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Department of International Economic and Social Affairs

Levels and Trends of Mortality since 1950

A joint study by the United Nations
and the World Health Organization

United Nations
New York, 1982

NOTE

Symbols of United Nations documents are composed of capital letters combined with figures. Mention of such a symbol indicates a reference to a United Nations document.

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The term "country" as used in the text of this report also refers, as appropriate, to territories or areas.

The title of the report on the United Nations model life table project referred to several times in the present publication is *Model Life Tables for Developing Countries* (ST/ESA/SER.A/77).

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Preface

The present study is a joint undertaking of the Population Division of the United Nations Secretariat and the World Health Organization, and is one in a series of collaborative efforts by these two bodies in recent years in the area of mortality studies. It is the first comprehensive review of international mortality levels and trends published by the United Nations since 1962.[1] Because of the dearth of information for the world's less developed countries at that time, the earlier study included very few data for the countries of Africa, Asia and Latin America. The present study attempts to redress the balance by devoting sizable chapters to each of these three major areas. Another chapter takes up mortality conditions in the more developed countries.

The quantity of information on mortality for the less developed regions, much of it based on sample surveys and analysis of census results rather than civil registration, which serves as the basis for mortality data in the more developed countries, has increased greatly, and a number of innovative techniques have been developed to deal with the special problems presented by these data. Nevertheless, there are still serious gaps in the data, and the quality of much of it is poor, particularly for Africa and large parts of Asia.

[1] *Population Bulletin of the United Nations, No. 6, 1962; with Special Reference to the Situation and Recent Trends of Mortality in the World* (United Nations publication, Sales No. 62.XIII.2).

The time-frame for the study is from around 1950 to the mid 1970s, and in addition to discussions of general mortality levels and trends, the following items have been considered within the constraints imposed by the data: age and sex differentials in mortality; mortality in the particularly vulnerable periods of infancy and early childhood; differential mortality by urban/rural residence and socio-economic characteristics such as education, income, occupation and social class; and morbidity and causes of death.

Acknowledgement is due to the following consultants for their contributions: Professor George C. Myers (Duke University) for the extended discussion of mortality differentials within countries in the more developed regions (chap. II, sect. E); Professor Ladislav T. Ruzicka (Australian National University) and Professor Alberto Palloni (University of Wisconsin) for preparing the original drafts of chapter IV (Asia) and chapter V (Latin America), respectively.

Valuable assistance in the preparation of this study was also received from the United Nations Cairo Demographic Centre, the United Nations Regional Institute for Population Studies at Legon, Ghana, the Latin American Demographic Centre, the Economic Commission for Western Asia and the Economic and Social Commission for Asia and the Pacific.

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Explanatory notes

The following symbols have been used in the tables throughout the report:

Three dots (. . .) indicate that data are not available or are not separately reported

A dash (—) indicates that the amount is nil or negligible

A blank indicates that the item is not applicable

A minus sign (−) indicates a deficit or decrease, except as indicated

Details and percentages in tables do not necessarily add to totals, because of rounding.

The following apply throughout the text and tables:

A full stop (.) is used to indicate decimals

A slash (/) indicates a crop year or financial year, e.g., 1970/71

A hyphen (-) between dates representing years, e.g., 1971-1973, signifies the full period involved, including the beginning and end years

Reference to "dollars" ($) indicates United States dollars, unless otherwise stated

Annual rates of growth or change, unless otherwise stated, refer to annual compound rates.

Chapter I

INTRODUCTION AND OVERVIEW

INTRODUCTION

Information on a country's mortality has come to play an important and diversified role in national planning. Mortality data help to identify a country's current demographic situation and to make clear its immediate demographic future. But beyond their role in demographic accounting, mortality data are serving as important indicators of socio-economic and health progress. They chart progress in one of the areas of most universal human concern, the lengthening of life and avoidance of premature death. They are also sensitive indicators of differences, within a national population, in the degree of progress towards modern conditions, thereby helping to identify target groups for special health and development programmes. They can also be very useful in evaluating the success of programmes already instituted. Finally, mortality levels are related to other variables of social concern, such as labour productivity and fertility, and receive attention because of those relationships.

These uses of mortality information are specific to particular planning units. But in evaluating how successful a certain area has been in modernizing its mortality conditions, it is necessary to compare the situation in that area to achievements that have been recorded elsewhere. This publication facilitates these comparisons by presenting data on the current situation and recent trends in mortality for most countries of the world. In so doing, it helps to identify common problems and special areas of concern, as well as the most successful national experience from which lessons can be drawn.

Most of the volume is focused on mortality conditions in developing countries, where the largest percentage of the world's population is found and an even larger percentage of deaths occurs. The concentration on developing countries is made possible by substantial recent improvements in data quality and availability in these countries. Nevertheless, there are very few developing countries where the most reliable information on mortality, deriving from a complete death registration combined with population censuses, is available. In its place is information from a wide variety of sources: multiround surveys covering small sample areas; incomplete vital registration corrected for estimated under-registration; single-round retrospective inquiries in censuses or surveys about household deaths in some fixed time period; comparisons of age distributions in two successive censuses; and, most prominently, retrospective questions on censuses or surveys regarding the survival of children and, occasionally, of other kin. These sources do not provide as reliable information on mortality levels as that based upon complete vital registration. Consequently, it is more hazardous to rely upon them for indications of mortality trends, since spurious trends can be produced by changes in data quality. It is even riskier to use them to make inferences about a change in trend, such as an acceleration or deceleration of mortality decline. However, in most of the world they must serve as a surrogate for completely accurate mortality information, and without these supplementary sources of data the estimation of mortality levels and trends in many places would be little more than guesswork. One advantage of survey data on mortality as compared to civil registration is that they sometimes provide richer detail on differences in mortality by socio-economic and other characteristics. Each of the following chapters attempts to use mortality data to identify these differences.

MEASURES

There are a variety of mortality measures in common usage and most of them appear in this volume. Some of these measures refer to all ages combined. One such measure is the crude death rate (CDR) which is defined for purposes of this volume as deaths in a particular year for all ages combined divided by total mid year population. Occasionally, the crude death rate will be expressed as an average of crude death rates recorded during several years. This measure is a crude indicator of mortality levels because it is highly influenced by the age composition of a population. For example, a country with a large fraction of its population over age 65 will tend to have a high crude death rate regardless of the level of mortality at specific ages. A more refined measure of mortality, which is not influenced by a population's age distribution, is life expectancy at a particular age (e^0_x, sometimes also called the expectation of life at age x).[1] This index measures the expected years of future life of an individual at age x if he or she were subject for the remainder of his or her life to the age-specific death rates beyond that age recorded in some specified period. For example, the male life expectancy at birth in Australia, 1970-1972, is the expected number of

[1] Strictly speaking the symbol (e^0_x refers to the average number of years lived by members of the cohort after age x, including fractions of a year, while the symbol e_x refers to the number of years *completed* after age x. However, hereafter we shall use the symbol e_x refer to the full expectation of life.

years a new-born male would live if he were subject at each age to the male age-specific death rates recorded at that age in Australia during 1970-1972.

The other mortality measures that will be encountered in this volume refer to experience during a particular age span, rather than to the whole of life. An age-specific death rate ($_nM_x$) is defined in an identical fashion to the crude death rate, except that the deaths in the numerator and mid year population in the denominator pertain only to a certain defined age span.[2] The age-specific death rate is converted by a simple arithmetic operation into a probability of death prior to the end of the interval for someone who survives to its beginning, $_nq_x$. Basically, this operation amounts to applying the age-specific death rate to a hypothetical group of people, starting the interval over and over again, as many times as there are years in the age interval. The complement of the probability of death in some age interval is of course the probability of surviving that interval $_np_x$ the sum of the death and survival probabilities is always 1.0.

By long-standing convention, the "infant mortality rate" (IMR), as used in this volume, is in fact closer to a probability of dying between birth and age 1 than to a true mortality rate, which would use the mid year population of infants as a denominator. Instead, the denominator of the infant mortality rate is the annual number of births, while the numerator is the number of infant deaths in that year.

A mortality measure that will be encountered frequently in this volume is the probability of death between birth and age 2 [$q(2)$ or $_2q_0$]. The reason for its currency is not so much its intrinsic value but rather its widespread availability. Thanks largely to technical developments attributable primarily to William Brass, estimates of the probability of death prior to age 2 are available for a large number of developing countries.[3] The popularity of this measure derives principally from Brass's demonstration that it can be estimated indirectly, from reports by women on the total number of their live births and on the number of those births who have survived to the time of survey or census. In particular, the fraction of children dead among reporting women aged 20-24 is often close to the probability that a child will die before age 2, and the correspondence can be made closer by using adjustment factors based upon the age profile of childbearing in the population. This technique, like others using surrogate information on deaths, is subject to error from several sources, the most important of which is the failure of women to report on children, living or dead.

The two types of mortality measures, those for specific ages and those for all ages combined, are related to one another since the age-specific data are a component of mortality data for all ages combined. More important, it has been shown that high mortality levels at one age tend to be associated with high levels at other ages. That is, if one population has a higher level of mortality at ages 1-4 than another population, it is also very likely to have higher levels at ages 5-9, 50-54 and even 80-84. The most extensive documentation of these relations is contained in a study by Coale and Demeny.[4] They demonstrated that age-specific death rates were typically correlated with one another at levels of +0.8 to +0.9 in a collection of more than 100 sets of age-specific death rates drawn from various nations and periods. Thus, there is a firm empirical basis for using mortality information pertaining to one age in order to make inferences about mortality levels at other ages.

However, the relation across populations between death rates at any pair of ages is by no means deterministic. In fact, Coale and Demeny have identified four different patterns of relations, which they designated regionally as "North", "East", "South" and "West". A particular death rate at ages 1-4, for example, is associated with a different death rate at ages 20-24 or 40-44 in the "North" than in the "East" pattern. Still other typical patterns of mortality have been suggested,[5] and the Population Division of the United Nations Secretariat is producing a new set of patterns that will reflect more accurately the situation in developing countries.[6] At the present time it is not altogether clear which set of patterns should supply the basic reference group for particular developing countries. As a result, the translation of an age-specific death rate into a composite measure of mortality such as life expectancy at birth is subject to considerable pattern uncertainty. This uncertainty is such that the estimate of life expectancy at birth associated with a particular value of the probability of death before age 2 can vary by as much as 5-6 years, but it is unlikely to introduce much more error than this. The value for interpopulation comparisons of having a common measure of mortality, such as life expectancy at birth, would seem to outweigh disadvantages resulting from uncertainty regarding the choice of reference mortality pattern.

It should be noted that all mortality measures can be defined in such a way that they pertain to a particular cause of death or to a set of causes. In this volume the measures that relate to specific causes are principally age-specific death rates. These are defined in a fashion identical to that for age-specific death rates for all causes combined, except that the numerator contains only deaths ascribed to a particular underlying cause.[7] Since the causes of death are coded in such a way as to be mutually exclusive and exhaustive, the sum of cause-specific death rates at a particular age is simply the age-specific death rate from all causes combined.

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[2] The notation for the age-specific death rates in a life table population is $_nm_x$.

[3] William Brass and others, eds. *The Demography of Tropical Africa* (Princeton, N.J., Princeton University Press, 1968.)

[4] Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966).

[5] *Age and Sex Patterns of Mortality; Model Life-tables for Underdeveloped Countries* (United Nations publication, Sales No. 55.XIII.9). Norman Carrier and John Hobcraft, *Demographic Estimation for Developing Societies* (London, Population Investigation Committee, 1971).

[6] United Nations model life table project (publication forthcoming).

[7] For a discussion of the concept of underlying cause of deaths, see Iwao Moriyama, "Development of the present concept of cause of death", *American Journal of Public Health*, vol. 46 (1956), pp. 436-441.

Issues considered

This review is organized primarily on a geographic basis. However, more developed countries are considered as a group regardless of the region in which they are located. For purposes of this volume, "the more developed countries" include Europe, the Union of Soviet Socialist Republics, Northern America, Japan, Australia and New Zealand. One chapter is devoted to this group of countries and other chapters are devoted to Africa, Asia (except Japan) and Latin America.

Each chapter deals with a common set of issues. An attempt is made to assess levels of mortality among countries of the region in the most recent period for which information is available. Other information available on mortality in a country since 1950 is also introduced so that mortality trends in the region can be identified. The function of the volume is not, however, to estimate levels and trends in mortality for every country of the world; this important function is served by other publications prepared by the Population Division of the United Nations Secretariat.[8] Instead, attention is confined to countries which appeared able to supply reasonably reliable mortality information. What is reasonably reliable is necessarily a subjective matter, since the variety of types of data available does not permit application of uniform tests. Doubtless some readers will disagree with the choices that have been made, and in some instances new studies have appeared since this volume went to press that would alter certain of the estimates appearing herein. Standards of reliability had to be relaxed for the sub-Saharan African region simply because so few estimates would have survived rigorous tests of reliability. Although mortality data in Latin America and Asia seem to have improved somewhat in quantity and quality throughout the post-war period, the same cannot be said for tropical Africa.

In addition to estimates of levels and trends in mortality within a region, each chapter also attempts to identify major demographic differentials in mortality. Age and sex patterns of mortality are examined where information permits, and these will be seen to show very important regional differences. Furthermore, mortality differences among groups defined by basic socio-economic criteria are described. Among these criteria, the most abundant mortality information exists for urban versus rural residence and, with respect to child mortality, for educational group of the mother. Father's literacy and occupation are also available on occasion to supplement the child mortality tabulations. For the more developed countries, a far richer set of variables is often available for examining socio-economic mortality differences. However, the data available for developing regions are often completely adequate to establish the existence of socio-economic mortality differences. One of the most important functions that this volume will serve is the systematic documentation of enormous differences in mortality conditions within many developing countries. These differences are sometimes as large as those which distinguish more developed from less developed countries. They suggest that, in the drive to improve mortality conditions in the developing world, attention must be paid to the distribution of health-related resources within countries as well as among countries.

[8] Among them, see, in particular, *World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment* (United Nations publication, ST/ESA/SER.R/33, 1979).

