn in a high-income country.

Despite the much greater uncertainty in relation to levels of adult mortality compared with those for children, the estimates shown in table 2.3 nonetheless indicate substantially different trends in adult mortality across different regions between 1990 and 2001. For most regions, the risk of death between ages 15 and 60 fell by about 10 to 17 percent over the decade. This was not the case in Europe and Central Asia, where policy shifts, particularly in relation to alcohol, together with broader social change, have largely been responsible for the 15 percent rise in adult male mortality and the 6 percent increase in the risk of death for women. Note that these estimates mask the large cyclical fluctuations in adult mortality in Russia, in particular, that characterized the region's mortality trends in the 1990s.

Table 2.3 also reveals the large increase in adult mortality in Sub-Saharan Africa, which was due primarily to the unfolding of the HIV/AIDS epidemic in southern Africa. Notwithstanding the substantial uncertainty surrounding these estimates, the epidemic appears to have been of proportionately greater consequence for women, with the rise in their risk of death (67 percent) being twice that of males, among whom other causes of death such as violence were more common. If these estimates are correct, then 52.0 percent of African males reaching age 15 and 44.0 percent of females will die before their 60th birthdays, compared with, for instance, 6.5 percent of women in high-income countries, who despite their already low risk enjoyed a further 11 percent decline in mortality during the 1990s. These reversals in mortality decline have effectively negated gains elsewhere, with the result that the global risk of adult death has remained essentially unchanged for males, and may even have risen slightly for females.

Taken together, the probability of death up to the age of five and between the ages of 15 and 60 are a better reflection of the risk of premature death than either alone, although both have particular public health implications. One might argue that health policy should be equally concerned with keeping adults alive into old age as it is with keeping children alive into adulthood. A convenient metric in this regard is the risk of death between birth and age 60 (table 2.3). In high-income countries, given 2001 mortality rates, only about 7 percent of females and 13 percent of males would be dead by age 60, compared with 55 percent of females and 62 percent of males in Sub-Saharan Africa. Significant improvements in this summary measure of premature death can be observed in all regions except Europe and Central Asia and Sub-Saharan Africa. Worldwide, the index appears to have improved slightly for males and not at all for females.

Other features of global mortality summarized in table 2.3 are worth highlighting. First is the impressive evidence of a continued decline in mortality among older age groups in high-income countries that began in the early 1970s. The risk of a 60-year-old dying before age 80 declined by about 15 percent for both men and women in high-income countries so that at 2001 rates, less than 30 percent of women who reach age 60 will be dead by age 80, as will less than 50 percent of men. Second, crude death rates in East Asia and the Pacific, Latin America and the Caribbean, and the Middle East and North Africa are lower than in high-income countries, reflecting the impact of the older age structure of rich countries, and are particularly low in Latin America and the Caribbean. Third, the proportion of deaths that occur below age five, while declining in all regions, varies enormously across them, from just over 1 percent in high-income countries to just over 40 percent in Sub-Saharan Africa. In some low- and middle-income regions, particularly East Asia and the Pacific, Europe and Central Asia, and Latin America and the Caribbean, the proportion is well below 20 percent. The net effect of these changes in age-specific mortality since 1990 has been to increase global life expectancy at birth by 0.7 years for females and by about twice this for males: a modest scorecard.

## TRENDS IN CAUSES OF CHILD DEATH, 1990–2001

The estimation of cause of death patterns for world regions will, for the foreseeable future, be substantially uncertain given the paucity of data on medically certified deaths in many low- and middle-income countries (Mathers and others 2005; Sibai 2004). Verbal autopsies, that is, structured interviews with relatives of the deceased about symptoms experienced prior to death, will not yield the diagnostic accuracy achievable with medical certification based on good clinical case histories and medical records. This is not to deny that verbal autopsies can meet broad policy needs for information about causes of death, particularly with clinical input into the coding of interviewees' responses, but their reliability for diagnosing leading causes of child death is questionable (Snow and others 1992). Thus, estimates of child mortality derived from proportionate mortality models that are based largely on verbal autopsies need to be viewed with caution (Lopez 2003; Morris, Black, and Tomaskovic 2003).

Yet, despite these concerns about the quality of cause of death data, investigators can more confidently assess the comparative magnitude of causes of death for children than for adults. The fact that the demographic "envelope" of child deaths is reasonably well understood in all regions limits excessive claims about deaths due to individual causes, a constraint that is not a feature of adult mortality given the relative ignorance of age-specific death rates in many countries. In addition, the need for data on cause-specific outcomes to assess and monitor the impact of various child survival programs in recent decades has led to a reasonably substantial epidemiological literature that might permit cause-specific estimation, but under an unacceptably large number of assumptions (Black, Morris, and Bryce 2003).

A critical feature of any estimation exercise is a rigorous assessment of data sets for biases, study methods, and generalizability of results. Investigators have undertaken a number of efforts to estimate the causes of child mortality over the past decade or so (Bryce and others 2005; Lopez 1993; Morris, Black, and Tomaskovic 2004; Williams and others 2002), but undoubtedly the most comprehensive was the study by Murray and Lopez (1996) and its 2001 revision (chapter 3 in this volume). Both the latter Global Burden of Disease (GBD) studies apply methods to force epidemiological consistency according to the evidence available for each region, and inevitably the constraint of demography has meant that the GBD estimates of cause-specific mortality will differ from those developed largely independently of other causes. That is, the GBD estimates of specific causes of death are constrained to sum to the number of deaths derived from demographic analyses, whereas cause-specific estimates that are derived in the absence of such demographic constraints are unbounded and tend to be inclusive at the margin rather than exclusive. Differences in regional estimates between 1990 and 2001 arise in part because the countries included in the regions differed and, more important, because of better information for more recent periods. Yet, despite improved information, the true level of child death rates from major causes such as malaria and perinatal conditions (birth trauma, birth asphyxia, sepsis, and prematurity) remains largely unknown.

Notwithstanding methodological differences and uncertainties, deriving implied estimates of trends in the leading causes of child mortality is possible by comparing results from the two GBD studies, and these are summarized in table 2.4. These estimates have been simply obtained as the difference between the regional estimates for 1990 and 2001, but the implied pattern of change is interesting nonetheless. The conversion of the 1990 regional GBD estimates (Murray and Lopez 1996) to the regions used for the 2001 assessment

**Table 2.4** Mortality in Children Under Five by Cause, 1990 and 2001

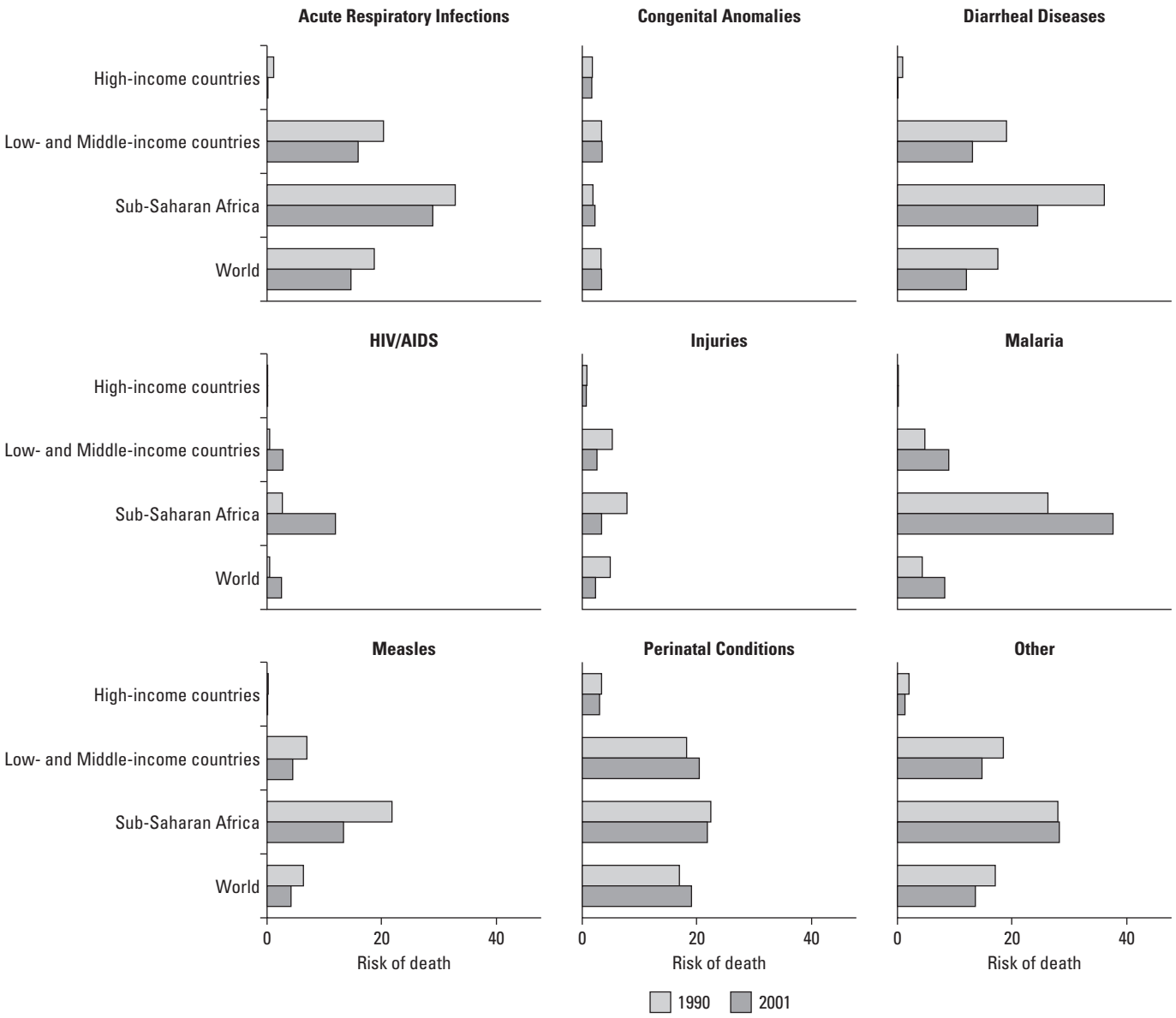
| | Low- and middle-income countries | | East Asia and Pacific | | Europe and Central Asia | | Latin America and the Caribbean | | Middle East and North Africa | | South Asia | | Sub-Saharan Africa | | High-income countries | | World | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Disease and indicator** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** |
| Acute respiratory infections | | | | | | | | | | | | | | | | | | |
| Deaths (thousands) | 2,521 | 1,943 | 492 | 197 | 68 | 36 | 83 | 44 | 138 | 76 | 1,027 | 833 | 713 | 757 | 13 | 2 | 2,533 | 1,944 |
| % of childhood deaths | 21.0 | 18.4 | 23.8 | 14.0 | 19.5 | 20.6 | 14.1 | 10.9 | 20.6 | 17.7 | 23.2 | 23.1 | 18.3 | 16.8 | 11.1 | 2.3 | 20.9 | 18.3 |
| Probability of dying before age 5 per 1,000 live births | 20 | 16 | 13 | 6 | 8 | 6 | 7 | 4 | 16 | 9 | 29 | 22 | 33 | 29 | 1 | 0 | 19 | 15 |
| Congenital anomalies | | | | | | | | | | | | | | | | | | |
| Deaths (thousands) | 421 | 421 | 118 | 115 | 25 | 24 | 30 | 41 | 22 | 41 | 186 | 142 | 41 | 58 | 19 | 18 | 440 | 439 |
| % of childhood deaths | 3.5 | 4.0 | 5.7 | 8.2 | 7.1 | 13.5 | 5.1 | 10.1 | 3.3 | 9.5 | 4.2 | 3.9 | 1.0 | 1.3 | 16.3 | 24.6 | 3.6 | 4.1 |
| Probability of dying before age 5 per 1,000 live births | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 5 | 5 | 4 | 2 | 2 | 2 | 2 | 3 | 3 |
| Diarrheal diseases | | | | | | | | | | | | | | | | | | |
| Deaths (thousands) | 2,362 | 1,599 | 274 | 201 | 61 | 12 | 108 | 46 | 144 | 66 | 991 | 631 | 784 | 643 | 11 | 0 | 2,374 | 1,600 |
| % of childhood deaths | 19.7 | 15.2 | 13.2 | 14.3 | 17.4 | 6.9 | 18.3 | 11.4 | 21.6 | 15.3 | 22.4 | 17.5 | 20.1 | 14.3 | 9.9 | 0.6 | 19.6 | 15.1 |
| Probability of dying before age 5 per 1,000 live births | 19 | 13 | 7 | 6 | 7 | 2 | 9 | 4 | 17 | 8 | 28 | 17 | 36 | 25 | 1 | 0 | 17 | 12 |
| HIV/AIDS | | | | | | | | | | | | | | | | | | |
| Deaths (thousands) | 62 | 340 | — | 5 | — | 0 | 2 | 6 | 0 | 1 | — | 14 | 60 | 313 | 0 | 0 | 62 | 340 |
| % of childhood deaths | 0.5 | 3.2 | 0.0 | 0.4 | 0.0 | 0.2 | 0.3 | 1.4 | 0.0 | 0.1 | 0.0 | 0.4 | 1.5 | 7.0 | 0.0 | 0.1 | 0.5 | 3.2 |
| Probability of dying before age 5 per 1,000 live births | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 12 | 0 | 0 | 0 | 3 |
| Injuries | | | | | | | | | | | | | | | | | | |
| Deaths (thousands) | 647 | 302 | 206 | 82 | 25 | 11 | 28 | 19 | 32 | 24 | 188 | 79 | 169 | 87 | 9 | 7 | 656 | 309 |
| % of childhood deaths | 5.4 | 2.9 | 9.9 | 5.8 | 7.0 | 6.6 | 4.7 | 4.6 | 4.8 | 5.6 | 4.2 | 2.2 | 4.3 | 1.9 | 7.8 | 9.8 | 5.4 | 2.9 |
| Probability of dying before age 5 per 1,000 live births | 5 | 2 | 5 | 2 | 3 | 2 | 2 | 2 | 4 | 3 | 5 | 2 | 8 | 3 | 1 | 1 | 5 | 2 |
| Malaria | | | | | | | | | | | | | | | | | | |
| Deaths (thousands) | 588 | 1,086 | 7 | 27 | 0 | 0 | 2 | 1 | 1 | 17 | 9 | 57 | 570 | 984 | 0 | 0 | 588 | 1,086 |
| % of childhood deaths | 4.9 | 10.3 | 0.3 | 1.9 | 0.1 | 0.0 | 0.3 | 0.3 | 0.1 | 3.9 | 0.2 | 1.6 | 14.6 | 21.8 | 0.2 | 0.1 | 4.8 | 10.2 |
| Probability of dying before age 5 per 1,000 live births | 5 | 9 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 26 | 38 | 0 | 0 | 4 | 8 |

*(Continues on the following page.)*

**Table 2.4** Continued

| | Low- and middle-income countries | | East Asia and Pacific | | Europe and Central Asia | | Latin America and the Caribbean | | Middle East and North Africa | | South Asia | | Sub-Saharan Africa | | High-income countries | | World | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Disease and indicator** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **2001** | **1990** | **200** |
| Measles | | | | | | | | | | | | | | | | | | |
| Deaths (thousands) | 869 | 556 | 75 | 45 | 12 | 5 | 38 | — | 30 | 10 | 239 | 145 | 474 | 351 | 3 | 0 | 872 | 556 |
| % of childhood deaths | 7.2 | 5.3 | 3.6 | 3.2 | 3.5 | 2.9 | 6.5 | 0.0 | 4.5 | 2.3 | 5.4 | 4.0 | 12.2 | 7.8 | 2.5 | 0.1 | 7.2 | 5.2 |
| Probability of dying before age 5 per 1,000 live births | 7 | 5 | 2 | 1 | 1 | 1 | 3 | 0 | 4 | 1 | 7 | 4 | 22 | 13 | 0 | 0 | 6 | 4 |
| Perinatal conditions | | | | | | | | | | | | | | | | | | |
| Deaths (thousands) | 2,261 | 2,492 | 480 | 506 | 83 | 57 | 162 | 164 | 141 | 106 | 906 | 1,086 | 487 | 573 | 38 | 32 | 2,298 | 2,524 |
| % of childhood deaths | 18.8 | 23.7 | 23.2 | 36.0 | 23.6 | 32.9 | 27.6 | 40.3 | 21.2 | 24.7 | 20.4 | 30.1 | 12.5 | 12.7 | 33.0 | 44.5 | 18.9 | 23.8 |
| Probability of dying before age 5 per 1,000 live births | 18 | 20 | 12 | 15 | 10 | 10 | 14 | 14 | 17 | 13 | 26 | 29 | 22 | 22 | 3 | 3 | 17 | 19 |
| Other causes | | | | | | | | | | | | | | | | | | |
| Deaths (thousands) | 2,288 | 1,792 | 420 | 228 | 77 | 28 | 137 | 85 | 159 | 90 | 888 | 625 | 607 | 737 | 22 | 13 | 2,309 | 1,805 |
| % of childhood deaths | 19.0 | 17.0 | 20.3 | 16.2 | 21.9 | 16.3 | 23.2 | 21.0 | 23.8 | 20.9 | 20.0 | 17.3 | 15.5 | 16.4 | 19.1 | 17.9 | 19.0 | 17.0 |
| Probability of dying before age 5 per 1,000 live births | 18 | 15 | 11 | 7 | 9 | 5 | 12 | 7 | 19 | 11 | 25 | 17 | 28 | 28 | 2 | 1 | 17 | 14 |
| Total | | | | | | | | | | | | | | | | | | |
| Deaths (thousands) | 12,019 | 10,532 | 2,072 | 1,407 | 352 | 174 | 588 | 407 | 668 | 429 | 4,434 | 3,612 | 3,904 | 4,504 | 115 | 73 | 12,134 | 10,605 |
| % of childhood deaths | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Probability of dying before age 5 per 1,000 live births | 97 | 86 | 54 | 43 | 41 | 29 | 51 | 35 | 80 | 53 | 127 | 97 | 180 | 172 | 10 | 7 | 89 | 80 |

*Sources:* Estimates for 1990 are based on Murray and Lopez 1996, weighted to World Bank regions using population under five years old. Estimates for 2001 are from chapter 3 in this volume.
*Note:* — = not available or not applicable. Estimates of child mortality are rounded to the nearest whole number.




*Sources:* Estimates for 1990 are from Murray and Lopez 1996; estimates for 2001 are from chapter 3 in this volume.

**Figure 2.4** Change in Risk of Death for Children Under Five by Cause (probability of mortality per 1,000 live births), 1990–2001

was done simply by population weighting, a very approximate procedure. By contrast, the 2001 estimates were prepared as regional aggregates of country-specific estimates (see chapter 3,) and this has undoubtedly affected comparisons further.

Global mortality from malaria increased by 0.5 million during the 1990s, with 80 percent of the deaths occurring in Sub-Saharan Africa. The proportion of all child deaths due to malaria doubled from 5 percent in 1990 to 10 percent in 2001 worldwide and increased from 15 percent in 1990 to 22 percent in 2001 in Sub-Saharan Africa. The only other causes that appear to have increased are HIV/AIDS in Africa, a reasonable conclusion given female prevalence levels, and the category of perinatal conditions, which are strongly dependent on the quality and availability of prenatal services. Causes that appear to have declined substantially include acute respiratory infections (2.5 million to 1.9 million deaths or 15 percent of all child deaths), diarrheal diseases (2.4 million to 1.6 million deaths or 13 percent of child deaths), measles (0.8 million to 0.5 million

deaths or 5 percent of child deaths), and injuries (0.6 million to 0.3 million deaths or 2 percent of child deaths).

The implied pattern of change in the risk of child death varies across regions for all major conditions listed in table 2.4, particularly with regard to the magnitude of change. This can be seen more clearly from figure 2.4, which summarizes these trends for broad regional aggregates and for Sub-Saharan Africa. In general, the absolute change in risk of death has been greater in Sub-Saharan Africa than elsewhere, both for causes with increased risk (HIV/AIDS, malaria) and where risk has declined (diarrheal diseases, measles).

While these changes may be in accord with what is known about regional health development and economic growth, they need to be confirmed. Some of the suggested changes warrant further investigation, for example, death rates from perinatal causes appear to have risen in both East Asia and the Pacific and South Asia and remained unchanged in Latin America and the Caribbean, which may or may not be in line with what is known about developments in prenatal care and safe motherhood initiatives. Similarly, measles appears to have disappeared as a cause of child death in Latin America and the Caribbean. The risk of child death from congenital anomalies appears to have risen in both Latin America and the Caribbean and the Middle East and North Africa, but why is unclear. Similarly, the large suggested declines in the risk of child deaths because of injury in South Asia and Sub-Saharan Africa appear unlikely and may largely reflect better data and methods for measuring injury deaths.

## DISCUSSION

Understanding the demographic context of health status assessments such as the GBD studies is essential if policy directions and program delivery are to be focused appropriately. Knowledge about the size and composition of populations and how they are changing is critical for health planning and priority setting. Demographers and demographic institutions such as the UN Population Division have applied the demographic ethos that available data permit making estimates and reasonable predictions of population change provided the data are interpreted and used appropriately.

Such estimates and projections have been useful for social and economic development for countries, regions, and the world as a whole. They suggest that health and social policies need to pay increasing attention to the key demographic trends observed in the 1990s, namely, rapidly falling fertility virtually everywhere, rapidly aging populations, and unprecedented reversals of the long-term path of mortality decline in Europe and Central Asia and Sub-Saharan Africa The causes of these so-called mortality shocks are reasonably well understood, but the lessons for health policy cannot be overemphasized. Globally, the mortality reversals caused by inadequate preventive programs, social disintegration, and failure to understand the gravity of rapidly expanding epidemics have meant that the 1990s were a lost decade for further improvements in adults' survival prospects. Thus, despite the substantial and continued declines in mortality from major vascular diseases in high-income countries, worldwide the risk of death in adulthood did not change in the 1990s, although some gains in reducing mortality in the elderly were achieved, particularly in rich countries.