Recent pace of mortality decline in developing countries

The chapters in this volume are specific to particular regions and groups of countries. This regional focus is appropriate because problems of health and development often show unique regional features. Nevertheless, it is useful to attempt to draw together results from certain common issues considered in the chapters. Perhaps the most central of these issues is the recent pace of mortality decline in developing countries. In particular, various alarums have been sounded about a supposed deceleration in rates of mortality improvement. The present volume, which has attempted to identify the most reliable information available on mortality levels in developing countries, provides a fresh opportunity to examine these trends. As noted above, measurement error is inescapably present when dealing with developing country mortality data. Such error often produces trends when none are present and obscures those which actually occurred. These problems are often critical in making judgements about a particular country, but they are less consequential in dealing with large groups of countries simply because they can be expected largely to offset one another.

In considering mortality trends it is necessary to choose an index of mortality. Very different trends can be registered on different indexes. In particular, a certain percentage change in all age-specific death rates results in less and less percentage improvement in life expectancy as the initial level of mortality improves.[9] For present purposes, the mean annual change in life expectancy at birth is used as the basic index of mortality change. Life expectancy at birth is the most common index of mortality conditions and estimates of it are available in the present work for all three major developing regions in the period from 1950 to the present. However, it should be emphasized that geographic coverage by this index is quite incomplete and that the countries which can supply data may not be representative of all countries.

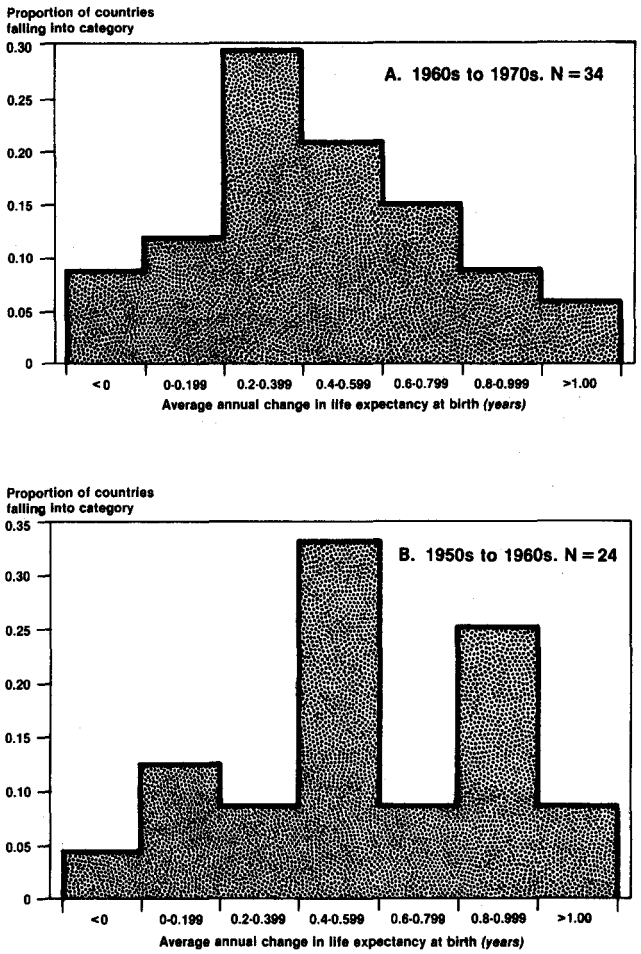
Data for this analysis are drawn from tables III.1 and III.8 in chapter III (Africa), table IV.4 in chapter IV (Asia), and table VA.1 in the annex to chapter V (Latin America). A country is included if it can supply an observation on life expectancy in the 1960s and another in the 1970s, and if central dates of these observations are separated by at least five years.[10] Thirty-four countries are represented: 16 from Latin America, nine from Asia and nine

[9] Nathan Keyfitz and Antonio Golini, "Mortality comparisons: the male-female ratio", *Genus*, vol. 331, Nos. 1-4 (1975), pp. 1-34.

[10] Where several choices were available the latest date was chosen for the 1970s and a date closest to the middle of the 1960s. For the subsequent analysis of change between the 1950s and 1960s, the same data points were chosen for the 1960s and the earliest available data point for the 1950s. Occasionally, when data for the 1950s were unavailable, an observation was substituted from the late 1940s.

from Africa.[11] Analysis is focused on the mean of male and female life expectancies.

Figure I.1. Frequency distribution of rates of mortality change in developing countries



Sources: Based on data in tables II.1, III.8, IV.4 and VA.1.

Figure I.1A shows the distribution of annual rates of change in life expectancy between the 1960s and 1970s for these 34 countries. The distribution is unimodal and skewed to the right. The mode occurs in the range of 0.2 to 0.399 years of gain in life expectancy per calendar year. As is typical of distributions skewed to the right, the mean rate of increase of 0.45 years of life per calendar year exceeds the mode. The most common rate of gain falls short of the average rate of gain because several outstandingly rapid improvements were included in the average. The distribution presented in figure I.1 is probably best interpreted as a combination of the true distribution for these 34 countries and a pattern of (probably substantial) measurement error having approximately a zero mean and a bell-shaped distribution.

The distribution of changes in life expectancy for the period from the 1960s to the 1970s is substantially different from that recorded for the period from the 1950s to the 1960s. Unfortunately, only 24 developing countries have supplied data for this earlier period and some of the irregularity shown in figure I.1B is doubtless attributable to this small sample size. But the mean of the earlier distribution, 0.57, clearly lies to the right of the mean of 1960s-1970s changes. Furthermore, there is a distinct bimodality to the distribution for the 1950s-1960s. Closer inspection reveals a regional basis for this bimodality. The mode for Latin American countries is in the 0.80-0.99 range, and these countries account for four of the six observations falling into this category. The mode for the combined group of African-Asian countries falls into the 0.40-0.59 range and they account for five of the eight observations located there. With such small numbers it is unwise to attribute too much significance to these observations, but it is certainly noteworthy that 18 out of 24 countries, or three quarters, had a rate of gain in life expectancy during the 1950s-1960s period that exceeded the modal gain for the 1960s-1970s period.

Table I.1, which presents mean rates of change in life expectancy for the two periods, suggests that much of the decline in rates of gain in life expectancy is attributable to Latin American countries, where the average gain between the 1960s and the 1970s was only half as large as that for the earlier period. Column 3 of the table shows that this slowdown is not attributable to a changing composition of countries supplying information in the two periods. A reduction of about one half is also observed when attention is confined to the 11 countries that can supply data for both periods. In Asia and Africa, however, the situation is much less distinct. The Asian countries show some hint of an accelerated mortality decline between the periods. In Africa, the direction of change depends upon whether or not Algerian data are included. Deaths from activities of war increased Algerian mortality in the 1960s and caused a reduction in life expectancy between the 1950s and the 1960s, followed by a sharp increase in the later period. The changes in rates of decline in Asia and Africa are hardly decisive, and the small number of cases available cautions against drawing any generalizations based upon these data.

The tentative picture that emerges is that mortality declines in developing countries have decelerated during the period from the 1960s to the 1970s but that this deceleration is largely confined to Latin American countries. Since these countries have in general achieved the highest life expectancies within the developing regions, the question

[11] The Latin American countries are: Barbados, Cuba, Dominican Republic, Jamaica, Puerto Rico, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Panama, Argentina, Chile, Colombia, Uruguay and Venezuela. Asian countries are Burma (towns), Hong Kong, India, Malaysia (peninsular), Nepal, Philippines, Singapore, Sri Lanka and Thailand. African countries are Algeria, Burundi, Cape Verde, Ghana, Lesotho, Liberia, Mauritius, the United Republic of Tanzania (mainland) and Zaire. For India, 1970-1972, a value of 48.9 years, calculated in the Population Division on the basis of data from the Sample Registration System, was used.

TABLE I.1. AVERAGE ANNUAL RATE OF CHANGE IN LIFE EXPECTANCY AT BIRTH IN DEVELOPING COUNTRIES

(Years; number of countries in parentheses)

Region	1950s to 1960s (1)	1960s to 1970s (2)	1960s to 1970s for countries in column 1 (3)
Latin America	0.70 (11)	0.35 (16)	0.36 (11)
Asia	0.48 (7)	0.57 (9)	0.60 (7)
Africa	0.43 (6)	0.53 (9)	0.62 (6)
Excluding Algeria	0.60 (5)	0.45 (8)	0.51 (5)
Developing countries	0.57 (24)	0.45 (34)	0.49 (24)

Sources: Based on data in tables III.1, III.8, IV.4 and VA.1.

TABLE I.2. AVERAGE ANNUAL RATE OF CHANGE IN LIFE EXPECTANCY AT BIRTH IN DEVELOPING COUNTRIES CLASSIFIED BY LEVEL OF LIFE EXPECTANCY AT START OF PERIOD

(Years; number of observations in parentheses)

Initial level of life expectancy (Years)	Period	
	1950s to 1960s	1960s to 1970s
30. – 39.99	0.64 (5)	0.47 (4)
40. – 49.99	0.59 (7)	0.70 (7)
50. – 59.99	0.61 (8)	0.35 (8)
60. – 64.99	0.62 (3)	0.43 (7)
65+	– (0)	0.24 (7)
All	0.61 (23)	0.43 (33)

Sources: Based on data in tables III.1, III.8, IV.4 and VA.1.

arises of whether they are experiencing a more or less natural deceleration of mortality decline as the biological limits of life expectancy are approached.

One way to investigate this question is to examine rates of mortality decline for countries classified according to their initial level of life expectancy at birth. Table I.2 presents the average rates of change for the two post-war periods under consideration.[12]

According to table I.2, during the period from the 1950s to the 1960s the average rate of mortality improvement was about 0.6 year per calendar year regardless of the level of mortality at the outset of the period. However, no countries at the outset had achieved a life expectancy exceeding 65 years. By the 1960s, seven countries had achieved a life expectancy of at least 65 years, and these countries showed the slowest average gain in years of life between the 1960s and the 1970s. Their average gain of 0.24 year per calendar year was exactly half of the 0.48 year value recorded by countries that started the period with life expectancies below 65 years. Thus, there is reason to believe that part of the deceleration in average rates of mortality improvement resulted from the fact that, by the 1960s, a substantial number of countries had entered a range of relatively high life expectancies where mortality advances tend to occur much more slowly. However, this slowdown at higher life expectancies was not inevitable, since a healthier rate of gain of 0.5 year of life per calendar year would still have left the seven countries with a level of life expectancy in the 1960s below that typical of the developed countries.

But this changing distribution of countries according to initial life expectancy is not a complete explanation of the deceleration in mortality advance. As shown in table I.2, in three of the four categories where comparisons can be made between rates of advance in the 1950s-1960s and the 1960s-1970s, gains in life expectancy decelerated. For countries beginning with life expectancies *below* 65 years, the average annual increase was 0.61 year in the 1950s-1960s (N = 23) and 0.48 year in the 1960s-1970s (N = 26). This decline is not large but it is surely disturbing to those concerned with improving living conditions in developing countries. It is clearly the major factor contributing to the slowdown from average gains of 0.61 year to gains of 0.43 year. That is, even if no countries had moved into the range of life expectancies above 65 years where advance seems slowest, a decline of 0.13 in average rates of advance (of the observed 0.18 decline) would have occurred between the two decades. So approximately one third of the slowdown is attributable to the emergence of selected countries into the low mortality-slow advance zone, but the remaining two thirds is attributable to a reduced pace of improvement at higher mortality levels where the large majority of developing countries have been located throughout the post-war period.

A note of caution should again be interjected. It is possible that the majority of developing countries, which are not able to supply reasonably reliable data on recent mortality trends, would have very different experiences than the countries which have supplied data. Furthermore, even in the latter group, measurement errors are fully capable of producing spurious trends and changes in trend. But national and international decisions must often be made on the basis of the results available, however incomplete they may be. These suggest that mortality improvements in developing countries have decelerated in recent years and that the deceleration applied regardless of the level of life expectancy attained.

[12] Data for Algeria are not included because of its anomalous mortality conditions and trends that were cited above.

Chapter II

THE MORE DEVELOPED COUNTRIES

The mortality statistics of the more developed countries are extensive and relatively reliable. Birth and death registration is virtually 100 per cent complete, and periodic and frequent population censuses, updated annually during intercensal periods with data on births, deaths and international migration, ensure a fairly accurate population base for computing age-specific death rates and constructing life tables. As a result, the over-all mortality trends displayed by the data for these countries can be assumed to reflect closely the actual situation.

The countries included in the more developed category for purposes of the present analysis are listed below in regional groupings. Countries with fewer than 200,000 inhabitants have been omitted from the analysis.

Major area	*Region*	*Countries*
Northern America	Northern America	Canada, United States of America
East Asia	Japan	Japan
Europe	Eastern Europe	Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, Romania
	Northern Europe	Denmark, Finland, Iceland, Ireland, Norway, Sweden, United Kingdom: England and Wales; Northern Ireland; Scotland
	Southern Europe	Albania, Cyprus, Greece, Israel, Italy, Malta, Portugal, Spain, Yugoslavia
	Western Europe	Austria, Belgium, France, Federal Republic of Germany, Luxembourg, Netherlands, Switzerland
Oceania	Australia and New Zealand	Australia, New Zealand
Union of Soviet Socialist Republics	Union of Soviet Socialist Republics	Union of Soviet Socialist Republics

Between 1950 and the mid 1970s, the period covered by the present study, mortality continued its secular decline in those countries where it was already quite low at the start of the period, i.e., the countries of Northern and Western Europe, and the oversea English-speaking countries. In these countries, mortality progress during that period continued the downward trends which had begun in the nineteenth and early twentieth centuries. However, in Japan, the Union of Soviet Socialist Republics and the countries of Southern and Eastern Europe, which had lagged far behind the others, mortality decline did not assert itself until after the Second World War, with the diffusion of antibiotic therapy and other modern medical achievements and the improvement in economic and social conditions. After 1950 mortality gains were much more rapid in the latter countries than in the countries which had achieved low mortality levels, with the result that differences in mortality between the two groups of countries were narrowed considerably. Today, despite economic and cultural differences among the more developed countries, their mortality levels are relatively homogeneous. In the early to mid 1970s, expectation of life at birth for both sexes combined in these countries ranged over only an eight-year span, from about 68 to 75 years. The ranges of life expectancy in the less developed countries of Africa, Asia and Latin America were much wider, as will be shown in subsequent chapters.