The trend in child mortality during the 1990s was only marginally more satisfactory. While most regions achieved significant gains in child survival, progress was modest in Sub-Saharan Africa, and as a result, the global decline in child mortality slowed to an annual average of about 1 percent over the decade.

Decades of intensive data collection on child mortality in many low- and middle-income countries by dedicated international survey programs and the efforts of agencies such as the United Nations Children's Fund mean that trends in overall child mortality, and the numbers of child deaths they imply, can be established with reasonable certainty. The trends in the leading causes of child mortality are, however, much more difficult to establish (Rudan and others 2005). Much debate in the literature has centered on whether the risk of malaria infection in Sub-Saharan Africa increased in the 1990s, and thus whether the massive increase in malaria deaths suggested in table 2.4 is real (Korenromp and others 2003; Snow, Trape, and Marsh 2001; Trape 2001). Most malaria mortality in Sub-Saharan Africa is diagnosed via verbal autopsies, which, where studied, have been shown to be a poor diagnostic tool for malaria (Snow and others 1992). While some evidence from demographic surveillance sites using verbal autopsies indicates that malaria mortality rates have increased in eastern and southern Africa (summarized in Korenromp and others 2003) and that the spread of chloroquine resistance may have been the primary reason (Snow and others 1999; Trape 2001), whether this is sufficiently widespread to account for the implied rise of almost 50 percent in malaria mortality rates over the decade (figure 2.4) is unclear. Other factors, such as

a general deterioration in clinical care and a decline in the efficacy of chloroquine therapy, may also have contributed (Snow and others 2001), but how much of the rise is real and how much is due to different interpretations of available data in 1990 and 2001 remains unknown.

Similarly, the substantial implied declines in the risk of child death from acute respiratory infections and diarrheal diseases need to be understood in the context of likely contributing factors. One of these is no doubt malnutrition, because it is a major risk factor for both conditions (Black, Morris, and Bryce 2003; Pelletier, Frongillo, and Habicht 1993; Rice and others 2000; Tupasi and others 1988). In the 1990s, malnutrition, as assessed by childhood stunting, declined in all regions except Sub-Saharan Africa (de Onis, Frongillo, and Blossner 2000), which is consistent with the modest declines in mortality from respiratory infections among children in the region. Increased use of oral rehydration therapy and improved access to safe water and sanitation in the 1990s would suggest some decline in mortality from diarrheal disease, but whether they were sufficient to account for the one-third decline in risk, including in Sub-Saharan Africa, is also unclear (Victora and others 2000). The large absolute decline in childhood diarrheal deaths from 2.4 million in 1990 to 1.6 million in 2001 is surprising, and suggests that the 2001 estimate may be an undercount. Some other studies (Morris, Black, and Tomaskovic 2003; UNICEF 2003) suggest a figure about 20 percent higher for 2001.

Malnutrition is also a leading risk factor for measles mortality, and hence changes in the proportion and distribution of underweight children should be broadly consistent with mortality trends from the disease (Fishman and others 2004). Effective vaccination coverage is a primary determinant of mortality from measles, and further increases in vaccination coverage in the 1990s should have led to lower mortality. This is certainly apparent from the estimates reported here, but the extent of that decline is subject to some controversy, depending on the methods used to estimate current mortality. Using proportionate mortality models largely derived from verbal autopsy data, Morris, Black, and Tomaskovic (2003) estimate that measles deaths account for only about 2.2 percent of all child deaths in South Asia and Sub-Saharan Africa, significantly less than Stein and others' (2003) estimates of 4 to 8 percent for the same period using data on vaccination coverage and assumptions about efficacy and case fatality rates. This implies a global estimate of measles deaths that is about half the 556,000 estimated for 2001 in chapter 3, and thus a much faster rate of decline in the measles mortality rate during the 1990s than the one-third reduction suggested by the GBD estimates. The truth may well lie somewhere in between and requires urgent resolution if measles control efforts are to be appropriately guided.

While the confirmation of mother to child transmission of HIV infection implies that mortality from the disease will increase with increasing prevalence among women, the extent of the impact on child mortality continues to be debated. The GBD estimates suggest that HIV/AIDS led to an increase in child mortality of, on average, 10 per 1,000 in Sub-Saharan Africa between 1990 and 2001. Recent research suggesting a potential overestimation of HIV/AIDS mortality may lead to lower estimates of child mortality from the disease, which may attenuate this trend estimate. What is clear is that HIV/AIDS has not been the only cause of recent reversals in the decline in child mortality in Sub-Saharan Africa (Walker, Schwartzlander, and Bryce 2002) and that its effect on child survival in the 1990s may not have been as great as initially thought (Adetunji 2000).

Perinatal conditions that cover specific risks for the newborn, primarily birth asphyxia, birth trauma, prematurity, and sepsis, are undoubtedly a major cause of death among children, but until recently did not receive sufficient attention in the epidemiological literature, perhaps because interventions are largely related to the delivery of prenatal care and the intrapartum period. Virtually all children born alive who die from these causes do so in the first few days of life (Lawn, Cousens, and Zupan 2005). Hence some constraint on the probable demographic envelope of mortality from these causes can be derived by estimating the neonatal mortality rate in different regions as was done for the 1990 GBD study (Murray and Lopez 1996) and repeated for the 2001 estimates (chapter 3 in this volume). This has undoubtedly removed a major source of uncertainty about mortality from these conditions, but substantial uncertainty remains about their relative importance as a cause of neonatal death when considering other conditions such as tetanus (classified under infectious diseases in the 1990 and 2001 GBD studies), neonatal diarrhea, congenital anomalies, and injuries. As a result, the global estimate of deaths from perinatal causes is influenced by the availability and reliability of data on the causes of neonatal mortality, particularly in countries with the largest number of neonatal deaths: China, India, Nigeria, and Pakistan account for half of all neonatal deaths, and with the possible exception of China, none has reliable, nationally representative systems for cause of death reporting.

Given this context, judging whether mortality from perinatal causes indeed rose by 10 percent during the 1990s as suggested by figure 2.4 is difficult. If improvements in survival from these causes are largely related to better and more comprehensive service provision for pregnant women, which in turn is dependent on substantial infrastructure investments to improve health services, then modest declines in risk should be expected given economic growth in the 1990s. This was indeed the case in all regions except East Asia and the Pacific and South Asia, where the risk appears to have risen. Without compelling evidence that health service provision deteriorated in these regions during the 1990s, this increase in the risk of death from perinatal causes is probably a statistical artifact of data availability and different interpretation criteria used for 1990 and 2001. Privatization of the rural health care system in China during the 1990s may have led to a deterioration of prenatal care, but this remains to be established.

Finally, note the 50 percent reduction in the risk of child death from injuries implied by the GBD studies, which is primarily due to large reductions suggested for East Asia and the Pacific, South Asia, and Sub-Saharan Africa. Some decline in injury mortality is to be expected with economic and social development and the introduction of injury control programs and legislation, but the massive declines estimated for these regions may well be attributable to methodological differences in estimation procedures between the two dates (see chapter 3 in this volume). The descriptive epidemiology of injuries remains a major neglected area of the information base for policy to improve child health. For example, Rudan and others' (2005) review of information gaps in relation to assessing the burden of illness in children fails to even mention childhood injuries, even though burns, falls, and drownings are likely to be significant causes of child death (Etebu and Ekere 2004; Gali, Madziga, and Naaya 2004; Istre and others 2003; Mock and others 2004; Shen, Sanno-Duanda, and Bickler 2003). Thus, establishing the extent of changes in these risks, whose levels are based on essentially anecdotal evidence, remains difficult. Evidence of major declines in injury death rates therefore need to be viewed with great caution and may well be largely artifactual.

The global public health community's increasing interest in gaining a better understanding of the successes of, and challenges facing programs and policies to improve child survival has led to alternative assessments of the leading causes of child death. With the substantial data gaps and data quality issues pertaining to the estimation of child mortality, varying estimates of the leading causes of child death because of different estimation principles and variable interpretation of the data are hardly surprising. Scientific debate is to be encouraged insofar as it will guide data collection strategies to reduce unacceptable uncertainty, but the existence of alternative estimates of child mortality for 2001 makes the interpretation of changes over the past decade even more complex. The World Health Organization's Child Health Epidemiology Reference Group (CHERG), for example, working within the same total number of child deaths (10.5 million), has recently published quite different estimates of the causes of child mortality (Bryce and others 2005). According to CHERG's estimates, in 2001 perinatal causes were responsible for 3.9 million child deaths, that is, 37 percent of all child deaths and 55 percent more than the GBD figure (see chapter 3). Conversely, CHERG estimated lower levels of malaria mortality in children (853,000 deaths compared with 1,110,000 in the GBD study) and much lower measles mortality (395,000 versus 562,000 deaths). CHERG's implied rise in perinatal causes of child death is even more extreme than that suggested by the GBD study, whereas the rise in malaria deaths is less extreme. CHERG's estimates also imply far greater success of vaccination programs to reduce measles mortality than does the GBD figure. Note also that CHERG, which does not include any experts in noncommunicable diseases, including congenital anomalies, estimated only about half the number of noncommunicable disease deaths among children than estimated in the GBD study.

Public policy to accelerate the decline in child mortality would be well served through greater scientific collaboration to better understand the descriptive epidemiology of the leading causes of child death over the past decade or so and how this has changed. Notwithstanding the legitimate role of scientific discourse and the issue of comorbidity among the leading causes of child death, particularly diarrhea and pneumonia (Fenn, Morris, and Black 2005), the lack of clarity about the extent of the decline (or rise) in child deaths from specific causes or groups of causes, particularly those that have been the focus of massive programmatic efforts, hinders policy making. Having said this, it should also be borne in mind that for the GBD estimates at least, which have followed a consistent methodology and estimation framework, uncertainty in the rate of change of mortality for any given condition may well be less than period uncertainty around estimates for 1990 and 2001 because of the high likelihood of correlation of uncertainty of estimates for the two periods.

## CONCLUSIONS

Priority setting in health, as in other sectors concerned with social development, will increasingly depend on the availability of reliable, timely, representative, and relevant information on the comparative importance of diseases, injuries, and risk factors for the health of populations and how these are changing. Population scientists, particularly epidemiologists, have provided important insights into the descriptive epidemiology of some segments of some populations and on the causes of disease and injuries in those populations. Administrative requirements have resulted in most countries undertaking routine data collection efforts, but these are highly variable in terms of both quality and of what is being measured. As a result, we have substantial partial data collections on many aspects of population health status, but no country has complete data on all aspects of health relevant for policy, and in many parts of the world, health status is largely unknown. Efforts to bring these fragmentary pieces of data together to develop comprehensive estimates of the disease and injury burden and its causes are likely to be extremely valuable for policy making, particularly if the analytical methods and frameworks employed are understandable, transparent, and rigorously argued. Demographers were the first to attempt global, regional, and national efforts to estimate population size, structure, and determinants of change in a coherent fashion, and despite scientific differences of opinion about some of the methods and assumptions, the results have been enormously influential for guiding social development policies and programs.

The two GBD studies for 1990 (Murray and Lopez 1996) and 2001 (chapter 3 in this volume) attempted something similar for mortality and the burden of disease. Scholars and global health development agencies alike have repeatedly emphasized the interrelationship between demographic change and the health conditions of populations. This chapter has summarized the key quantitative findings about global demography and epidemiology that are relevant for disease control and public health development, leading to the following three broad conclusions:

- Despite significant investments in disease control in low- and middle-income countries over the past 50 years and the considerable success in reducing mortality, commensurate investments have not been made in the health intelligence base needed to monitor and evaluate changes in population health. As a result, uncertainty about the causes of child mortality in many countries and how these have changed over the last decade or so because of intervention programs is considerable. Moreover, data collection pertaining to health conditions among adults has been almost totally neglected, with the result that virtually nothing is known reliably about levels, let alone causes, of adult death in much of the developing world. HIV/AIDS has highlighted this neglect, but continued ignorance of the leading causes of adult mortality will continue to hinder policy action to reduce the large, avoidable causes of adult mortality that can be addressed through targeted prevention and treatment programs.
- Demographic change is often poorly understood, and thus potentially underappreciated in relation to health and social development policies. The evidence summarized in this chapter suggests that population aging is likely to become rapidly more pronounced in low- and middle-income countries than is currently appreciated, in part because swift fertility declines are under way in much of the developing world. The little evidence that is available about mortality trends among adults in developing countries suggests different paths of mortality change among regions, but indicates that globally, little progress was achieved in the 1990s. At older ages, the impressive and widely unappreciated declines in mortality that began in the high-income countries in the 1970s continued through the 1990s and show little sign of deceleration. In large part, these declines reflect progress in the control of major vascular diseases and point to continued steady gains in life expectancy in high-income countries.
- Despite at least two decades of intensive efforts by the global public health community to implement intervention programs and reorganize health services to reduce child mortality, knowledge about the major causes of death among children is insufficiently precise to resolve uncertainties about global progress with specific disease control strategies, and thus to be of maximum benefit for global policy action to reduce the more than 10 million child deaths that still occur each year. Results from the two GBD studies, while suggesting trends that are broadly consistent with public health knowledge, are equivocal about trends in specific conditions in some regions. Policy action to rapidly and substantially reduce this enormous burden of premature mortality will be better served if policy makers can be more appropriately informed about the causes of child death, including hitherto neglected areas such as perinatal conditions and injuries.

**Annex 2A** Key Demographic Indicators, by Country/Territory, 1990 and 2001

| | | 1990 | | | | | | | 2001 | | | | | | | Annual change in probability of dying under age 5, 1990–2001 (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Life expectancy at birth (years) | | Probability of dying per 1,000 | | | | | Life expectancy at birth (years) | | Probability of dying per 1,000 | | | | | |
| | | | | | Under age 5 | | Ages 15–59 | | | | | Under age 5 | | Ages 15–59 | | | |
| Country/Territory | World Bank region | Population (thousands) | Males | Females | Males | Females | Males | Females | Population (thousands) | Males | Females | Males | Females | Males | Females | Males | Females |
| Afghanistan | South Asia | 13,799 | 43.8 | 47.8 | 267 | 253 | 421 | 295 | 22,083 | 41.4 | 43.3 | 257 | 255 | 510 | 419 | −0.3 | 0.1 |
| Albania | Europe and Central Asia | 3,289 | 64.1 | 71.2 | 52 | 38 | 253 | 140 | 3,122 | 67.0 | 73.4 | 28 | 23 | 171 | 97 | −5.6 | −4.4 |
| Algeria | Middle East and North Africa | 25,017 | 65.4 | 67.8 | 70 | 68 | 188 | 153 | 30,746 | 67.4 | 71.0 | 55 | 44 | 172 | 129 | −2.3 | −3.9 |
| American Samoa | East Asia and Pacific | — | — | — | — | — | — | — | 59 | 59.9 | 36.4 | 86 | 79 | 295 | 229 | — | — |
| Andorra | High-income countries | — | — | — | — | — | — | — | 68 | 76.6 | 83.7 | 5 | 4 | 113 | 45 | — | — |
| Angola | Sub-Saharan Africa | 9,340 | 42.7 | 49.0 | 280 | 239 | 427 | 288 | 12,768 | 37.5 | 42.3 | 277 | 246 | 605 | 475 | −0.1 | 0.2 |
| Anguilla | Not included | — | — | — | — | — | — | — | 11 | 68.0 | 72.8 | 34 | 27 | 216 | 116 | — | — |
| Antigua and Barbuda | Latin America and the Caribbean | — | — | — | — | — | — | — | 72 | 68.9 | 73.7 | 22 | 18 | 197 | 128 | — | — |
| Argentina | Latin America and the Caribbean | 32,527 | 68.9 | 75.8 | 32 | 26 | 196 | 103 | 37,529 | 70.9 | 78.5 | 20 | 17 | 177 | 91 | −4.2 | −4.0 |
| Armenia | Europe and Central Asia | 3,545 | 61.9 | 69.0 | 68 | 52 | 276 | 158 | 3,088 | 67.0 | 72.9 | 38 | 34 | 208 | 99 | −5.3 | −3.8 |
| Aruba | High-income countries | — | — | — | — | — | — | — | 92 | 66.9 | 72.8 | 36 | 28 | 230 | 116 | — | — |
| Australia | High-income countries | 16,888 | 74.1 | 80.4 | 10 | 8 | 124 | 66 | 19,352 | 77.6 | 83.0 | 7 | 5 | 94 | 54 | −4.2 | −4.1 |
| Austria | High-income countries | 7,729 | 72.4 | 79.0 | 10 | 9 | 153 | 74 | 8,106 | 76.1 | 82.2 | 6 | 5 | 121 | 61 | −5.1 | −5.6 |
| Azerbaijan | Europe and Central Asia | 7,192 | 56.4 | 63.6 | 119 | 93 | 327 | 199 | 8,226 | 62.5 | 68.2 | 77 | 68 | 247 | 129 | −3.9 | −2.8 |
| Bahamas, The | High-income countries | 255 | 66.6 | 74.2 | 35 | 23 | 224 | 115 | 307 | 68.8 | 75.2 | 14 | 11 | 249 | 152 | −8.5 | −6.4 |
| Bahrain | High-income countries | 490 | 71.7 | 73.6 | 25 | 26 | 124 | 104 | 693 | 72.4 | 74.3 | 14 | 10 | 112 | 82 | −5.6 | −8.6 |
| Bangladesh | South Asia | 109,403 | 53.8 | 58.1 | 145 | 143 | 348 | 236 | 140,880 | 62.3 | 62.2 | 76 | 78 | 251 | 258 | −5.9 | −5.5 |
| Barbados | Latin America and the Caribbean | 257 | 69.2 | 76.4 | 21 | 14 | 193 | 96 | 268 | 70.5 | 77.7 | 18 | 17 | 187 | 103 | −1.6 | 1.7 |
| Belarus | Europe and Central Asia | 10,266 | 66.2 | 75.8 | 17 | 12 | 282 | 107 | 9,986 | 63.0 | 74.5 | 14 | 11 | 361 | 129 | −1.5 | −1.0 |
| Belgium | High-income countries | 9,967 | 72.7 | 79.5 | 11 | 8 | 139 | 75 | 10,273 | 74.9 | 81.4 | 6 | 5 | 128 | 67 | −5.2 | −4.5 |
| Belize | Latin America and the Caribbean | 186 | 64.4 | 69.5 | 50 | 48 | 250 | 154 | 245 | 67.2 | 72.2 | 45 | 34 | 191 | 124 | −0.9 | −3.2 |
| Benin | Sub-Saharan Africa | 4,650 | 49.0 | 55.5 | 201 | 168 | 385 | 251 | 6,387 | 50.4 | 52.8 | 165 | 157 | 415 | 351 | −1.8 | −0.6 |