A. Levels and trends in expectation of life at birth

Levels of expectation of life at birth for the more developed countries based on the most recent available official life table for each country are given in table II.1 in rank order of life expectancy. The rankings are only approximately correct, since the life tables refer to different dates within the 12-year period from 1965 to 1977. According to these life tables, male life expectancies ranged from a high of 72.7 years in Japan to 64 years in the USSR, while for females the range was from 78.1 years in Norway to 70.2 years in Yugoslavia. The Scandinavian countries were at or near the top of the list for both sexes, while the countries with the lowest life expectancies were mostly Southern and Eastern European countries and the USSR.

Important gains in longevity were made in the more developed countries between 1950 and the mid 1970s. Figure II.1 presents data on expectation of life at birth for males and females around these two dates for the 37 countries listed above. Among the salient features of figure II.1 are the marked upward shift in the range of life expectancy values between 1950 and the mid 1970s and the emergence of distinctly different distributions of male and female values. Around 1950, life expectancy ranged from 52 years to 69 years for males and from 54 years to 73 years for females. This was a range of 18 years for males and 20 years for females and an overlapping of 16 years between these ranges. At the more recent date the ranges had narrowed considerably to 64 to 72 years for males and 70 to 78 years for females (a range of only 9 years for each sex), with the values for the two sexes overlapping for only 3 years, from 70 to 72 years. There was also considerable concentration within these ranges. In the mid 1970s, 15 of the 37 countries considered had male life expectancies of 67 or 68 years, and 14 countries had female life expectancies of 73 or 74 years.

TABLE II.I. RANKING OF MORE DEVELOPED COUNTRIES ACCORDING TO EXPECTATION OF LIFE AT BIRTH FOR MALES AND FEMALES, 1970s

Males				Females		
Rank	Country and period	Expectation of life at birth (years)		Rank	Country and period	Expectation of life at birth (years)
1.	Japan	1977	72.69	1.	Norway	1975-1976	78.12
2.	Sweden	1976	72.12	2.	Japan	1977	77.95
3.	Norway	1975-1976	71.85	3.	Sweden	1976	77.90
4.	Iceland	1971-1975	71.6	4.	Iceland	1971-1975	77.5
5.	Netherlands	1971-1975	71.2	5.	Netherlands	1971-1975	77.2
6.	Denmark	1975-1976	71.1	6.	France	1974	76.9
7.	Israel	1975	70.3	7.	Denmark	1975-1976	76.8
8.	Switzerland	1968-1973	70.29	8.	United States	1976	76.7
9.	Greece	1970	70.13	9.	Canada	1970-1972	76.36
10.	Cyprus	1973	70.0	10.	Switzerland	1968-1973	76.22
11.	Spain	1970	69.69	11.	Finland	1975	75.93
12.	United Kingdom (England and Wales)	1974-1976	69.62	12.	Australia	1975	75.86
13.	Canada	1970-1972	69.34	13.	United Kingdom (England and Wales)	1974-1976	75.82
14.	France	1974	69.0	14.	Austria	1976	75.05
15.	United States	1976	69.0	15.	Spain	1970	74.96
16.	Italy	1970-1972	68.97	16.	Italy	1970-1972	74.88
17.	Australia	1975	68.85	17.	Germany, Federal Republic of	1974-1976	74.81
18.	German Democratic Republic	1976	68.82	18.	New Zealand	1970-1972	74.60
19.	Bulgaria	1969-1971	68.58	19.	German Democratic Republic	1976	74.42
20.	Ireland	1965-1967	68.58	20.	Poland	1975	74.26
21.	New Zealand	1970-1972	68.55	21.	Belgium	1968-1972	74.21
22.	Germany, Federal Republic of	1974-1976	68.30	22.	USSR	1971-1972	74
23.	Malta	1976	68.27	23.	United Kingdom (Scotland)	1973-1975	73.93
24.	Austria	1976	68.07	24.	Luxembourg	1971-1973	73.9
25.	Belgium	1968-1972	67.79	25.	Israel	1975	73.9
26.	United Kingdom (Scotland)	1973-1975	67.44	26.	Bulgaria	1969-1971	73.86
27.	Finland	1975	67.38	27.	Greece	1970	73.64
28.	Romania	1974-1976	67.37	28.	Czechoslovakia	1977	73.6*
29.	Poland	1975	67.02	29.	Malta	1976	73.10
30.	Luxembourg	1971-1973	67.0	30.	Cyprus	1973	72.9
31.	United Kingdom (Northern Ireland)	1974-1976	66.76	31.	Ireland	1965-1967	72.85
32.	Czechoslovakia	1977	66.7*	32.	Hungary	1974	72.42
33.	Hungary	1974	66.54	33.	Portugal	1974	72.03
34.	Albania	1969-1970	66.5	34.	Romania	1974-1976	71.97
35.	Yugoslavia	1970-1972	65.42	35.	United Kingdom (Northern Ireland)	1974-1976	70.72
36.	Portugal	1974	65.29	36.	Albania	1969-1970	70.4
37.	USSR	1971-1972	64	37.	Yugoslavia	1970-1972	70.22

Sources: Official publications, and files of the United Nations Statistical Office.

* Provisional data.

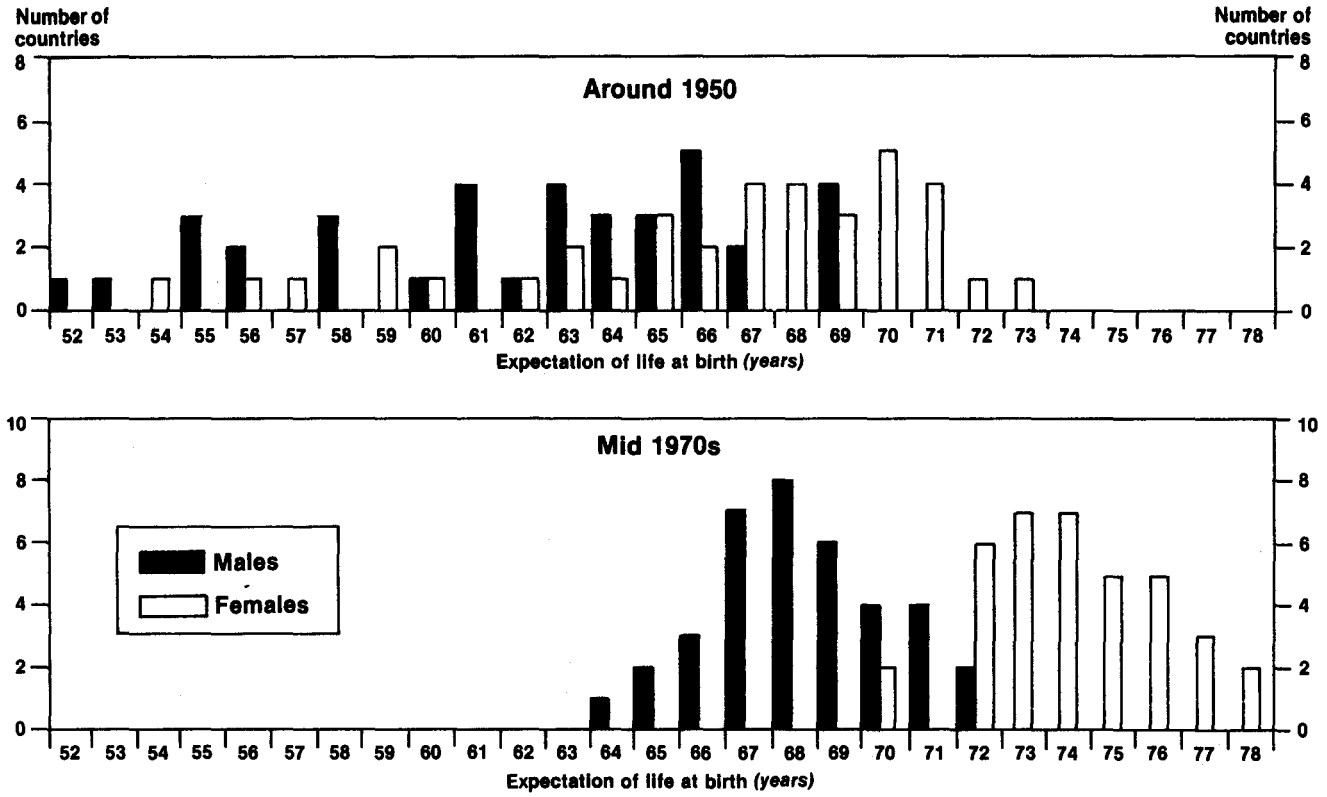
In table II.2 the values for expectation of life at birth around 1950 and in the 1970s are given, as well as the total increase in life expectancy over the period, and the average annual increase in absolute and percentage terms. The data presented in table II.2 are from official life tables only. Because many countries do not prepare life tables on an annual basis, there is variation from country to country in the boundary dates shown in the table, and therefore in the length of the intervals between the two dates. This should be kept in mind in the discussion which follows.

At the more recent of the two periods for which data are shown in table II.2 (with the exception of Ireland, this is a date in the 1970s), expectation of life at birth averaged 68.7 years for males and 74.7 years for females, compared with 62.6 years and 66.7 years for males and females, respectively, around 1950. The average increase over the period was, therefore, approximately 6 years for males and 8 years for females. However, there was much variation among countries with respect to gains in life expectancy during this period. This is illustrated by the following table, which gives the number of countries experiencing gains in expectation of life at birth of varying sizes, ranging from less than 3 years to 10 years and over, between around 1950 and the mid 1970s.

	Number of countries	
Size of gain	Males	Females
Less than 3 years	8	—
3-4 years	10	7
5-6 years	9	12
7-9 years	4	9
10 years and over	6	9
TOTAL	37	37

Source: Table II.2.

Figure II.1. Frequency distributions of expectation of life at birth in 37 more developed countries, males and females, around 1950 and mid 1970s



Source: Table II.2.

NOTE: Values of expectation of life at birth have been tabulated according to intervals from 52.0 to 52.9 years, 53.0 to 53.9 etc., rather than rounded to the nearest whole number; e.g., a life expectancy of 69.8 years has been tabulated as 69 rather than 70 years.

It can be seen from these figures that about half of the countries had increases in male life expectancy of 5 years or more, while 4 out of 5 countries had gains of this magnitude for females.

Generally speaking, the countries with the lowest values for life expectancy around 1950 had the greatest increases over the period considered, and, conversely, countries with the highest life expectancies at the start showed the smallest increases. Japan had the greatest increases—16.5 years for males and 18.4 years for females—followed by Bulgaria, with an increase of 15.3 years for males and 17.5 years for females. At the other extreme are countries with initial high life expectancies and only small increases. These countries include Iceland, the Netherlands and Norway. Thus, the period was marked by considerable convergence in national life expectancies, as already noted in the discussion of figure II.1.

Expectation of life at birth reflects a population's mortality experience at all ages, and changes in expectation of life at birth can be decomposed to determine the contribution of mortality changes in the various age-groups to total change in life expectancy. This contribution is a function of two factors: the size of increase in the probability of surviving to the end of the given age interval, and the position of the age-group itself along the age continuum. The greater the increase in the probability of surviving, and the younger the age-group in which the increase occurs, the greater the gain in life expectancy. Table II.3 presents the results of decomposing changes in expectation of life at birth for selected more developed countries into three broad age-groups for two or more intervals from around 1950 to the 1970s. As an example, in Canada between 1950-1952 and 1960-1962, expectation of life at birth for males increased by 2.0 years. Improvements in mortality in age-group 0-29 years contributed 1.4 years to the total improvement, while changes in mortality in age groups 30-64 years and 65 years and over contributed 0.5 years and 0.1 years, respectively.

At the earliest of the two or three intervals shown in the table, the greatest contributions to changes in expectation of life at birth were typically made by the youngest age-group, i.e., 0-29 years, and the smallest contributions were made by ages 65 years and over. While this pattern characterized both males and females, it was more prevalent among males. For females in several countries, the contribution from age-groups 30-64 years and 65 years and over were roughly equal (e.g., the United States, Romania, England and Wales), and in several others the contribution from the 65 years and over age-group was greater than that of the middle group (e.g., Israel, Italy, German Democratic Republic). For males during the most recent interval (generally from the 1960s to the 1970s), the

youngest age-group continued to contribute the most to increases in life expectancy, but frequently the contributions from the middle and oldest age-groups were negligible or even negative. As a group, the Eastern European countries showed the most unfavourable trends in male mortality at middle and old ages. The countries with the largest negative contributions to expectation of life at birth from age-group 30-64 years were Czechoslovakia (−0.7 year), Israel (−0.5 year) and Romania (−0.4 year). For age-groups 65 years and over, the largest negative contributions occurred in the German Democratic Republic (−0.7 year) and Romania (−0.5 year). Sizable negative balances also occurred at certain ages during the middle time period in the Netherlands (−0.4 year in age-groups 30-64 years) and Norway (−0.4 year and −0.7 year in age-groups 30-64 years and 65 years and over, respectively). Despite these negative contributions from the two older age-groups, only Czechoslovakia and the Nether-

TABLE II.2. EXPECTATION OF LIFE AT BIRTH AROUND 1950 AND MOST RECENT AVAILABLE PERIOD, AND ABSOLUTE AND RELATIVE CHANGE BETWEEN PERIODS, MORE DEVELOPED COUNTRIES

Major area, region and country	Expectation of life at birth (years)						Increase in expectation of life at birth between periods (years)		Average annual increase in expectation of life at birth between periods (years)		Average annual rate of change in expectation of life at birth between periods (percentage)	
	Around 1950			Most recent period								
	Period[a]	Males	Females	Period[a]	Males	Females	Males	Females	Males	Females	Males	Females
Northern America												
Canada	1950-1952	66.3	70.8	1970-1972	69.3	76.4	3.0	5.5	0.15	0.28	0.2	0.4
United States	1950-1954[b]	65.9	71.7	1976	69.0	76.7	3.1	5.0	0.16	0.25	0.2	0.3
Japan	1949-1950	56.2	59.6	1977	72.7	78.0	16.5	18.4	0.60	0.67	0.9	1.0
Europe												
Eastern Europe												
Bulgaria	1946-1947	53.3	56.4	1969-1971	68.6	73.9	15.3	17.5	0.65	0.74	1.1	1.2
Czechoslovakia	1949-1957	60.9	65.5	1975	66.9	73.9	6.0	8.4	0.24	0.34	0.4	0.5
German Democratic Republic	1952-1953	65.1	69.1	1976	68.8	74.4	3.7	5.3	0.16	0.23	0.2	0.3
Hungary	1948-1949	58.3	63.2	1974	66.5	72.4	7.8	9.2	0.31	0.36	0.5	0.5
Poland	1948	55.6	62.5	1975	67.0	74.3	11.4	11.8	0.42	0.44	0.7	0.6
Romania	1956	61.5	65.0	1974-1976	67.4	72.0	5.9	7.0	0.31	0.37	0.5	0.5
Northern Europe												
Denmark	1946-1950	67.8	70.1	1975-1976	71.1	76.8	3.4	6.7	0.12	0.24	0.2	0.3
Finland	1946-1950	58.6	65.9	1975	67.4	75.9	8.8	10.1	0.33	0.37	0.5	0.5
Iceland	1946-1955	69.4	73.5	1971-1975[c]	71.6	77.5	2.2	4.0	0.09	0.16	0.1	0.2
Ireland	1950-1952	64.5	67.1	1965-1967	68.6	72.9	4.1	5.8	0.27	0.39	0.4	0.6
Norway	1946-1950	69.3	72.7	1975-1976	71.9	78.1	2.6	5.5	0.09	0.20	0.1	0.3
Sweden	1946-1950	69.0	71.6	1976	72.1	77.9	3.1	6.3	0.11	0.23	0.2	0.3
United Kingdom:												
England and Wales	1950-1954[b]	67.1	72.3	1974-1976	69.6	75.8	2.5	3.5	0.11	0.15	0.2	0.2
Northern Ireland	1950-1952	65.5	68.8	1973-1975	67.2	73.6	1.7	4.8	0.07	0.21	0.1	0.3
Scotland	1950-1954[b]	65.0	69.5	1973-1975	67.4	73.9	2.4	4.5	0.11	0.20	0.2	0.3
Southern Europe												
Albania	1950-1951	52.6	54.4	1969-1970	66.5	70.4	13.9	16.0	0.73	0.84	1.2	1.4
Cyprus	1948-1950	63.6	68.8	1973	70.0	72.9	6.4	4.1	0.27	0.17	0.4	0.2
Greece	1950	63.4	66.7	1970	70.1	73.6	6.7	7.0	0.34	0.35	0.5	0.5
Israel	1950-1954[b,d]	67.2	70.1	1975	70.3	73.9	3.1	3.8	0.13	0.17	0.2	0.2
Italy	1950-1953	63.8	67.3	1970-1972	69.0	74.9	5.2	7.6	0.27	0.39	0.4	0.5
Malta	1948	55.7	57.7	1975-1976[b]	68.4	72.9	12.7	15.2	0.46	0.55	0.7	0.9
Portugal	1949-1952	55.5	60.5	1974	65.3	72.0	9.8	11.5	0.42	0.49	0.7	0.7
Spain	1950	58.8	63.5	1970	69.7	75.0	10.9	11.5	0.55	0.58	0.9	0.8
Yugoslavia	1952-1954	56.9	59.3	1971-1972	65.6	70.4	8.7	11.1	0.47	0.60	0.8	0.9
Western Europe												
Austria	1949-1951	61.9	67.0	1976	68.1	75.1	6.2	8.1	0.24	0.31	0.4	0.4
Belgium	1946-1949	62.0	67.3	1968-1972	67.8	74.2	5.8	6.9	0.26	0.31	0.4	0.4
France	1950-1951	63.6	69.3	1974	69.0	76.9	5.4	7.6	0.23	0.32	0.3	0.4
Germany, Federal Republic of	1949-1951	64.6	68.5	1974-1976	68.3	74.8	3.7	6.3	0.15	0.25	0.2	0.4
Luxembourg	1946-1948	61.7	65.8	1971-1973	67.0	73.9	5.3	8.2	0.22	0.34	0.3	0.5
Netherlands	1947-1949	69.4	71.5	1971-1975	71.2	77.2	1.8	5.7	0.07	0.23	0.1	0.3
Switzerland	1948-1953	66.4	70.9	1968-1973	70.3	76.2	3.9	5.4	0.20	0.27	0.3	0.4
Oceania												
Australia	1946-1948	66.1	70.6	1975	68.9	75.9	2.8	5.3	0.10	0.19	0.1	0.3
New Zealand	1950-1952	67.2	71.3	1970-1972	68.6	74.6	1.4	3.3	0.07	0.17	0.0	0.2
USSR	1954-1955	61	67	1971-1972	64	74	3.0	7.0	0.18	0.41	0.3	0.6

Source: Compiled from data in table IIA.1.

[a] Unless otherwise indicated, dates refer to years of official life tables.

[b] Data are averages of values from two or more official life tables within the years indicated.

[c] Expectation of life at birth according to the most recent life table for Iceland, that of 1975-1976, is 73.0 years for males and 79.2 years for females. However, because of random fluctuations due to the small number of deaths annually, life expectancy for a five-year period is presented.

[d] For Jewish population.

TABLE II.3. CHANGES IN EXPECTATION OF LIFE AT BIRTH (e_0) AND CONTRIBUTION TO CHANGES FROM THREE BROAD AGE-GROUPS, AROUND 1950 TO 1970s

(*Years*)

Major area, region, country and period	Males				Females			
	Change in e_0	Contribution to change by age-groups			Change in e_0	Contribution to change by age-groups		
		0-29	30-64	65 and over		0-29	30-64	65 and over
Northern America								
Canada								
1950-1952 to 1960-1962	2.0	1.4	0.5	0.1	3.3	1.4	1.1	0.8
1960-1962 to 1970-1972	1.0	0.8	0.1	0.1	2.2	0.7	0.3	1.2
United States								
1950-1954 to 1960-1964	0.9	0.4	0.5	0.0	1.7	0.5	0.6	0.6
1960-1964 to 1970-1973	0.6	0.3	0.2	0.1	1.6	0.5	0.4	0.7
East Asia								
Japan								
1949-1950 to 1952-1954	6.2	3.7	1.8	0.7	6.7	4.0	1.7	1.0
1952-1954 to 1960-1964	4.1	3.3	1.1	−0.3	5.2	3.7	1.7	−0.2
1960-1964 to 1970-1974	3.9	1.8	1.2	0.9	4.2	1.6	1.3	1.3
Europe								
Eastern Europe								
Bulgaria								
1946-1947 to 1956-1957	10.9	7.2	2.7	1.0	11.3	7.9	2.2	1.2
1956-1957 to 1965-1967	4.6	4.2	0.4	0.0	5.0	4.1	0.7	0.2
Czechoslovakia								
1949-1951 to 1960-1964	6.6	5.4	1.1	0.1	7.7	5.2	1.5	1.0
1960-1964 to 1970-1973	−1.0	−0.0	−0.7	−0.3	0.1	−0.1	0.0	0.1
German Democratic Republic								
1952-1953 to 1960-1964	2.7	2.2	0.2	0.3	3.7	2.1	0.7	0.9
1960-1964 to 1971-1972	0.7	1.4	0.0	−0.7	1.0	1.2	0.2	−0.4
Hungary								
1948-1949 to 1959-1960	6.4	5.3	1.4	−0.3	6.3	5.0	1.4	−0.1
1959-1960 to 1970-1972	1.4	1.6	−0.2	0.0	2.8	1.6	0.5	0.7
Poland								
1948 to 1952-1953	3.0	2.7	0.6	−0.3	1.7	1.6	0.4	−0.3
1952-1953 to 1960-1961	6.2	4.3	1.4	0.5	6.3	4.0	1.5	0.8
1960-1961 to 1970-1972	2.0	2.4	−0.2	−0.2	3.2	2.3	0.5	0.4
Romania								
1956 to 1961-1963	3.3	1.5	1.0	0.8	4.0	2.4	0.8	0.8
1961-1963 to 1970-1972	1.5	2.4	−0.4	−0.5	1.9	1.6	0.4	−0.1
Southern Europe								
Greece								
1950 to 1960-1962	4.0	2.0	1.6	0.4	4.1	2.0	1.5	0.6
1960-1962 to 1970	2.7	1.6	0.8	0.3	3.0	1.8	1.0	0.2
Israel								
1949-1951 to 1958-1960	3.9	2.7	0.8	0.4	3.6	2.3	0.6	0.7
1958-1960 to 1972-1973	0.1	0.6	−0.5	−0.0	0.3	0.6	0.3	−0.6
Italy								
1950-1953 to 1960-1962	3.5	2.5	0.5	0.5	5.0	2.7	1.0	1.3
1960-1962 to 1970-1972	1.7	1.5	0.3	−0.1	2.6	1.5	0.5	0.6
Spain								
1950 to 1960	8.6	6.0	2.1	0.5	8.4	6.2	1.6	0.6
1960 to 1970	2.4	1.5	0.3	0.6	3.1	1.5	0.5	1.1
Northern Europe								
Denmark								
1946-1950 to 1951-1955	2.1	1.4	0.5	0.2	2.4	1.4	0.7	0.3
1951-1955 to 1961-1965	0.4	0.8	−0.1	−0.3	1.9	0.7	0.6	0.6
1961-1965 to 1971-1975	0.6	0.7	−0.2	0.1	2.0	0.7	0.0	1.3
Ireland								
1950-1952 to 1960-1962	3.6	2.3	1.0	0.3	4.8	2.4	1.6	0.8
1960-1962 to 1965-1967	0.5	0.5	0.1	−0.1	1.0	0.5	0.3	0.2
Norway								
1946-1950 to 1951-1955	1.9	1.3	0.5	0.1	2.1	1.1	0.7	0.3
1951-1955 to 1966-1970	−0.0	1.1	−0.4	−0.7	2.1	1.0	0.6	0.5
1966-1970 to 1975-1976	0.8	0.4	0.2	0.2	1.3	0.3	0.2	0.8
Sweden								
1946-1950 to 1951-1955	1.5	0.8	0.5	0.2	1.9	0.8	0.7	0.4
1951-1955 to 1961-1965	1.1	0.7	0.3	0.1	2.3	0.6	0.8	0.9
1961-1965 to 1971-1975	0.5	0.6	−0.2	0.1	1.9	0.4	0.3	1.2
United Kingdom								
England and Wales								
1950-1954 to 1960-1964	1.0	0.6	0.3	0.1	1.7	0.7	0.5	0.5
1960-1964 to 1970-1974	1.0	0.5	0.4	0.1	1.4	0.4	0.2	0.8
Northern Ireland								
1950-1952 to 1960-1962	2.2	1.6	0.5	0.1	3.6	1.6	1.4	0.6
1960-1962 to 1970-1972	−0.0	0.3	−0.1	−0.2	1.3	0.5	0.2	0.6

TABLE II.3 (*continued*)

Major area, region, country and period	Males				Females			
		Contribution to change by age-groups				Contribution to change by age-groups		
	Change in e_0	0-29	30-64	65 and over	Change in e_0	0-29	30-64	65 and over
Europe (*continued*)								
Northern Europe (*continued*)								
United Kingdom (*continued*)								
Scotland								
1950-1954 to 1960-1964	1.2	1.1	0.3	−0.2	2.6	1.3	0.8	0.5
1960-1964 to 1973-1975	1.2	0.7	0.3	0.2	1.8	1.4	−0.6	1.0
Western Europe								
Austria								
1949-1951 to 1959-1961	3.7	2.9	0.7	0.1	5.1	3.0	0.9	1.2
1959-1961 to 1970-1974	1.4	1.2	0.2	−0.0	2.1	1.2	0.8	0.1
Belgium								
1946-1949 to 1959-1963	5.7	4.2	1.4	0.1	6.3	3.8	1.8	0.7
1959-1963 to 1968-1972	0.1	0.1	0.2	−0.2	0.7	0.1	0.2	0.4
France								
1950-1951 to 1960-1964	3.9	2.6	0.8	0.5	5.1	2.5	1.4	1.2
1960-1964 to 1970-1974	0.8	0.1	0.4	0.3	2.0	0.6	0.5	0.9
Germany, Federal Republic of								
1949-1951 to 1960-1962	2.3	2.5	0.1	−0.3	3.9	2.4	0.8	0.7
1960-1962 to 1970-1972	0.6	0.7	0.1	−0.2	1.5	0.7	0.3	0.5
Netherlands								
1947-1949 to 1951-1955	1.5	1.0	0.3	0.2	2.0	0.9	0.7	0.4
1951-1955 to 1961-1965	0.8	1.3	−0.4	−0.1	2.4	0.9	0.6	0.9
1961-1965 to 1971-1975	−0.5	−0.1	−0.1	−0.3	1.3	0.3	0.2	0.8
Switzerland								
1948-1953 to 1958-1963	2.4	1.3	0.7	0.4	3.3	1.2	1.1	1.0
1958-1963 to 1968-1973	1.6	0.7	0.6	0.3	2.1	0.6	0.6	0.9
Oceania								
New Zealand								
1950-1952 to 1960-1962	1.3	1.0	0.3	−0.0	2.4	1.0	0.9	0.5
1960-1962 to 1970-1972	0.1	0.5	−0.2	−0.2	0.9	0.4	0.1	0.4

Source: Calculated from $e(x)$ and $p(a)$ values from official life tables in national publications and the files of the United Nations Statistical Office.

NOTE: To develop the formulas used in the decompositional procedure, define

e_x = life expectancy at age x

$p(a)$ = probability of surviving from birth to age a

${}_tp_a$ = probability of surviving from age a to age $a + t$.

By definition, life expectancy at birth is equal to $e_0 = \int_0^\infty p(a)\,da$.