| Bermuda | High-income countries | — | — | — | — | — | — | — | 80 | 68.0 | 72.8 | 34 | 27 | 216 | 116 | — | — |
| Bhutan | South Asia | 1,696 | 53.8 | 59.5 | 145 | 129 | 349 | 227 | 2,125 | 60.0 | 62.1 | 95 | 94 | 275 | 228 | −3.8 | −2.9 |
| Bolivia | Latin America and the Caribbean | 6,669 | 55.3 | 61.1 | 129 | 114 | 336 | 216 | 8,481 | 61.6 | 64.4 | 80 | 75 | 261 | 211 | −4.4 | −3.8 |
| Bosnia and Herzegovina | Europe and Central Asia | 4,308 | 68.3 | 75.3 | 26 | 18 | 204 | 105 | 4,067 | 69.1 | 76.3 | 21 | 16 | 193 | 91 | −2.0 | −1.3 |
| Botswana | Sub-Saharan Africa | 1,354 | 62.4 | 69.0 | 64 | 52 | 271 | 158 | 1,750 | 41.5 | 42.2 | 99 | 97 | 762 | 718 | 4.0 | 5.7 |
| Brazil | Latin America and the Caribbean | 148,809 | 61.9 | 69.0 | 68 | 51 | 276 | 158 | 174,029 | 65.5 | 72.1 | 44 | 36 | 247 | 135 | −4.0 | −3.3 |
| British Virgin Islands | Not included | — | — | — | — | — | — | — | 20 | 68.0 | 72.8 | 34 | 27 | 215 | 116 | — | — |
| Brunei Darussalam | High-income countries | 257 | 70.0 | 77.7 | 18 | 11 | 182 | 85 | 342 | 74.7 | 77.4 | 15 | 13 | 115 | 87 | −1.9 | 1.6 |
| Bulgaria | Europe and Central Asia | 8,718 | 68.2 | 74.9 | 20 | 15 | 216 | 97 | 8,033 | 68.6 | 75.2 | 18 | 15 | 221 | 97 | −1.2 | −0.1 |
| Burkina Faso | Sub-Saharan Africa | 8,921 | 47.1 | 52.9 | 224 | 196 | 398 | 267 | 12,259 | 40.6 | 42.7 | 232 | 217 | 596 | 520 | 0.3 | 0.9 |
| Burundi | Sub-Saharan Africa | 5,609 | 49.2 | 55.4 | 198 | 169 | 384 | 252 | 6,412 | 39.0 | 42.7 | 192 | 180 | 680 | 565 | −0.3 | 0.5 |
| Cambodia | East Asia and Pacific | 9,744 | 55.7 | 62.4 | 126 | 103 | 334 | 207 | 13,478 | 52.3 | 57.5 | 147 | 123 | 392 | 290 | 1.4 | 1.6 |
| Cameroon | Sub-Saharan Africa | 11,661 | 54.1 | 60.2 | 142 | 123 | 346 | 222 | 15,429 | 48.0 | 50.0 | 160 | 155 | 498 | 434 | 1.1 | 2.1 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Canada | High-income countries | 27,701 | 74.0 | 80.7 | 9 | 7 | 132 | 71 | 31,025 | 77.0 | 82.5 | 6 | 5 | 98 | 59 | −3.5 | −3.4 |
| Cape Verde | Sub-Saharan Africa | 349 | 61.6 | 69.4 | 71 | 49 | 279 | 155 | 445 | 66.4 | 72.7 | 44 | 32 | 209 | 121 | −4.3 | −4.0 |
| Cayman Islands | High-income countries | — | — | — | — | — | — | — | 38 | 68.0 | 72.8 | 34 | 27 | 216 | 116 | — | — |
| Central African Republic | Sub-Saharan Africa | 2,943 | 49.0 | 56.5 | 200 | 159 | 385 | 246 | 3,770 | 42.6 | 44.1 | 187 | 173 | 607 | 556 | −0.6 | 0.8 |
| Chad | Sub-Saharan Africa | 5,822 | 47.5 | 53.7 | 218 | 187 | 395 | 262 | 8,103 | 45.7 | 49.2 | 203 | 181 | 485 | 401 | −0.7 | −0.3 |
| Channel Islands | High-income countries | 142 | — | — | — | — | — | — | 145 | 75.5 | 81.6 | 6 | 5 | 120 | 60 | — | — |
| Chile | Latin America and the Caribbean | 13,100 | 69.8 | 76.6 | 21 | 17 | 191 | 97 | 15,419 | 73.1 | 79.9 | 17 | 14 | 137 | 68 | −1.9 | −2.0 |
| China | East Asia and Pacific | 1,161,382 | 66.9 | 69.6 | 38 | 46 | 190 | 145 | 1,292,586 | 69.5 | 72.6 | 32 | 42 | 166 | 104 | −1.7 | −0.7 |
| Colombia | Latin America and the Caribbean | 34,970 | 65.8 | 72.4 | 40 | 31 | 234 | 130 | 42,826 | 67.5 | 76.3 | 27 | 19 | 235 | 102 | −3.7 | −4.4 |
| Comoros | Sub-Saharan Africa | 527 | 55.0 | 61.9 | 132 | 107 | 339 | 210 | 726 | 60.9 | 64.5 | 84 | 75 | 273 | 210 | −4.2 | −3.3 |
| Congo, Democratic Republic of | Sub-Saharan Africa | 37,370 | 47.4 | 53.6 | 221 | 189 | 397 | 263 | 49,785 | 41.1 | 46.1 | 222 | 198 | 583 | 449 | 0.0 | 0.4 |
| Congo, Republic of | Sub-Saharan Africa | 2,494 | 55.9 | 63.2 | 123 | 96 | 331 | 202 | 3,542 | 52.2 | 54.5 | 109 | 101 | 460 | 409 | −1.1 | 0.5 |
| Cook Islands | Not included | — | — | — | — | — | — | — | 18 | 68.9 | 74.1 | 23 | 19 | 176 | 112 | — | — |
| Costa Rica | Latin America and the Caribbean | 3,076 | 73.0 | 77.7 | 19 | 15 | 129 | 79 | 4,013 | 74.4 | 79.3 | 12 | 10 | 128 | 75 | −3.6 | −3.6 |
| Côte d'Ivoire | Sub-Saharan Africa | 12,505 | 51.7 | 58.0 | 169 | 144 | 365 | 237 | 16,098 | 43.5 | 48.1 | 192 | 143 | 567 | 498 | 1.2 | −0.1 |
| Croatia | Europe and Central Asia | 4,842 | 68.6 | 76.3 | 14 | 10 | 223 | 89 | 4,445 | 70.9 | 78.5 | 9 | 8 | 180 | 73 | −4.3 | −2.7 |
| Cuba | Latin America and the Caribbean | 10,628 | 72.8 | 76.7 | 15 | 11 | 155 | 111 | 11,238 | 75.2 | 80.0 | 9 | 7 | 139 | 90 | −4.4 | −4.3 |
| Cyprus | High-income countries | 681 | 71.7 | 77.3 | 12 | 12 | 161 | 88 | 789 | 75.0 | 78.8 | 8 | 8 | 105 | 53 | −3.8 | −3.8 |
| Czech Republic | Europe and Central Asia | 10,306 | 68.0 | 75.5 | 14 | 10 | 220 | 95 | 10,257 | 72.1 | 79.0 | 5 | 4 | 168 | 74 | −8.7 | −8.0 |
| Denmark | High-income countries | 5,140 | 72.1 | 77.9 | 10 | 8 | 152 | 99 | 5,338 | 74.7 | 79.6 | 6 | 5 | 124 | 77 | −4.5 | −3.5 |
| Djibouti | Middle East and North Africa | 528 | 46.4 | 49.8 | 188 | 161 | 487 | 417 | 681 | 49.5 | 51.9 | 157 | 144 | 455 | 400 | −1.7 | −1.0 |
| Dominica | Latin America and the Caribbean | — | — | — | — | — | — | — | 78 | 71.1 | 75.7 | 13 | 14 | 204 | 121 | — | — |
| Dominican Republic | Latin America and the Caribbean | 7,058 | 61.2 | 68.5 | 74 | 55 | 283 | 162 | 8,485 | 64.8 | 71.4 | 38 | 32 | 256 | 151 | −6.0 | −5.0 |
| Ecuador | Latin America and the Caribbean | 10,264 | 62.5 | 69.2 | 63 | 50 | 270 | 156 | 12,616 | 67.5 | 73.1 | 36 | 32 | 219 | 135 | −5.2 | −4.2 |
| Egypt, Arab Republic of | Middle East and North Africa | 55,768 | 57.8 | 62.4 | 109 | 99 | 307 | 215 | 69,124 | 65.0 | 68.7 | 42 | 42 | 240 | 158 | −8.7 | −7.8 |
| El Salvador | Latin America and the Caribbean | 5,110 | 62.2 | 68.7 | 66 | 54 | 273 | 160 | 6,313 | 66.2 | 72.6 | 37 | 34 | 265 | 145 | −5.2 | −4.0 |
| Equatorial Guinea | Sub-Saharan Africa | 354 | 47.3 | 53.5 | 222 | 190 | 397 | 263 | 468 | 51.8 | 54.7 | 160 | 147 | 382 | 317 | −3.0 | −2.4 |
| Eritrea | Sub-Saharan Africa | 3,103 | 52.9 | 58.6 | 156 | 138 | 356 | 232 | 3,847 | 42.9 | 57.3 | 118 | 103 | 659 | 334 | −2.5 | −2.7 |
| Estonia | Europe and Central Asia | 1,584 | 64.8 | 74.9 | 18 | 14 | 298 | 107 | 1,353 | 65.1 | 76.7 | 12 | 8 | 319 | 116 | −4.3 | −5.5 |
| Ethiopia | Sub-Saharan Africa | 48,856 | 47.5 | 53.6 | 219 | 189 | 395 | 263 | 67,266 | 46.2 | 49.5 | 186 | 169 | 500 | 417 | −1.5 | −1.0 |
| Faeroe Islands | High-income countries | — | — | — | — | — | — | — | 46 | 75.5 | 81.6 | 6 | 5 | 120 | 60 | — | — |
| Falkland Islands | Not included | — | — | — | — | — | — | — | 3 | 68.0 | 72.7 | 34 | 27 | 216 | 117 | — | — |
| Fiji | East Asia and Pacific | 724 | 67.2 | 72.6 | 32 | 30 | 217 | 128 | 822 | 64.4 | 70.2 | 30 | 27 | 287 | 180 | −0.6 | −1.2 |
| Finland | High-income countries | 4,986 | 70.9 | 78.9 | 7 | 7 | 183 | 70 | 5,188 | 74.5 | 81.5 | 5 | 3 | 139 | 61 | −3.6 | −6.3 |
| France | High-income countries | 56,735 | 73.3 | 81.7 | 10 | 8 | 162 | 67 | 59,564 | 75.7 | 83.7 | 6 | 5 | 136 | 60 | −5.0 | −4.5 |
| French Guiana | Not included | — | — | — | — | — | — | — | 169 | 68.1 | 72.8 | 33 | 27 | 216 | 116 | — | — |
| French Polynesia | High-income countries | 195 | — | — | — | — | — | — | 237 | 59.8 | 36.6 | 88 | 81 | 295 | 230 | — | — |
| Gabon | Sub-Saharan Africa | 953 | 58.0 | 64.1 | 103 | 89 | 313 | 196 | 1,283 | 57.2 | 61.3 | 101 | 80 | 342 | 281 | −0.2 | −1.0 |