This expression can be broken into three parts, namely,

$$(1) \qquad e_0 = \int_0^{30} p(a)da + \int_{30}^{65} p(a)da + \int_{65}^{\infty} p(a)da.$$

While expression (1) appears to give a unique decomposition of life expectancy into three age intervals, it is necessary to recognize that mortality in the first age interval, zero to 30, will affect the value of $p(a)$ in the other two intervals. Likewise, mortality between 30 and 65 will affect the value of $p(a)$ above age 65. An explicit expression of this dependence for the first interval is

$$(2) \qquad e_0 = \int_0^{30} p(a)da + p(30)\int_{30}^{\infty} \frac{p(a)}{p(30)}\,da$$

$$= \int_0^{30} p(a)da + p(30) \cdot e_{30}.$$

Varying mortality under age 30 affects both terms in this latter expression. To derive the decompositional formula that attributes changes in life expectancy to the ages under 30, designate the value of the functions at the second point in time with a superscript "2" and at the first time point with a "1". Then

$$e^2_0 - e^1_0 = \int_0^{30} p^2(a)da - \int_0^{30} p^1(a)da + p^2(30)\,e^2_{30} - p^1(30)\,e^1_{30}.$$

After manipulations of the kind described by Kitagawa (Evelyn Kitagawa, "Components of a difference between two rates", *Journal of the American Statistical Association*, vol. 50 (1955), pp. 1168–1194), this latter expression can be written as

$$(3) \qquad e^2_0 - e^1_0 = \int_0^{30} p^2(a)da - \int_0^{30} p^1(a)da$$

$$+ \left[p^2(30) - p^1(30)\right]\left[\frac{e^2_{30} + e^1_{30}}{2}\right]$$

$$+ \left[e^2_{30} - e^1_{30}\right]\left[\frac{p^2(30) + p^1(30)}{2}\right]$$

The first two rows on the right hand side of (3) express the amount of difference in e_0 attributable to differences in mortality below age 30. They represent, respectively, the difference in person-years lived below age 30 in the two life tables; and the difference in probabilities of survival to age 30, weighted by the average life expectancy at age 30 in the two tables. The third term remains to be decomposed into mortality between ages 30 and 65 and mortality above age 65. Through an identical procedure to that just described (but noting that differences in life expectancy at 30 must be weighted by the average probability of surviving to that age), the amount of the difference in life expectancy at birth attributable to mortality differences between 30 and 65 can be derived as

$$(4) \qquad \Delta e_0 = \frac{p^1(30) + p^2(30)}{2}\left[\int_{30}^{65} p^2(a)da - \int_{30}^{65} p^1(a)da\right.$$

$$\left. + ({}_{35}p^2_{30} - {}_{35}p^1_{30})\,\frac{(e^2_{65} + e^1_{65})}{2}\right],$$

and that attributable to mortality above age 65 as

$$(5) \qquad \Delta e_0 = (e^2_{65} - e^1_{65})\left(\frac{p^2(65) + p^1(65)}{2}\right).$$

Expressions (4) and (5) add up to the third term in expression (3), so that the initial difference in life expectancy is completely accounted for. It should be noted that the decompositional procedure is not unique, since other formulas could be employed that would yield somewhat different results.

lands actually showed declines in male life expectancy for one of the time intervals in the table. For the other countries with negative contributions at older ages, mortality decline in the youngest age category more than compensated, resulting in net gains in expectation of life at birth.

For females during the most recent interval, age patterns of contributions to changes in life expectancy often differed from those of males. There were far fewer negative contributions resulting from increases in death rates among females. The typical pattern found among males, with the largest contributions from age-group 0-29 years and the smallest from age-group 65 years and over, can also be found among females, but mainly in countries of Southern and Eastern Europe. The most notable feature of the female pattern in the other countries is the greater positive contributions of the older age-groups, particularly the 65 years and over group. In fact, in 11 of 27 countries the oldest age-group contributed the most to increases in life expectancy.

For many countries, it has been the greater improvement in mortality at the older ages for females which has widened the life expectancy gap between the sexes since the 1950s. Canada serves as an example. Between 1950-1952 and 1970-1972, the absolute contribution to expectation of

TABLE II.4. TRENDS IN MEDIAN AGE-SPECIFIC DEATH RATES, 1950-1954 TO MID 1970s, MORE DEVELOPED COUNTRIES

Age-group (years)	Median age-specific death rates (deaths under 1 year per 100,000 live births; deaths at other ages per 100,000 population in appropriate sex-age category)				Percentage decline in rates			
	1950-1954	1960-1964	Around 1970	Mid 1970s	1950-1954 to mid 1970s	1950-1954 to 1960-1964	1960-1964 to 1970	1970 to mid 1970s
				Males				
Under 1	4 191	2 909	2 237	1 860	55.6	30.6	23.1	16.9
1-4	207	122	101	83	59.9	41.1	17.2	17.8
5-9	83	57	54	43	48.2	31.3	5.3	20.4
10-14	68	49	45	40	41.2	27.9	8.2	11.1
15-19	131	109	110	104	20.6	16.8	+ 0.9	5.5
20-24	187	148	145	138	26.2	20.9	2.0	4.8
25-29	185	146	143	136	26.5	21.1	2.1	4.9
30-34	209	171	162	158	24.4	18.2	5.3	2.5
35-39	277	229	223	218	21.3	17.3	2.6	2.2
40-44	410	343	348	339	17.3	16.3	+ 1.5	2.6
45-49	641	557	559	556	13.3	13.1	+ 0.4	0.5
50-54	1 067	932	911	913	14.4	12.7	2.3	+ 0.2
55-59	1 627	1 534	1 523	1 444	11.2	5.7	0.7	5.2
60-64	2 531	2 522	2 506	2 383	5.8	0.4	0.6	5.3
65-69	3 870	3 864	4 032	3 751	3.1	0.2	+ 4.4	7.0
70-74	6 072	6 020	6 235	5 868	3.4	0.9	+ 3.6	5.9
75-79	9 818	9 565	9 813	9 556	2.7	2.6	+ 2.6	2.6
80-84	15 693	14 728	14 718	14 619	6.8	6.2	0.1	0.7
85 and over	25 519	25 026	23 569	22 852	10.5	1.9	5.8	3.0
Implied life expectancy at birth (*years*)	66.1	68.1	68.6	69.3				
				Females				
Under 1	3 483	2 300	1 752	1 406	59.6	34.0	23.8	19.7
1-4	169	99	80	66	60.9	41.4	19.2	17.5
5-9	57	39	34	30	47.4	31.6	12.8	11.8
10-14	46	29	28	24	47.8	37.0	3.5	14.3
15-19	71	47	45	45	36.6	33.8	4.3	–
20-24	104	61	53	49	52.9	41.4	13.1	7.5
25-29	127	72	63	58	54.3	43.3	12.5	7.9
30-34	150	102	90	79	47.3	32.0	11.8	12.2
35-39	207	152	134	116	44.0	26.6	11.8	13.4
40-44	288	218	211	196	31.9	24.3	3.2	7.1
45-49	442	352	336	316	28.5	20.4	4.6	6.0
50-54	643	538	519	489	24.0	16.3	3.5	5.8
55-59	961	815	791	752	21.7	15.2	2.9	4.9
60-64	1 565	1 348	1 310	1 183	24.4	13.9	2.8	9.7
65-69	2 600	2 287	2 239	1 962	24.5	12.0	2.1	12.4
70-74	4 634	4 097	3 883	3 495	24.6	11.6	5.2	10.0
75-79	7 920	7 168	6 724	6 279	20.7	9.5	6.2	6.6
80-84	13 073	11 954	10 980	10 943	16.3	8.6	8.2	0.3
85 and over	22 677	21 826	20 842	20 087	11.4	3.8	4.5	3.6
Implied life expectancy at birth (*years*)	70.7	73.5	74.4	75.5				

Source: Calculated from data in table IIA.2.

NOTE: Data are for the more developed countries listed in table II.1 with the following exceptions: for 1950-1954, median rates are for 28 countries (excluding Albania, Bulgaria, Cyprus, Czechoslovakia, Luxembourg, Malta, Romania, Spain, USSR); for 1960-1964, for 31 countries (excluding Albania, Cyprus, Luxembourg, Romania, Spain, USSR); for around 1970, for 33 countries (excluding Albania, Cyprus, Luxembourg, USSR); for mid 1970s, for 35 countries (excluding Albania and Cyprus).

life at birth from changing mortality at ages 0-29 years was virtually the same for males and females—just over 2 years. The contributions of age-groups 30-64 years and 65 years and over, however, totalled only 0.8 year for males, compared with 3.4 years for females. This pattern is seen frequently among the countries in table II.3, for example, in Austria, Czechoslovakia, Hungary, New Zealand and Switzerland. In all these cases, the contribution to improvement in life expectancy from the under 30 years age-group was roughly the same, in years, for males and females. It was the greater improvement in mortality in ages beyond 30 years among females that accounted for the absolute widening of the life expectancy gap between the sexes in these countries.

B. Age patterns of mortality

1. *Trends in age-specific death rates since 1950*

Age curves of mortality for low-mortality countries are J-shaped, with the relatively high death rates for the first year of life marking the left-hand boundary of the J hook (see figs. II.3 and II.4). Death rates decline rapidly during the early years of life and reach a low point between the ages of 10 and 12 years. There is a steep rise in rates at 15-19 years, followed by a flattening of the curve. In the late twenties or early thirties the rates begin to increase again, gradually at first, then more rapidly. Death rates similar to those of infancy are reached again, typically, by about 55-59 years of age among males, but not until 60-64 years or even later among females. Because the mortality curve changes rather rapidly with age over most of the age span, it is customary in the analysis of mortality data to examine trends and patterns for relatively narrow age-groups. In the present discussion of age patterns of mortality, the age span is divided into 19 segments, consisting of under 1 year, 1-4 years, then 5-year age-groups from 5-9 years through 80-84 years, and a final open-ended age-group of 85 years and over.

The mortality data which serve as the basis for this discussion are the median values of the age-specific death rates in the more developed countries for four periods from 1950-1954 to the mid 1970s. These rates are given in table II.4, together with the percentage changes for the entire period 1950-1954 to the mid 1970s, and for three subperiods. The rates are not strictly comparable from date to date, as they are based on an increasing number of countries, from 28 in 1950-1954 to 35 in the mid 1970s. As the missing countries are biased toward the high-mortality end of the range, the median rates for the earlier dates—which exclude a greater number of these countries—are understated, and the improvement in mortality between 1950-1954 and the mid 1970s is likewise understated.

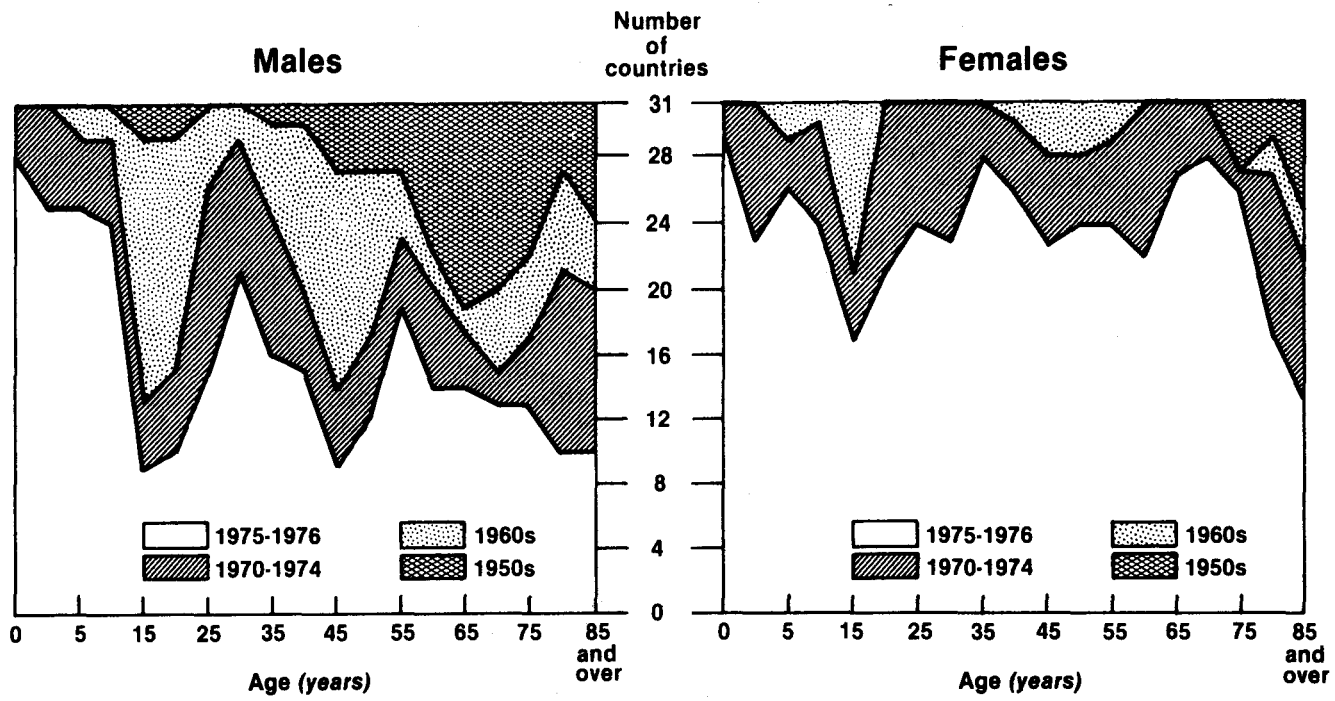
There were very large declines in the median age-specific death rates in most age-groups from the early 1950s to the mid 1970s. Generally speaking, the greatest declines were observed in the youngest age-groups, and the smallest declines in the oldest age-groups. There were several exceptions to this broad generalization, however. The largest relative decline was in the 1-4 year age-group, rather than among infants, and this was true for males as well as for females. A second exception occurred in the 15-19 year age-group, where percentage declines were lower than those of the two adjacent age-groups. This also occurred among both sexes, and was due primarily to increases in mortality from accidents in this age-group in many countries. A third exception occurred among older males, who showed very small percentage declines at ages 60-79 years, smaller than at the two oldest age-groups. Finally, mortality decline among women aged 20-29 years was greater than in adjacent age-groups, mainly because of the large reductions in mortality from tuberculosis, which had been a leading cause of death among young adult women.

Mortality improvement, in relative terms, was greater for females than for males in every age-group except 5-9 years and 85 years and over where it was about the same for both sexes. At the younger ages, the gains registered by females were only slightly higher than for males. For the four youngest age-groups, female mortality declined between 47 per cent and 61 per cent, compared with reductions between 41 per cent and 60 per cent for males. Between ages 15-19 and 55-59 years, the percentage declines in death rates among females, which ranged from 22 to 54, were approximately twice as high as among males, who had decreases ranging from 11 to 27 per cent. The greatest disparities in mortality improvement between the sexes occurred at ages 65-79 years, where proportionate declines were seven to eight times greater among women. These differences in relative mortality declines between males and females reflect the differential success in reducing mortality from the various causes of death, as discussed in a later section.

When mortality change is examined for the three subperiods separately, it is seen that the largest percentage declines occurred for most age-groups in the earliest of the three periods, i.e., from 1950-1954 to 1960-1964. The momentum of mortality decline slackened for both sexes in the middle period, from 1960-1964 to 1970, but the slowdown was more marked among males, for whom there were even slight increases in rates in several age-groups. In the most recent period, from 1970 to the mid 1970s, there was an acceleration in the pace of decline, and larger decreases occurred in most age-groups than in the middle period. Thus, on an aggregate level, the early 1970s saw a modest reversal of the unfavourable mortality trends among older males.

While the median age-specific death rates in the mid 1970s were, for all age-groups, lower than those of 1950-1954, an examination of trends in individual countries reveals many instances of deterioration in death rates. For purposes of this analysis, four subperiods were considered—the 1950s, 1960s, 1970-1974 and 1975-1976—and the age-specific death rates for 31 more developed countries were tabulated according to the subperiod in which they were lowest. The results of this tabulation appear in table II.5 and figure II.2. It can be seen that, while progress has been steady among females, in the sense that each successive time period has brought lower age-specific death rates, among males reversals of trend have been quite prominent. For females, the lowest death rates in the

Figure II.2. Distribution of 31 more developed countries according to period in which age-specific death rates were lowest: 1950s, 1960s, 1970-1974 or 1975-1976



Source: Table II.5.

vast majority of countries were in the most recent period, i.e., 1975-1976, and virtually all of the remaining countries recorded their lowest rates in the next most recent period, 1970-1974. Only in two age-groups, 15-19 years and 85 years and over, did substantial numbers of countries record their lowest rates prior to 1970. The continued decline in female mortality right up to the mid 1970s, from levels which were already very low, is an impressive phenomenon.

Among males, the pattern was similar to that of females in the four youngest age-groups, in which most countries recorded their lowest rates in 1975-1976. However, from ages 15-19 years and above, many countries had their lowest rates in the 1950s or 1960s. The age-groups with the poorest performance were 15-19, 20-24, 45-49, 80-84 and 85 years and over. In these age-groups, only nine or 10 countries had their lowest rates in 1975-1976. Increases in male mortality were not confined to countries with particu-

TABLE II.5. DISTRIBUTION OF 31 MORE DEVELOPED COUNTRIES ACCORDING TO PERIOD IN WHICH AGE-SPECIFIC DEATH RATES WERE LOWEST: 1950s, 1960s, 1970-1974 OR 1975-1976
(Number of countries)

	Males				*Females*			
Age-group (years)	*1950s*	*1960s*	*1970-1974*	*1975-1976*	*1950s*	*1960s*	*1970-1974*	*1975-1976*
Under 1	—	—	3	28	—	—	2	29
1-4	—	—	6	25	—	—	8	23
5-9	—	2	4	25	—	2	3	26
10-14	—	2	5	24	—	1	6	24
15-19	2	16	4	9	—	10	4	17
20-24	2	14	5	10	—	—	10	21
25-29	—	5	11	15	—	—	7	24
30-34	—	2	8	21	—	—	8	23
35-39	1	6	8	16	—	—	3	28
40-44	1	10	5	15	—	1	4	26
45-49	4	13	5	9	—	3	5	23
50-54	4	10	5	12	—	3	4	24
55-59	4	4	4	19	—	2	5	24
60-64	9	2	6	14	—	—	9	22
65-69	12	2	3	14	—	—	4	27
70-74	11	5	2	13	—	—	3	28
75-79	9	5	4	13	4	—	1	26
80-84	4	6	11	10	2	2	10	17
85 and over	7	4	10	10	5	4	9	13

Source: Tabulated from data in table IIA.2 but excluding Luxembourg, Romania, Spain and the USSR.

larly low or particularly high mortality. Rather, countries at all levels of mortality experienced some increases between the 1950s or 1960s and the 1970s.

2. *Comparison with model life tables*

Deaths occur with certain regularities in human populations. These regularities are manifested not only in the shape of the age-specific mortality curve, which tends to be U-shaped among high-mortality countries and J-shaped among low-mortality countries; not only in the high intercorrelation of age-specific death rates, whereby countries with high death rates for a given age-group will very likely also have high rates for the other age-groups and vice versa; but also in the manner in which the age curve of mortality changes as mortality declines. The age patterns of mortality decline reflect the degree to which mortality from the various causes of death is brought under control. As an example, in high-mortality populations death rates from the infectious and parasitic diseases generally exceed by far those of low-mortality populations in every age-group. However, it is only in the early decades of life that the infectious and parasitic diseases constitute a very large proportion of mortality from all causes in the high-mortality populations. With increasing age, mortality from the degenerative diseases, particularly the cardiovascular diseases and neoplasms, increases in relative importance, while the contribution of the infectious and parasitic diseases to over-all mortality declines, relatively. Because the infectious diseases are much more tractable than the degenerative diseases, the age-groups in which the former predominate generally show the greatest mortality declines during the transition from high to low mortality.[1]

Several systems of model life tables have been developed[2] based on the mortality experience of dozens of populations since the nineteenth century, which attempt to incorporate the regularities, or patterns, of mortality identified in these populations. The model life tables have applications in various aspects of demographic analysis, including the making of population projections and the estimating of population parameters from incomplete data in countries where vital registration is deficient. In the present subsection are examined mortality trends in the more developed countries since the 1950s in the context of one of the model life table systems, that of Coale and Demeny, in order to highlight the broad features of recent mortality change in these countries. The model life tables merely serve as a convenient frame of reference against which to assess such change and no claims are made for their predictive ability. Before proceeding with the analysis, the Coale and Demeny regional model life tables are briefly described.

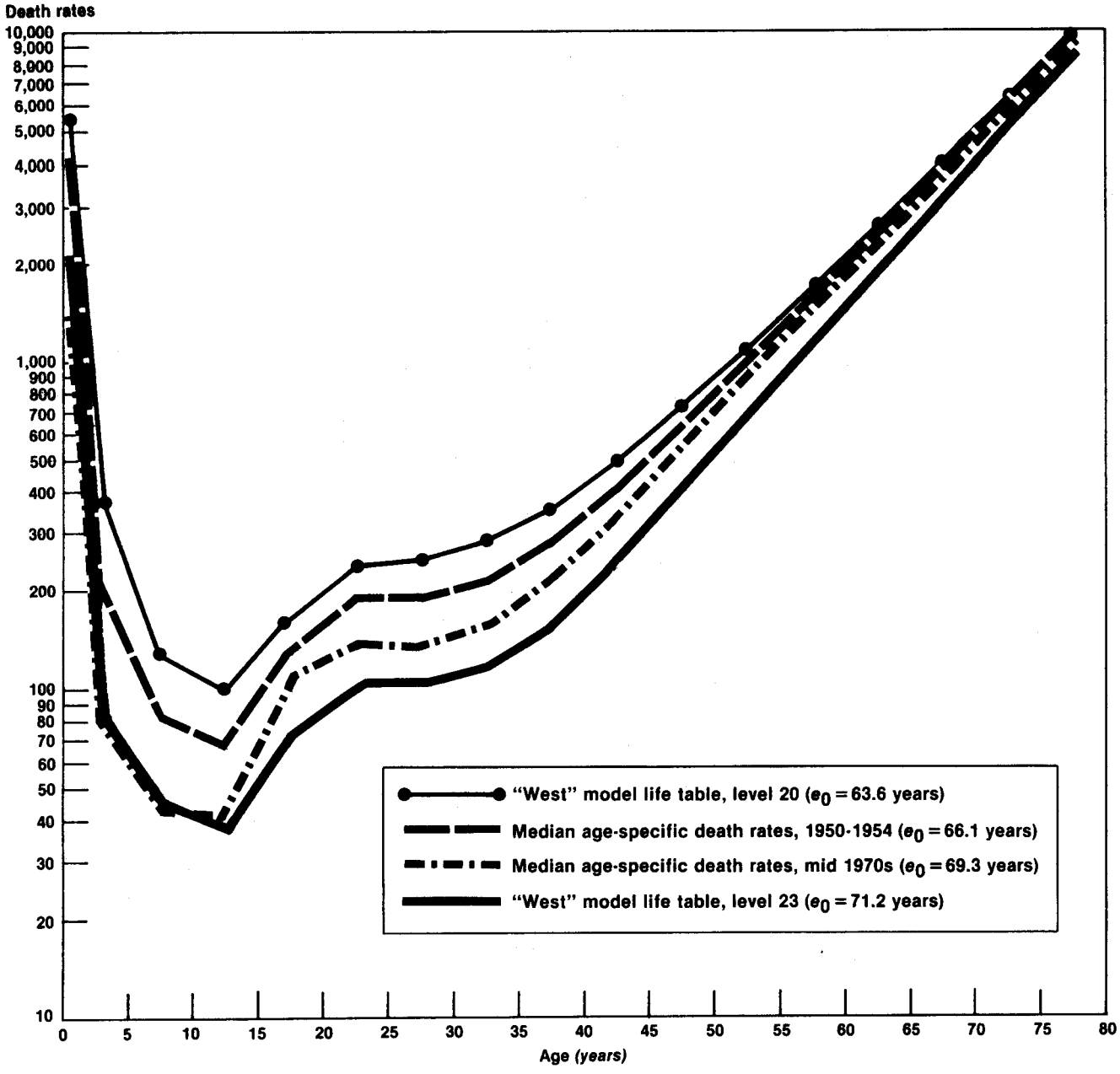
The regional model life tables are based on actual mortality experience of populations from the mid nineteenth century to the late 1950s, as represented by 192 national and subnational life tables. Three distinct geographic-specific age patterns of mortality were identified among these country life tables, and were designated "East", "North" and "South" in accordance with the geographical location of the countries exhibiting the patterns. The life tables of the remaining countries (and these included the vast majority of the tables) were of diverse patterns and constituted a residual group designated "West". Four families of model life tables were constructed, each family incorporating the distinctive mortality relations among the age-groups observed in the country life tables. For each family, life tables for males and females were constructed for 24 mortality levels ranging from level 1, with the highest mortality and lowest expectation of life at birth, to level 24, with the highest life expectancy. The difference between male and female life expectancy at each level was chosen so as to preserve the typical relations found in the country life tables. The progression from one mortality level to the next lower level proceeds systematically through reductions in age-specific mortality in all age-groups, although the relative size of the reductions varies with age. It is greatest in the younger ages (childhood, infancy, adolescence and early adulthood), then declines progressively with age.

In the present analysis, the medians of countries' age-specific death rates for 1950-1954 and the mid 1970s, as shown in table II.4, and figures II.3 (for males) and II.4 (for females) are compared with schedules of death rates associated with different mortality levels in the Coale and Demeny model life table system. Although the median rates for the two dates are not strictly comparable, since they pertain to different sets of countries (28 countries in 1950-1954 and 35 in the mid 1970s), the features of mortality change which emerge nevertheless remain valid. In addition to the curves of the median death rates, also plotted in figures II.3 and II.4 are the age-specific death rate values from the regional model life tables, "West" family, for two mortality levels which bracket the two sets of median rates for each sex. For males, the death rates pertaining to levels 20 and 23 of the model life tables are shown in figure II.3, with associated life expectancy values of 63.6 years and 71.2 years, respectively. The life expectancy values associated with the median age-specific death rates for males are 66.1 years for 1950-1954 and 69.3 years for the mid 1970s. It can be seen from figure II.3 that the pattern of changes in the median age-specific death rate curves between 1950-1954 and the mid 1970s diverges from that of the model life tables between levels 20 and 23. In both sets of curves (i.e., the medians and the models), the shift to a lower mortality level is associated

[1] For a detailed account of this transition in the United States which has relevance for many other countries as well, see Abdel R. Omran, "Epidemiologic transition in the U.S.; the health factor in population change", *Population Bulletin*, vol. 32, No. 2 (May 1977).

[2] These are the United Nations model life tables (*Age and Sex Patterns of Mortality; Model Life-tables for Under-developed Countries* (United Nations publication, Sales No. 55.XIII.9); *Manual III: Methods for Population Projection by Sex and Age* (United Nations publication, Sales No. 56.XIII.3)); the Coale and Demeny regional model life tables (Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966)); and the Brass model life tables (William Brass and others, *eds. The Demography of Tropical Africa* (Princeton, N.J., Princeton University Press, 1968), chap. 3; Norman Carrier and John Hobcraft, *Demographic Estimation for Developing Societies* (London, Population Investigation Committee, 1971), appendix I and table A). The Population Division of the United Nations Secretariat is completing work on the preparation of new model life tables based on the mortality experience of less developed countries; the results of this project will be presented in a forthcoming publication.

Figure II.3. Comparison of median age-specific death rates for males in more developed countries in 1950-1954 and mid 1970s with Coale and Demeny "West" model life table $m(x)$ values.



Sources: Tables II.4 and IIA.3.

with the typical pattern of declines in age-specific mortality—the greatest declines in rates in relative terms occurring at the younger ages and the size of the decline thereafter diminishing with increasing age. However, when the size of the reduction in the death rates among older males is compared with the declines in rates at the younger ages, it is seen that the median rates at the older ages show smaller relative declines than those of the models. In other words, the size of the reduction in the medians of the observed death rates among older males has not been commensurate with progress made at younger ages when measured against the standard of the model life tables.