*(Continues on the following page.)*

**Annex 2A** Continued

| | | 1990 | | | | | | | 2001 | | | | | | | Annual change in probability of dying under age 5, 1990–2001 (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Life expectancy at birth (years) | | Probability of dying per 1,000 | | | | | Life expectancy at birth (years) | | Probability of dying per 1,000 | | | | | |
| | | | | | Under age 5 | | Ages 15–59 | | | | | Under age 5 | | Ages 15–59 | | | |
| Country/Territory | World Bank region | Population (thousands) | Males | Females | Males | Females | Males | Females | Population (thousands) | Males | Females | Males | Females | Males | Females | Males | Females |
| Gambia, The | Sub-Saharan Africa | 936 | 52.0 | 58.1 | 165 | 143 | 362 | 235 | 1,351 | 55.3 | 58.8 | 134 | 119 | 330 | 264 | −1.9 | −1.6 |
| Georgia | Europe and Central Asia | 5,460 | 67.9 | 74.9 | 28 | 20 | 210 | 109 | 5,224 | 68.3 | 74.3 | 26 | 20 | 216 | 89 | −0.7 | −0.1 |
| Germany | High-income countries | 79,433 | 72.0 | 78.5 | 10 | 8 | 157 | 77 | 82,349 | 75.4 | 81.6 | 6 | 4 | 121 | 62 | −5.3 | −4.9 |
| Ghana | Sub-Saharan Africa | 15,277 | 54.9 | 61.0 | 134 | 115 | 340 | 217 | 20,028 | 56.3 | 58.8 | 107 | 100 | 355 | 303 | −2.1 | −1.3 |
| Gibraltar | Not included | — | — | — | — | — | — | — | 27 | 75.5 | 81.6 | 6 | 5 | 120 | 60 | — | — |
| Greece | High-income countries | 10,161 | 74.7 | 79.5 | 11 | 10 | 117 | 56 | 10,947 | 75.5 | 80.9 | 7 | 6 | 118 | 49 | −3.8 | −5.7 |
| Greenland | High-income countries | — | — | — | — | — | — | — | 56 | 75.5 | 81.6 | 6 | 5 | 120 | 60 | — | — |
| Grenada | Latin America and the Caribbean | — | — | — | — | — | — | — | 81 | 65.8 | 68.7 | 25 | 21 | 263 | 224 | — | — |
| Guadeloupe | Not included | — | — | — | — | — | — | — | 432 | 68.0 | 72.8 | 34 | 27 | 216 | 116 | — | — |
| Guam | High-income countries | 134 | — | — | — | — | — | — | 158 | 59.9 | 36.5 | 86 | 80 | 295 | 229 | — | — |
| Guatemala | Latin America and the Caribbean | 8,749 | 59.5 | 65.8 | 89 | 75 | 299 | 183 | 11,728 | 62.9 | 68.7 | 58 | 51 | 285 | 167 | −3.8 | −3.5 |
| Guinea | Sub-Saharan Africa | 6,122 | 45.2 | 49.7 | 248 | 232 | 411 | 285 | 8,242 | 50.5 | 53.5 | 166 | 155 | 408 | 333 | −3.7 | −3.6 |
| Guinea-Bissau | Sub-Saharan Africa | 1,016 | 43.3 | 49.6 | 273 | 232 | 424 | 285 | 1,407 | 45.4 | 48.4 | 219 | 201 | 464 | 384 | −2.0 | −1.3 |
| Guyana | Latin America and the Caribbean | 731 | 57.9 | 65.7 | 104 | 76 | 314 | 184 | 762 | 61.3 | 66.7 | 62 | 51 | 302 | 206 | −4.6 | −3.5 |
| Haiti | Latin America and the Caribbean | 6,914 | 52.7 | 58.2 | 157 | 142 | 357 | 235 | 8,111 | 48.8 | 50.8 | 140 | 130 | 497 | 444 | −1.0 | −0.8 |
| Holy See (Vatican City) | Not included | — | — | — | — | — | — | — | 1 | 75.5 | 81.6 | 6 | 5 | 120 | 60 | — | — |
| Honduras | Latin America and the Caribbean | 4,868 | 61.9 | 68.7 | 68 | 54 | 276 | 160 | 6,619 | 64.4 | 70.4 | 45 | 42 | 263 | 148 | −3.8 | −2.1 |
| Hungary | Europe and Central Asia | 10,365 | 65.1 | 73.8 | 19 | 15 | 305 | 133 | 9,968 | 68.0 | 76.7 | 11 | 9 | 264 | 113 | −5.0 | −4.6 |
| Iceland | High-income countries | 255 | 75.5 | 80.7 | 9 | 5 | 116 | 77 | 285 | 78.1 | 81.7 | 4 | 3 | 88 | 56 | −8.0 | −5.5 |
| India | South Asia | 846,418 | 57.3 | 58.0 | 113 | 126 | 301 | 246 | 1,033,395 | 60.0 | 61.8 | 89 | 98 | 291 | 222 | −2.2 | −2.3 |
| Indonesia | East Asia and Pacific | 182,117 | 58.3 | 64.9 | 100 | 82 | 310 | 189 | 214,356 | 64.4 | 67.4 | 50 | 40 | 246 | 213 | −6.2 | −6.4 |
| Iran, Islamic Republic of | Middle East and North Africa | 56,703 | 62.5 | 66.5 | 73 | 71 | 253 | 173 | 67,245 | 65.8 | 71.1 | 45 | 38 | 225 | 140 | −4.4 | −5.8 |
| Iraq | Middle East and North Africa | 17,341 | 63.5 | 68.3 | 79 | 71 | 215 | 138 | 23,860 | 58.7 | 62.8 | 122 | 112 | 258 | 180 | 3.9 | 4.2 |
| Ireland | High-income countries | 3,515 | 71.9 | 77.6 | 11 | 9 | 133 | 81 | 3,865 | 74.1 | 79.5 | 8 | 6 | 117 | 68 | −3.0 | −3.6 |
| Isle of Man | Europe and Central Asia | — | — | — | — | — | — | — | 74 | 75.5 | 81.6 | 6 | 5 | 120 | 60 | — | — |
| Israel | High-income countries | 4,514 | 75.0 | 78.4 | 13 | 11 | 107 | 71 | 6,174 | 77.1 | 81.2 | 7 | 6 | 100 | 54 | −5.0 | −5.7 |
| Italy | High-income countries | 56,719 | 73.7 | 80.4 | 10 | 8 | 129 | 60 | 57,521 | 76.6 | 82.6 | 6 | 5 | 99 | 50 | −5.5 | −4.6 |
| Jamaica | Latin America and the Caribbean | 2,369 | 69.0 | 75.5 | 22 | 17 | 195 | 103 | 2,603 | 71.0 | 74.4 | 16 | 14 | 164 | 123 | −3.0 | −1.7 |
| Japan | High-income countries | 123,537 | 76.1 | 82.4 | 7 | 6 | 109 | 53 | 127,271 | 78.2 | 85.8 | 5 | 4 | 97 | 47 | −3.9 | −3.3 |
| Jordan | Middle East and North Africa | 3,254 | 66.5 | 71.0 | 44 | 42 | 209 | 137 | 5,183 | 68.5 | 73.1 | 29 | 27 | 193 | 122 | −3.9 | −4.0 |
| Kazakhstan | Europe and Central Asia | 16,809 | 63.2 | 69.9 | 58 | 46 | 262 | 151 | 15,533 | 58.4 | 68.9 | 40 | 30 | 420 | 192 | −3.4 | −3.9 |
| Kenya | Sub-Saharan Africa | 23,585 | 57.6 | 64.2 | 106 | 87 | 316 | 194 | 31,065 | 50.4 | 52.6 | 117 | 112 | 496 | 434 | 0.9 | 2.3 |
| Kiribati | East Asia and Pacific | — | — | — | — | — | — | — | 85 | 61.8 | 66.5 | 82 | 69 | 288 | 194 | — | — |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Korea, Democratic People's Republic of | East Asia and Pacific | 19,956 | 63.6 | 68.5 | 55 | 55 | 259 | 162 | 22,409 | 64.4 | 67.1 | 56 | 54 | 236 | 191 | 0.1 | −0.2 |
| Korea, Republic of | High-income countries | 42,869 | 69.5 | 78.2 | 20 | 9 | 189 | 81 | 47,142 | 71.5 | 79.1 | 8 | 7 | 173 | 65 | −8.5 | −2.8 |
| Kuwait | High-income countries | 2,143 | 72.7 | 75.6 | 20 | 16 | 118 | 81 | 2,353 | 75.6 | 76.5 | 14 | 10 | 84 | 62 | −3.5 | −3.8 |
| Kyrgyz Republic | Europe and Central Asia | 4,395 | 59.0 | 66.1 | 93 | 73 | 304 | 181 | 4,995 | 60.1 | 68.4 | 65 | 57 | 346 | 165 | −3.2 | −2.3 |
| Lao People's Democratic Republic | East Asia and Pacific | 4,132 | 51.4 | 57.1 | 173 | 153 | 368 | 242 | 5,403 | 53.8 | 55.9 | 149 | 133 | 340 | 308 | −1.4 | −1.3 |
| Latvia | Europe and Central Asia | 2,713 | 64.2 | 74.5 | 20 | 15 | 311 | 118 | 2,351 | 64.8 | 75.8 | 15 | 12 | 323 | 117 | −2.7 | −2.0 |
| Lebanon | Middle East and North Africa | 2,712 | 66.7 | 71.6 | 42 | 32 | 210 | 143 | 3,537 | 67.4 | 71.9 | 36 | 29 | 205 | 140 | −1.3 | −0.9 |
| Lesotho | Sub-Saharan Africa | 1,570 | 52.6 | 59.1 | 159 | 134 | 358 | 229 | 1,794 | 34.6 | 40.1 | 159 | 153 | 871 | 705 | 0.0 | 1.2 |
| Liberia | Sub-Saharan Africa | 2,135 | 45.0 | 50.8 | 251 | 219 | 412 | 278 | 3,099 | 40.5 | 43.9 | 244 | 223 | 569 | 463 | −0.3 | 0.2 |
| Libya | Middle East and North Africa | 4,306 | 67.0 | 72.1 | 44 | 40 | 199 | 121 | 5,340 | 70.2 | 75.4 | 20 | 19 | 174 | 100 | −7.4 | −6.9 |
| Liechtenstein | High-income countries | — | — | — | — | — | — | — | 33 | 75.5 | 81.6 | 6 | 5 | 120 | 60 | — | — |
| Lithuania | Europe and Central Asia | 3,739 | 66.5 | 76.3 | 15 | 12 | 286 | 107 | 3,484 | 66.5 | 77.7 | 11 | 10 | 297 | 102 | −2.5 | −1.9 |
| Luxembourg | High-income countries | 378 | 72.1 | 78.5 | 10 | 8 | 151 | 86 | 441 | 75.6 | 81.8 | 5 | 5 | 120 | 66 | −5.9 | −4.6 |
| Macedonia, FYR | Europe and Central Asia | 1,909 | 69.1 | 73.9 | 37 | 32 | 167 | 94 | 2,035 | 69.0 | 75.0 | 19 | 16 | 195 | 90 | −6.3 | −6.4 |
| Madagascar | Sub-Saharan Africa | 11,956 | 50.9 | 56.6 | 178 | 158 | 371 | 245 | 16,439 | 54.2 | 58.2 | 147 | 127 | 335 | 264 | −1.7 | −2.0 |
| Malawi | Sub-Saharan Africa | 9,456 | 45.1 | 49.7 | 250 | 232 | 412 | 285 | 11,627 | 40.0 | 40.9 | 199 | 192 | 648 | 601 | −2.1 | −1.7 |
| Malaysia | East Asia and Pacific | 17,845 | 68.7 | 75.3 | 24 | 18 | 199 | 105 | 23,492 | 69.6 | 74.8 | 10 | 9 | 193 | 107 | −7.5 | −6.7 |
| Maldives | South Asia | 216 | 58.0 | 59.7 | 103 | 127 | 314 | 225 | 300 | 66.3 | 65.4 | 42 | 49 | 211 | 207 | −8.1 | −8.7 |
| Mali | Sub-Saharan Africa | 9,046 | 44.1 | 49.1 | 262 | 238 | 418 | 288 | 12,256 | 43.7 | 45.5 | 235 | 226 | 489 | 418 | −1.0 | −0.5 |
| Malta | Middle East and North Africa | 360 | 73.8 | 78.4 | 13 | 9 | 101 | 62 | 391 | 75.9 | 79.8 | 8 | 6 | 89 | 54 | −4.5 | −2.7 |
| Marshall Islands | East Asia and Pacific | — | — | — | — | — | — | — | 52 | 60.7 | 64.3 | 47 | 37 | 347 | 292 | — | — |
| Martinique | Not included | — | — | — | — | — | — | — | 388 | 68.0 | 72.8 | 34 | 27 | 215 | 116 | — | — |
| Mauritania | Sub-Saharan Africa | 2,030 | 49.3 | 55.5 | 197 | 169 | 383 | 251 | 2,724 | 49.7 | 54.4 | 187 | 156 | 394 | 305 | −0.5 | −0.7 |
| Mauritius | Sub-Saharan Africa | 1,057 | 65.5 | 73.3 | 27 | 20 | 263 | 121 | 1,198 | 68.1 | 75.4 | 21 | 14 | 222 | 119 | −2.4 | −3.5 |
| Mexico | Latin America and the Caribbean | 83,225 | 64.4 | 70.5 | 50 | 42 | 250 | 146 | 100,456 | 71.8 | 77.1 | 31 | 25 | 175 | 99 | −4.3 | −4.9 |
| Micronesia, Federated States of | East Asia and Pacific | 96 | — | — | — | — | — | — | 107 | 64.6 | 67.8 | 65 | 53 | 214 | 179 | — | — |
| Moldova | Europe and Central Asia | 4,364 | 66.9 | 73.3 | 33 | 27 | 221 | 123 | 4,276 | 63.8 | 71.4 | 32 | 24 | 301 | 149 | −0.4 | −1.1 |
| Monaco | High-income countries | — | — | — | — | — | — | — | 34 | 77.3 | 84.3 | 5 | 4 | 113 | 49 | — | — |
| Mongolia | East Asia and Pacific | 2,216 | 57.0 | 62.6 | 112 | 101 | 322 | 206 | 2,528 | 59.8 | 66.0 | 80 | 70 | 320 | 209 | −3.1 | −3.3 |
| Montserrat | Not included | — | — | — | — | — | — | — | 4 | 68.9 | 73.6 | 32 | 26 | 205 | 110 | — | — |
| Morocco | Middle East and North Africa | 24,564 | 63.1 | 67.4 | 90 | 80 | 206 | 141 | 29,585 | 68.6 | 72.6 | 45 | 43 | 161 | 104 | −6.3 | −5.6 |
| Mozambique | Sub-Saharan Africa | 13,465 | 44.7 | 50.3 | 255 | 225 | 415 | 281 | 18,204 | 41.7 | 44.4 | 211 | 201 | 596 | 503 | −1.7 | −1.0 |
| Myanmar | East Asia and Pacific | 40,506 | 53.8 | 61.2 | 146 | 114 | 349 | 215 | 48,205 | 56.2 | 61.8 | 118 | 95 | 332 | 236 | −1.9 | −1.7 |
| Namibia | Sub-Saharan Africa | 1,409 | 59.0 | 65.3 | 93 | 78 | 304 | 186 | 1,930 | 49.7 | 52.2 | 92 | 88 | 572 | 496 | −0.2 | 1.1 |
| Nauru | Not included | — | — | — | — | — | — | — | 12 | 59.3 | 66.2 | 19 | 14 | 456 | 308 | — | — |
| Nepal | South Asia | 18,625 | 54.4 | 57.7 | 139 | 147 | 344 | 238 | 24,060 | 59.6 | 59.6 | 87 | 93 | 300 | 292 | −4.3 | −4.2 |
| Netherlands | High-income countries | 14,952 | 73.8 | 80.2 | 10 | 8 | 116 | 67 | 15,982 | 75.8 | 80.9 | 7 | 6 | 97 | 66 | −3.7 | −3.1 |
| Netherlands Antilles | High-income countries | 188 | — | — | — | — | — | — | 217 | 68.1 | 72.8 | 33 | 27 | 216 | 116 | — | — |
| New Caledonia | High-income countries | 171 | — | — | — | — | — | — | 220 | 59.8 | 36.5 | 87 | 80 | 295 | 230 | — | — |