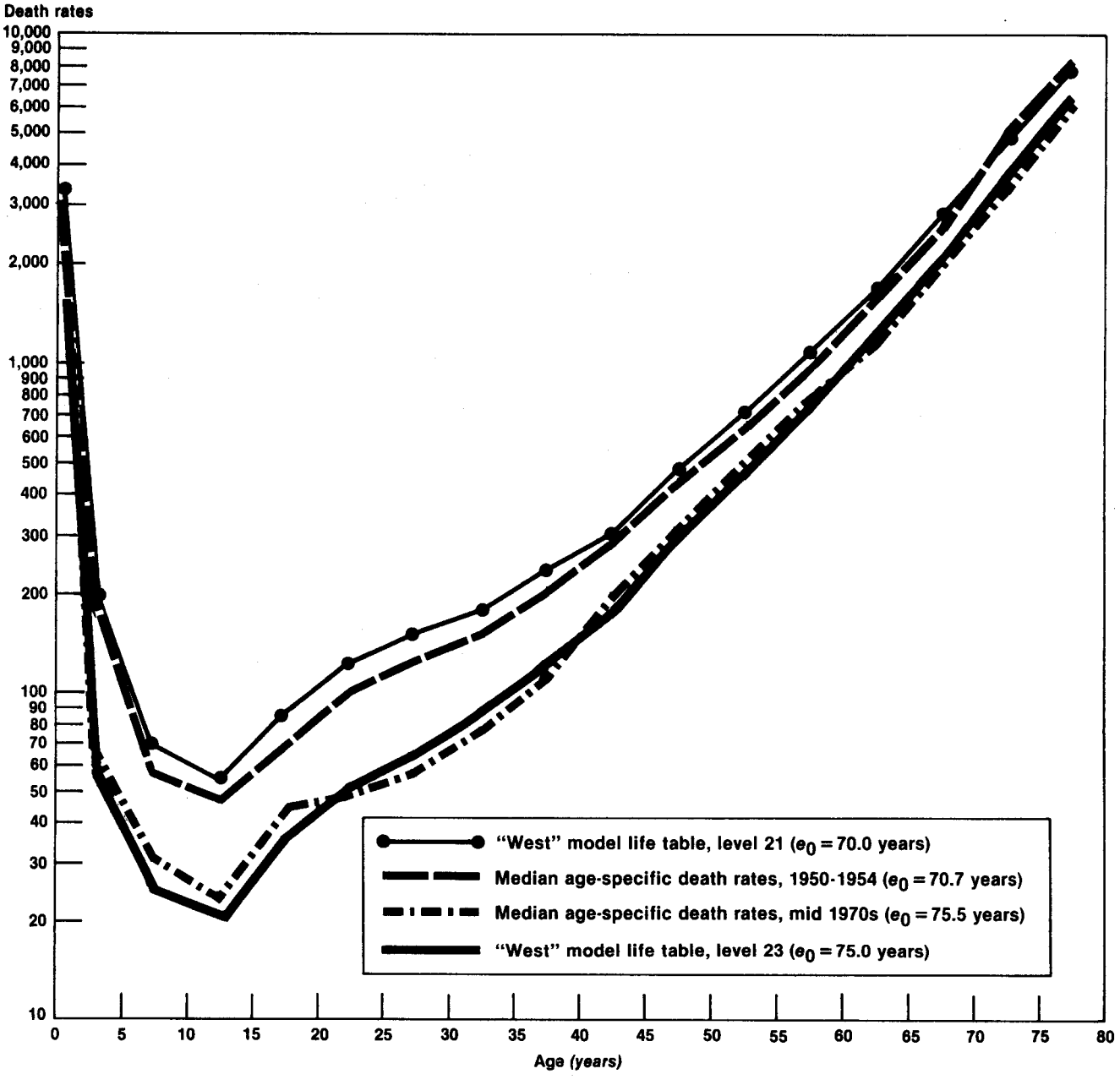
These relationships are quantified in table II.6 which presents data pertaining to the median rates and the model life table rates for five broad age-groups. It can be seen, from the upper panel, that the magnitude of the percentage declines in death rates for males decreases with increasing age for both the median death rates and the model life table rates. The poor mortality performance observed for older males becomes clear from the lower panel. For males aged 20-34 years, for example, the decline in the median death rates between 1950-1954 and the mid 1970s was only 57 per cent of the decline observed among the youngest age-group, i.e., under 20 years. In contrast, the corre-

sponding percentage found between levels 21 and 22 of the model life tables, "West" family, was 96 per cent. For the 35-49 year age-group, these percentages were 38 for the median rates compared with 78 for those of the model. A similar pattern characterizes the remaining two age-groups.

As a result of the patterns just described, the right slope of the curve of median age-specific death rates for males has become much steeper between 1950-1954 and the mid 1970s. This is evident from figure II.3. At the youngest ages in the mid 1970s, the median death rates are below those of the model level 23 (life expectancy of 71.2 years), while those at the old ages are most closely matched with rates of level 21 (not plotted in fig. II.3) with its associated life expectancy of more than 5 years less (66.0 years). If the age-specific death rate curves for levels 21 and 22 of the "West" model life tables had been plotted, one would have seen a progressive drift in the median rates for the mid 1970s from level 23 (with life expectancy, or e_0, of 71.2 years) at ages under 15, to level 22 (e_0 = 68.6 years) for ages 15-19 through 55-59 years, to level 21 (e_0 = 66.0 years) at ages 60-64 through 70-74 years, and finally to level 20 (e_0 = 63.6 years) at the oldest age-group, 75-79 years.

Figure II.4. Comparison of median age-specific death rates for females in more developed countries in 1950-1954 and mid 1970s with Coale and Demeny "West" model life table $m(x)$ values.

(Deaths per 100,000 population)



Sources: Tables II.4 and IIA.3.

TABLE II.6. RELATIVE DECLINES IN MEDIAN AGE-SPECIFIC DEATH RATES FOR MORE DEVELOPED COUNTRIES, 1950-1954 TO MID 1970s, COMPARED WITH RELATIVE DECLINES IN AGE-SPECIFIC DEATH RATES BETWEEN MODEL LIFE TABLES OF DIFFERENT MORTALITY LEVELS.

	Males		*Females*	
Age-group (years)	*Median death rates, 1950-1954 to mid 1970s*	*Regional model life tables, "West" family, levels 20 to 23 (levels 21 to 22 in parentheses)*	*Median death rates, 1950-1954 to mid 1970s*	*Regional model life tables, "West" family, levels 21 to 23*
		Percentage decline in rates		
Under 20	45.1	63.8 (−26.1)	50.5	61.0
20-34	25.7	58.4 (−25.0)	51.5	57.2
35-49	17.3	51.1 (−20.3)	34.8	43.5
50-64	10.5	31.7 (−11.4)	23.4	29.8
65-79	3.1	18.8 (−6.5)	23.3	18.2
		Declines in rates for age-groups 20 years and over as percentage of decline for age-group 0-19 years		
20-34	57	92 (95.8)	102	94
35-49	38	80 (77.8)	69	71
50-64	23	50 (43.7)	46	49
65-79	7	29 (24.9)	46	30

Sources: Calculated from median age-specific death rates in table II.4, and age-specific death rate schedules for model life tables in table IIA.3.

The relative deterioration in older male mortality was already under way in certain countries at the time the regional model life tables were being prepared, and was reflected in the more recent country life tables for those countries. But the impact of this trend on the model life tables was diluted by the inclusion of older country tables in which the tendency was not yet evident.[2a] Since the 1950s, the trend has become more pronounced, thereby increasing the divergence of the median age-specific death rate curves for the most recent period from those of the models.

The curves of median age-specific death rates for females conform much more closely to the model life table curves than is the case for males. The curves of median rates shown in figure II.4 imply life expectancies of 70.7 years in 1950-1954 and 75.5 years in the mid 1970s, while the death rate curves pertaining to levels 21 and 23 of the "West" model life tables are associated with life expectancy values of 70.0 years and 75.0 years, respectively. As can be seen, the curves of median rates for 1950-1954 and the mid 1970s are closely congruent with those of model life table levels 21 and 23, respectively, indicating that the predictive ability of the models has been greater for females than for males. Looking at the lower panel of table II.6, the pattern of relative improvement in mortality by age is seen to be fairly similar for the median rates and those of the model. For age-group 35-49 years, for example, the improvement in the median rates between 1950-1954 and the mid 1970s was equal to 69 per cent of the improvement in the under 20 year age-group, compared with 71 per cent in the models. For the next age-group, 50-64 years, the percentages were also very close—46 per cent for the median rates and 49 per cent for the model rates. For the remaining two age-groups, 20-34 years and 65-79 years, mortality improvement relative to that of the youngest age-group was actually greater for the median rates than in the models: 102 per cent compared with 94 per cent at ages 20-34, and 46 per cent as against 30 per cent in the 65-79 year age-group.

This slight tendency noted above for mortality among females at older ages to improve faster than in the model life tables has been most pronounced among countries of Northern and Western Europe as well as Canada, Australia, New Zealand and Japan. In figure II.5, the curves of average age-specific death rates for females in 12 selected countries from these regions have been plotted for the same two periods, 1950-1954 and the mid 1970s. These countries were all among the countries whose mortality patterns served as the basis of the "West" family of model life tables. Also shown, once again, are the female death rate curves for levels 21 and 23 of the "West" model life tables, as well as the curve for level 24, which has the highest life expectancy value of all levels—77.5 years. Whereas for males there is a drift, with increasing age, to model life tables with higher mortality, among females in the selected countries the reverse occurs. The mean rates for the mid 1970s are closest to those of level 23 for most of the age span, approach the lower rate of level 24 at 60-64 years, and fall even below the level 24 rates at ages thereafter, thus surpassing the boundaries of the model life table system.

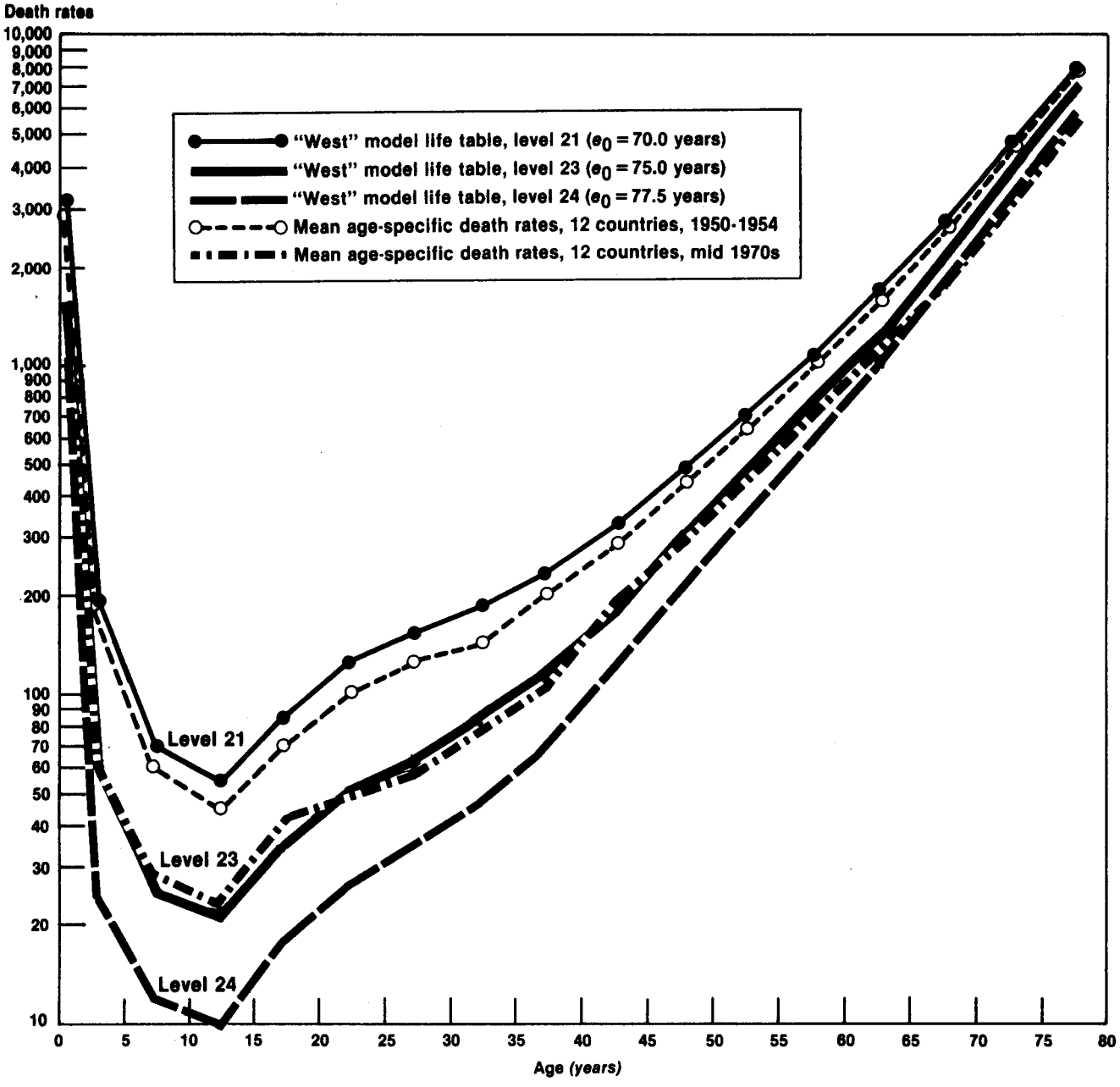
C. CAUSES OF DEATH

An analysis of mortality by causes of death helps to explain some of the trends and patterns observed in earlier sections. The present section consists of three subsections. In the first, levels and trends of mortality by broad groups of causes of death are examined in the aggregate for 23 more developed countries. The second and third subsections examine levels and trends of mortality among adults by country for the two numerically most important causes-of-death groups, the cardiovascular diseases and neoplasms.

[2a] Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966), pp. 20 and 37.