*(Continues on the following page.)*

**Annex 2A** Continued

| | | 1990 | | | | | | | 2001 | | | | | | | Annual change in probability of dying under age 5, 1990–2001 (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Life expectancy at birth (years) | | Probability of dying per 1,000 | | | | | Life expectancy at birth (years) | | Probability of dying per 1,000 | | | | | |
| | | | | | Under age 5 | | Ages 15–59 | | | | | Under age 5 | | Ages 15–59 | | | |
| Country/Territory | World Bank region | Population (thousands) | Males | Females | Males | Females | Males | Females | Population (thousands) | Males | Females | Males | Females | Males | Females | Males | Females |
| New Zealand | High-income countries | 3,360 | 72.5 | 78.5 | 13 | 9 | 143 | 93 | 3,815 | 76.5 | 81.6 | 8 | 6 | 101 | 65 | −4.8 | −3.1 |
| Nicaragua | Latin America and the Caribbean | 3,824 | 61.3 | 68.0 | 73 | 58 | 282 | 166 | 5,204 | 67.7 | 72.3 | 39 | 34 | 213 | 146 | −5.7 | −5.0 |
| Niger | Sub-Saharan Africa | 7,650 | 39.2 | 42.9 | 329 | 311 | 449 | 320 | 11,134 | 42.6 | 42.6 | 251 | 257 | 496 | 442 | −2.5 | 1.7 |
| Nigeria | Sub-Saharan Africa | 86,018 | 49.8 | 54.7 | 191 | 177 | 379 | 256 | 117,823 | 48.1 | 49.8 | 184 | 181 | 448 | 387 | −0.3 | 0.2 |
| Niue | Not included | — | — | — | — | — | — | — | 2 | 67.9 | 73.1 | 34 | 26 | 193 | 132 | — | — |
| Northern Mariana Islands | High-income countries | — | — | — | — | — | — | — | 73 | 65.3 | 36.4 | 86 | 80 | 295 | 229 | — | — |
| Norway | High-income countries | 4,241 | 73.4 | 79.9 | 10 | 7 | 128 | 65 | 4,494 | 76.1 | 81.7 | 5 | 4 | 103 | 61 | −6.1 | −5.3 |
| West Bank and Gaza | Middle East and North Africa | 2,154 | — | — | — | — | — | — | 3,310 | 68.4 | 72.0 | 27 | 29 | 200 | 140 | — | — |
| Oman | Middle East and North Africa | 1,845 | 68.6 | 74.3 | 33 | 27 | 184 | 106 | 2,688 | 70.8 | 76.1 | 17 | 16 | 168 | 95 | −6.1 | −4.8 |
| Pakistan | South Asia | 110,901 | 54.6 | 58.4 | 137 | 140 | 342 | 233 | 146,277 | 61.1 | 61.5 | 105 | 115 | 228 | 203 | −2.4 | −1.7 |
| Palau | East Asia and Pacific | — | — | — | — | — | — | — | 20 | 66.3 | 71.4 | 24 | 22 | 241 | 194 | — | — |
| Panama | Latin America and the Caribbean | 2,411 | 66.0 | 72.9 | 39 | 29 | 232 | 126 | 3,007 | 73.1 | 78.4 | 26 | 22 | 143 | 85 | −3.6 | −2.4 |
| Papua New Guinea | East Asia and Pacific | 4,114 | 58.1 | 62.8 | 102 | 100 | 312 | 205 | 5,460 | 58.3 | 61.4 | 99 | 92 | 310 | 250 | −0.2 | −0.7 |
| Paraguay | Latin America and the Caribbean | 4,219 | 65.6 | 72.2 | 42 | 32 | 237 | 131 | 5,604 | 68.7 | 74.2 | 37 | 27 | 170 | 123 | −1.0 | −1.6 |
| Peru | Latin America and the Caribbean | 21,753 | 59.5 | 66.3 | 88 | 71 | 299 | 179 | 26,362 | 67.1 | 71.6 | 41 | 37 | 206 | 145 | −6.9 | −6.0 |
| Philippines | East Asia and Pacific | 61,104 | 62.2 | 69.3 | 65 | 50 | 272 | 156 | 77,151 | 64.9 | 71.4 | 41 | 35 | 260 | 136 | −4.2 | −3.3 |
| Pitcairn | Not included | — | — | — | — | — | — | — | 0 | 59.9 | 36.4 | 86 | 80 | 295 | 230 | — | — |
| Poland | Europe and Central Asia | 38,111 | 66.5 | 75.6 | 20 | 16 | 263 | 102 | 38,651 | 70.2 | 78.5 | 9 | 8 | 209 | 84 | −6.9 | −6.2 |
| Portugal | High-income countries | 9,899 | 70.4 | 77.3 | 16 | 12 | 178 | 80 | 10,033 | 73.2 | 80.5 | 7 | 6 | 155 | 66 | −7.2 | −6.7 |
| Puerto Rico | Latin America and the Caribbean | 3,528 | 68.7 | 77.6 | 17 | 13 | 237 | 90 | 3,838 | 70.5 | 78.4 | 13 | 11 | 217 | 93 | −2.1 | −1.2 |
| Qatar | High-income countries | 467 | 67.7 | 74.6 | 29 | 21 | 211 | 111 | 591 | 75.2 | 74.3 | 15 | 13 | 93 | 82 | −5.7 | −4.3 |
| Romania | Europe and Central Asia | 23,207 | 66.8 | 73.2 | 34 | 27 | 239 | 114 | 22,437 | 67.9 | 74.9 | 24 | 20 | 235 | 107 | −3.1 | −3.0 |
| Russian Federation | Europe and Central Asia | 148,292 | 63.8 | 74.4 | 24 | 18 | 318 | 117 | 144,877 | 58.6 | 72.1 | 22 | 17 | 453 | 163 | −0.8 | −0.6 |
| Rwanda | Sub-Saharan Africa | 6,775 | 50.6 | 55.9 | 181 | 165 | 373 | 249 | 8,066 | 41.6 | 46.3 | 189 | 173 | 608 | 483 | 0.4 | 0.5 |
| Réunion | Not included | — | — | — | — | — | — | — | 734 | 49.4 | 52.0 | 176 | 168 | 422 | 352 | — | — |
| Samoa | East Asia and Pacific | 160 | 65.0 | 71.1 | 45 | 39 | 243 | 141 | 175 | 66.7 | 69.6 | 28 | 22 | 235 | 203 | −4.4 | −5.1 |
| San Marino | High-income countries | — | — | — | — | — | — | — | 27 | 77.2 | 84.0 | 6 | 3 | 85 | 32 | — | — |
| São Tomé and Principe | Sub-Saharan Africa | 116 | — | — | — | — | — | — | 153 | 61.1 | 63.1 | 85 | 86 | 262 | 220 | — | — |
| Saudi Arabia | Middle East and North Africa | 16,554 | 66.3 | 71.6 | 47 | 41 | 208 | 128 | 22,829 | 68.4 | 73.8 | 31 | 26 | 192 | 113 | −3.9 | −4.2 |
| Senegal | Sub-Saharan Africa | 7,345 | 52.6 | 58.7 | 158 | 138 | 358 | 232 | 9,621 | 54.2 | 57.1 | 140 | 131 | 350 | 285 | −1.1 | −0.5 |
| Serbia and Montenegro | Europe and Central Asia | 10,156 | 66.8 | 74.0 | 34 | 24 | 223 | 116 | 10,545 | 69.7 | 74.8 | 17 | 13 | 187 | 98 | −6.2 | −5.1 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Seychelles | Sub-Saharan Africa | — | — | — | — | — | — | — | 80 | 66.7 | 77.7 | 15 | 10 | 248 | 113 | — | — |
| Sierra Leone | Sub-Saharan Africa | 4,054 | 39.5 | 45.6 | 324 | 279 | 447 | 306 | 4,573 | 31.2 | 35.8 | 330 | 301 | 718 | 567 | 0.2 | 0.7 |
| Singapore | High-income countries | 3,016 | 72.8 | 77.8 | 10 | 8 | 152 | 93 | 4,105 | 76.8 | 81.7 | 4 | 3 | 93 | 54 | −8.3 | −7.4 |
| Slovak Republic | Europe and Central Asia | 5,256 | 70.3 | 76.9 | 17 | 13 | 179 | 92 | 5,394 | 69.5 | 78.0 | 10 | 8 | 210 | 79 | −4.4 | −4.8 |
| Slovenia | High-income countries | 1,918 | 69.9 | 77.9 | 12 | 8 | 207 | 81 | 1,988 | 72.5 | 80.2 | 6 | 4 | 165 | 72 | −6.6 | −5.2 |
| Solomon Islands | East Asia and Pacific | 319 | — | — | — | — | — | — | 450 | 63.5 | 67.3 | 86 | 75 | 202 | 149 | — | — |
| Somalia | Sub-Saharan Africa | 7,163 | 45.8 | 51.6 | 240 | 210 | 407 | 274 | 9,088 | 43.7 | 46.1 | 217 | 223 | 516 | 407 | −0.9 | 0.6 |
| South Africa | Sub-Saharan Africa | 36,848 | 61.9 | 69.0 | 68 | 52 | 275 | 158 | 44,416 | 50.4 | 54.5 | 80 | 75 | 566 | 448 | 1.5 | 3.4 |
| Spain | High-income countries | 39,303 | 73.3 | 80.4 | 10 | 8 | 146 | 60 | 40,875 | 76.1 | 83.2 | 6 | 5 | 121 | 48 | −5.3 | −5.1 |
| Sri Lanka | South Asia | 16,830 | 67.2 | 74.9 | 32 | 20 | 218 | 109 | 18,752 | 66.1 | 74.2 | 21 | 17 | 260 | 125 | −3.8 | −1.6 |
| St. Helena | Not included | — | — | — | — | — | — | — | 5 | 49.5 | 52.0 | 176 | 168 | 422 | 352 | — | — |
| St. Kitts and Nevis | Latin America and the Caribbean | — | — | — | — | — | — | — | 42 | 68.4 | 72.1 | 21 | 24 | 210 | 150 | — | — |
| St. Lucia | Latin America and the Caribbean | 131 | 66.9 | 72.3 | 22 | 17 | 246 | 158 | 147 | 69.5 | 74.9 | 14 | 14 | 217 | 138 | −4.2 | −1.7 |
| St. Pierre et Miquelon | Not included | — | — | — | — | — | — | — | 6 | 74.7 | 80.0 | 9 | 7 | 139 | 81 | — | — |
| St. Vincent and the Grenadines | High-income countries | 110 | — | — | — | — | — | — | 118 | 68.0 | 72.2 | 24 | 20 | 235 | 180 | — | — |
| Sudan | Sub-Saharan Africa | 24,927 | 55.5 | 61.4 | 128 | 112 | 335 | 214 | 32,151 | 55.4 | 59.6 | 112 | 106 | 364 | 269 | −1.2 | −0.4 |
| Suriname | Latin America and the Caribbean | 402 | 65.8 | 72.9 | 40 | 29 | 233 | 126 | 429 | 64.2 | 70.6 | 34 | 28 | 282 | 166 | −1.4 | −0.3 |
| Swaziland | Sub-Saharan Africa | 847 | 56.1 | 63.0 | 122 | 98 | 330 | 203 | 1,058 | 38.5 | 42.1 | 145 | 137 | 784 | 673 | 1.6 | 3.0 |
| Sweden | High-income countries | 8,559 | 74.8 | 80.5 | 8 | 6 | 114 | 66 | 8,860 | 77.8 | 82.5 | 4 | 3 | 85 | 54 | −5.9 | −6.3 |
| Switzerland | High-income countries | 6,834 | 73.9 | 80.9 | 9 | 8 | 126 | 62 | 7,173 | 77.4 | 83.2 | 6 | 5 | 95 | 53 | −3.7 | −4.0 |
| Syrian Arab Republic | Middle East and North Africa | 12,717 | 66.1 | 70.7 | 48 | 40 | 211 | 147 | 16,968 | 68.6 | 73.4 | 28 | 21 | 192 | 128 | −4.8 | −5.6 |
| Tajikistan | Europe and Central Asia | 5,303 | 60.1 | 66.8 | 83 | 67 | 293 | 175 | 6,144 | 60.7 | 66.0 | 69 | 58 | 290 | 182 | −1.7 | −1.4 |
| Tanzania | Sub-Saharan Africa | 26,068 | 51.6 | 56.8 | 170 | 156 | 366 | 244 | 35,565 | 45.4 | 47.5 | 164 | 145 | 559 | 510 | −0.3 | −0.7 |
| Thailand | East Asia and Pacific | 54,389 | 64.6 | 72.4 | 48 | 31 | 248 | 130 | 61,555 | 66.1 | 72.6 | 33 | 27 | 276 | 156 | −3.4 | −1.5 |
| Timor-Leste | East Asia and Pacific | 740 | — | — | — | — | — | — | 711 | 55.2 | 60.9 | 139 | 106 | 323 | 237 | — | — |
| Togo | Sub-Saharan Africa | 3,455 | 52.1 | 58.5 | 165 | 139 | 362 | 233 | 4,686 | 50.1 | 53.5 | 150 | 128 | 454 | 388 | −0.8 | −0.7 |
| Tokelau | Not included | — | — | — | — | — | — | — | 2 | 59.9 | 36.4 | 86 | 80 | 295 | 230 | — | — |
| Tonga | East Asia and Pacific | 99 | — | — | — | — | — | — | 102 | 69.2 | 71.7 | 23 | 15 | 190 | 175 | — | — |
| Trinidad and Tobago | Latin America and the Caribbean | 1,215 | 67.5 | 75.4 | 30 | 18 | 214 | 105 | 1,294 | 67.3 | 72.8 | 24 | 18 | 243 | 153 | −2.0 | −0.1 |
| Tunisia | Middle East and North Africa | 8,207 | 66.4 | 70.1 | 55 | 49 | 194 | 141 | 9,624 | 69.3 | 73.8 | 32 | 25 | 171 | 116 | −5.0 | −6.3 |
| Turkey | Europe and Central Asia | 57,593 | 60.3 | 65.9 | 82 | 74 | 292 | 182 | 69,303 | 67.8 | 72.1 | 44 | 42 | 180 | 113 | −5.7 | −5.2 |
| Turkmenistan | Europe and Central Asia | 3,668 | 57.4 | 64.3 | 108 | 87 | 318 | 194 | 4,720 | 58.7 | 66.8 | 65 | 49 | 365 | 192 | −4.7 | −5.3 |
| Turks and Caicos Islands | Not included | — | — | — | — | — | — | — | 19 | 68.0 | 72.8 | 34 | 27 | 216 | 116 | — | — |
| Tuvalu | Not included | — | — | — | — | — | — | — | 10 | 60.3 | 61.4 | 73 | 57 | 293 | 279 | — | — |
| Uganda | Sub-Saharan Africa | 17,359 | 51.4 | 57.6 | 172 | 148 | 367 | 239 | 24,225 | 47.2 | 50.0 | 150 | 138 | 518 | 449 | −1.2 | −0.6 |
| Ukraine | Europe and Central Asia | 51,891 | 65.6 | 74.9 | 19 | 14 | 287 | 112 | 49,290 | 61.8 | 73.1 | 23 | 17 | 376 | 137 | 1.8 | 1.9 |
| United Arab Emirates | High-income countries | 2,035 | 68.5 | 75.7 | 25 | 17 | 201 | 102 | 2,879 | 71.3 | 75.1 | 10 | 10 | 170 | 123 | −7.9 | −5.0 |
| United Kingdom | High-income countries | 56,761 | 72.9 | 78.6 | 11 | 8 | 129 | 78 | 58,881 | 75.2 | 80.0 | 7 | 6 | 111 | 70 | −3.6 | −3.0 |
| United States | High-income countries | 255,712 | 71.9 | 79.0 | 13 | 10 | 172 | 91 | 288,025 | 74.5 | 79.7 | 9 | 7 | 144 | 83 | −3.2 | −2.9 |
| U.S. Virgin Islands | High-income countries | 101 | — | — | — | — | — | — | 110 | 68.0 | 72.8 | 34 | 27 | 216 | 116 | — | — |

*(Continues on the following page.)*

**Annex 2A** Continued

| Country/Territory | World Bank region | 1990 Population (thousands) | 1990 Life expectancy at birth (years) | | 1990 Probability of dying per 1,000 | | | | 2001 Population (thousands) | 2001 Life expectancy at birth (years) | | 2001 Probability of dying per 1,000 | | | | Annual change in probability of dying under age 5, 1990–2001 (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Under age 5 | | Ages 15–59 | | | | | Under age 5 | | Ages 15–59 | | | |
| | | | Males | Females | Males | Females | Males | Females | | Males | Females | Males | Females | Males | Females | Males | Females |
| Uruguay | Latin America and the Caribbean | 3,106 | 69.0 | 76.5 | 27 | 23 | 196 | 98 | 3,366 | 71.1 | 79.5 | 18 | 13 | 181 | 89 | −3.6 | −5.2 |
| Uzbekistan | Europe and Central Asia | 20,515 | 62.3 | 69.0 | 65 | 52 | 272 | 158 | 25,313 | 65.2 | 70.7 | 39 | 28 | 246 | 150 | −4.5 | −5.7 |
| Vanuatu | East Asia and Pacific | 149 | 61.9 | 66.1 | 68 | 72 | 276 | 180 | 202 | 66.2 | 68.9 | 43 | 42 | 219 | 177 | −4.3 | −5.0 |
| Venezuela, República Bolivariana de | Latin America and the Caribbean | 19,502 | 69.1 | 74.4 | 35 | 29 | 181 | 107 | 24,752 | 70.9 | 77.0 | 24 | 20 | 185 | 98 | −3.4 | −3.5 |
| Vietnam | East Asia and Pacific | 66,074 | 63.1 | 69.8 | 59 | 47 | 264 | 152 | 79,197 | 67.1 | 72.0 | 42 | 33 | 200 | 132 | −3.2 | −3.1 |
| Wallis and Futuna Islands | Not included | — | — | — | — | — | — | — | 15 | 59.9 | 36.4 | 86 | 80 | 295 | 230 | — | — |
| Western Sahara | Not included | — | — | — | — | — | — | — | 293 | 63.2 | 49.7 | 72 | 67 | 233 | 159 | — | — |
| Yemen, Republic of | Middle East and North Africa | 11,944 | 54.5 | 57.1 | 147 | 137 | 327 | 271 | 18,651 | 58.2 | 61.7 | 111 | 98 | 292 | 232 | −2.5 | −3.0 |
| Zambia | Sub-Saharan Africa | 8,200 | 48.7 | 54.9 | 204 | 175 | 387 | 255 | 10,570 | 39.3 | 40.5 | 192 | 177 | 692 | 646 | −0.5 | 0.1 |
| Zimbabwe | Sub-Saharan Africa | 10,467 | 59.7 | 66.0 | 87 | 73 | 297 | 181 | 12,756 | 38.5 | 38.8 | 114 | 105 | 805 | 775 | 2.5 | 3.3 |

*Sources:* Population data are from United Nations 2003. Mortality estimates for 1990 are authors' calculations; estimates for 2001 are from chapter 3 in this volume.
*Note:* — = not available or not applicable. Estimates of child mortality are rounded to the nearest whole number.

## ACKNOWLEDGMENTS

We are grateful to Colin Mathers for his input into the estimation of child mortality levels in 1990 reported in this chapter.

## NOTES

1. While it would have been much more informative to base this assessment of demographic change on the 2004 Revision of *World Population Prospects* (United Nations 2005a), the results were released too late to be incorporated into the estimates reported in this and subsequent chapters. The differences between the two revisions, at least for regional aggregates, are unlikely to be substantial.

2. An exception is Timor-Leste, where fertility increased following independence in 2002 and is currently higher than in any other country.

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