Figure II.5. Comparison of mean age-specific death rates for females in 12 selected more developed countries of the "West" family in in 1950-1954 and mid 1970s with Coale and Demeny "West" model life table $m(x)$ values.

(Deaths per 100,000 population)



Sources: Mean rates are unweighted averages of the most recent age-specific deaths rates shown in table IIA.2 for the 12 countries identified in the note below. Model life table values from table IIA.3.

NOTE: The 12 countries are Australia, Belgium, Canada, Denmark, Finland, France, Japan, Netherlands, New Zealand, Sweden, Switzerland, United Kingdom (England and Wales).

1. *Levels and trends of mortality by causes of death from 1955 through 1974 based on average rates for 23 countries*

The base data used for the discussion in this subsection are the unweighted averages of age-specific death rates for a group of 23 more developed countries. The data relate to four five-year periods from 1955-1959 to 1970-1974. The analysis has been done for males and females separately for six groups of causes of death, namely, infectious diseases, malignant neoplasms, cardiovascular diseases, respiratory diseases, accidents and violence, and a residual group designated "other causes". The criteria for inclusion of a country were the availability of cause-of-death data according to an International Classification of Diseases (ICD) classification for each year from 1955 through 1974, and a population size of at least 1 million. The following countries have met these two criteria: Australia,

Austria, Belgium, Canada, Czechoslovakia, Denmark, Finland, France, the Federal Republic of Germany, Hungary, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Sweden, Switzerland, the United Kingdom (England and Wales; Northern Ireland; Scotland) and the United States of America.

The countries not included because of gaps in data are not representative in terms of their mortality levels and trends. Most of them have above average mortality, and they are all in Southern or Eastern Europe. The excluded countries with over 1 million population are: Albania, Bulgaria, the German Democratic Republic, Greece, Poland, Romania, Spain, Yugoslavia and the USSR. The over-all effect of excluding these countries from the present analysis is to lower the average death rates.

Between 1955-1959 and 1970-1974 there was an increase in the total number of deaths for the group of countries, from an average annual number of 5.6 million in 1955-1959, to 6.0 million in 1960-1964, to 6.2 million in 1965-1969, and, finally, to 6.4 million in 1970-1974. Although age-specific mortality was decreasing over the period, the total number of deaths increased for two reasons: the combined total population of these countries was increasing, and there was a shift to an older age structure with its concomitant higher mortality.

(a) *Changes in relative importance of cause-of-death groups*

Each age-group in the life span is characterized by different mortality levels for the various causes of death. Among infants, the most important causes of death in the 1970s were congenital anomalies and conditions related to the prenatal and early neonatal environments and the birth process - the so-called endogenous causes. The respiratory diseases were also important causes of death among infants, especially in the countries where infant mortality remained relatively high. After the first year of life, and continuing into the twenties, accidents were generally the leading cause of death for both males and females, with neoplasms generally in second place. Then the pattern of causes of death diverged for the two sexes. Cardiovascular diseases replaced accidents as the leading causes of death among men in the late thirties or early forties and remained in first place to the end of the life span. Among females, neoplasms moved from second to first place during the late twenties or early thirties, followed by either accidents or cardiovascular diseases. Neoplasms continued in first place for women into the fifties or sixties, while the cardiovascular diseases assumed an increasing proportion of the total. Finally, in the fifties or sixties, the cardiovascular diseases became the leading causes of death, with neoplasms second. This pattern continued for the remainder of the life span.

The over-all increase in numbers of deaths between 1955-1959 and 1970-1974 was associated with a shift in the proportions of deaths from particular causes. The major increases in proportions were for cardiovascular diseases, from 44 per cent of deaths in 1955-1959 to 48 per cent in 1970-1974, and malignant neoplasms (cancer), from 16 per cent to 19 per cent of all deaths. Infectious diseases declined from 3 per cent in 1955-1959 to 1 per cent in 1970-1974, while the contribution of all other causes, the residual group, decreased from 23 per cent to 17 per cent. Figure II.6 shows the contributions of each of the six groups of causes to over-all mortality by age-group for both sexes, and how these have changed over time.

Perhaps the most striking feature of figure II.6 is the virtual disappearance of infectious diseases as a cause of mortality. In the age-group from 1 to 49 years, the proportion of total deaths from infectious diseases declined from 11.0 per cent in 1955-1959, to 6.2 per cent in 1960-1964, to 3.6 per cent in 1965-1969, and to only 2.4 per cent in 1970-1974. This decline in the contribution of infectious diseases has, for young children, also been accompanied by a steady decline in the proportion of respiratory disease deaths. In 1955-1959, almost 20 per cent of deaths to children aged from 1 to 4 years were in this category. By 1970-1974, the corresponding proportion was only around 13.5 per cent.

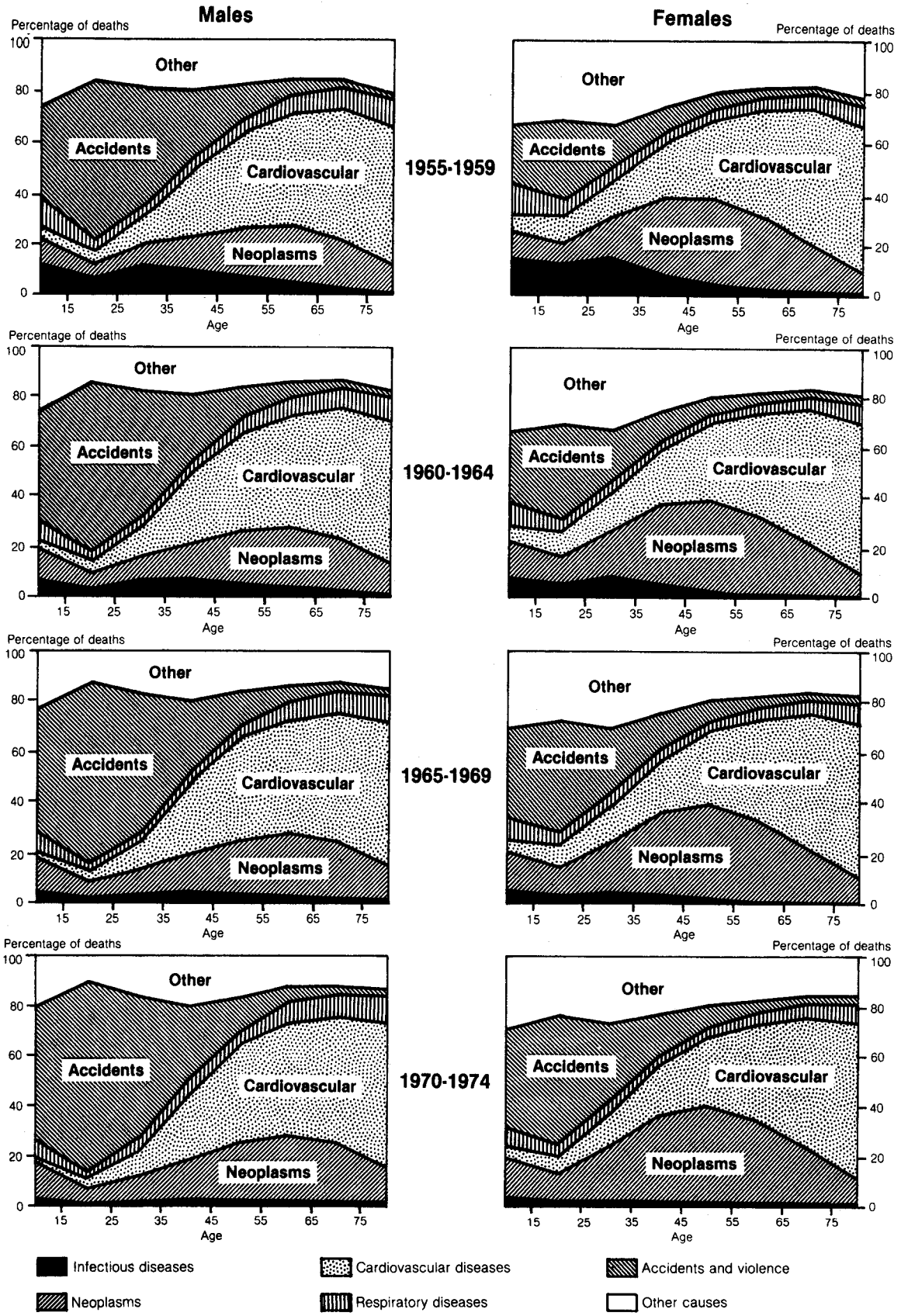
Relative declines in the contribution to total deaths from some causes must, of course, be counterbalanced by rises for other causes. Among infants there has been a steady rise in the proportion of deaths attributed to accidents and violence. In the 1-4 year age-group for boys, this proportion rose from 24.0 per cent in 1955-1959 to 40.4 per cent in 1970-1974. The corresponding figures for girls in this age-group were 19.4 per cent and 33.7 per cent, respectively. In the 15-24 year age-group, the proportion of male deaths attributed to accidents and violence in 1955-1959 was 63.2 per cent, approximately twice the female figure of 31.5 per cent. By 1970-1974, these proportions had increased markedly to 75.2 per cent for males and to 52.1 per cent for females.

Because the age structure of the population in the more developed countries was older in 1970-1974 than in 1955-1959,[2b] there have been increases in the proportion of deaths from diseases associated with middle and old age. For example, there was a rise in the proportion of deaths from cardiovascular diseases despite substantial declines in age-specific mortality from these diseases. In the case of malignant neoplasms, the increase in proportion can be attributed in part to the aging of the population and in part to actual increases in age-specific mortality among middle-aged and older males.

The "other" category of diseases is composed of two quite different components. The first consists of clearly designated causes, based on the ICD classification, which do not fall into any of the five other broad groups of diseases discussed here. Examples would be diabetes mellitus, peptic ulcer and cirrhosis of the liver. The second component is imprecise and is made up of deaths from senility, symptoms and other ill-defined conditions. In many countries this component is substantial at the older age-groups, where multiple causation may make assignment to one specific cause difficult. Generally, as medical certification of deaths improves, deaths tend more and more to

[2b] The percentage of the population aged 65 years and over in the more developed countries increased from an estimated 7.5 per cent in 1950 to about 10.5 per cent in 1975. *World Population Trends and Policies; 1977 Monitoring Report, vol. I, Population Trends* (United Nations publication, ST/ESA/SER.A/62), p. 128.

Figure II.6. Trends in the percentage contribution of six broad grounds of causes of death to over-all mortality by age-group and sex, averages for 23 more developed countries, 1955-1959 to 1970-1974



Source: World Health Organization data bank.

NOTE: The 23 countries are identified in the text at the beginning of section C.

be assigned to specific ICD causes, and the relative size of this component decreases. This may result in an artifactual increase over time in mortality from some of the specific causes, or at least to an artifactually slower decline. In the group of countries under study, there was a decline in the proportion of deaths recorded as senility, symptoms and ill-defined conditions in the population aged 75 years and older. This is probably the main component of the decline in the proportion of deaths from "other" causes seen for the elderly in figure II.6.

(b) *Trends in age-specific mortality by cause*

(i) *Mortality by cause in three age-groups (under 1 year, 1 to 74 years, 75 years and over)*

In order to compare mortality for the several broad groups of causes of death over time, sex-age-cause-specific death rates have been computed by dividing the number of deaths in a given sex-age-cause category by the population in the corresponding sex-age group and multiplying by 100,000 (to give rates per 100,000 population). Table II.7 summarizes the changes in average death rates by cause for three age-groups in the group of 23 countries. The age-groups are under 1 year, 1 to 74 years and 75 years and over. The changes in the 1-74 year age-group are based on age-standardized death rates, i.e., rates which have been adjusted for changes in the age structure of the population within this broad age-group. (Trends in the 1-74 year interval are disaggregated by age in subsection 1 (*b*) (ii) below). The table compares successive five-year periods by expressing the rates for the later period as a percentage of those for the earlier period, then subtracting 100 per cent. Finally, the table gives the total change in rates over the entire period between 1955-1959 and1970-1974, as well as the rates themselves for 1970-1974.

The period from 1955-1959 to 1970-1974 saw a decrease in over-all average death rates in the 23 countries for all causes combined in each of the three age-groups. The decline was largest for infants—over 40 per cent—and least for the very old—only 9 per cent. For infants, the size of the decline was roughly the same for both sexes, but for the other two age-groups the average percentage decrease among females was more than three times that of males. For infants and the very old, the rates show a progressively faster decline between successive periods. For both sexes combined, the declines among infants were 16.2 per cent between 1955-1959 and 1960-1964, 17.7 per cent between 1960-1964 and 1965-1969 and 18.7 per cent between 1965-1969 and 1970-1974. Decreases for both infants and the very old follow the same pattern when the sexes are considered separately. For both sexes together in the 1-74 year age-group, the rate of decline slowed between 1960-1964 and 1965-1969, while for males alone it was nil. However, the decrease between 1965-1969 and 1970-1974 was greater than that between 1955-1959 and 1960-1964.

There were very large declines in average death rates from infectious diseases in the 23 countries between 1955-1959 and 1970-1974 over most of the age span. Among persons aged between 1 and 74 years, the rates dropped by about 70 per cent. The rates for the very old also declined, but only by about 10 per cent. Infant mortality from infectious diseases declined by 39 per cent between 1955-1959 and 1960-1964, but increased in the two later periods. These increases (some 20 per cent from 1960-1964 to 1965-1969, and over 50 per cent from 1965-1969 to 1970-1974) are probably due in large part, if not entirely, to changes in the classification of certain diseases of infancy between the Seventh (1955) and Eighth (1965) Revisions of the International Classification of Diseases. Countries generally began reporting deaths according to the 1965 Revision for data years 1967 or 1968. A particularly disturbing effect was brought about by the change in classification of deaths due to neonatal diarrhoea, which were not included with the group of infectious diseases in the Sixth and Seventh Revisions, but were included therein in the Eighth Revision.[3]

For males aged 1-74 years, the decline in mortality from infectious diseases was approximately the same in each of the three periods—somewhat over 30 per cent—but among females, it was greatest in the earliest period (42 per cent) and lowest in the most recent period (27 per cent). In the 75 years and over age-group, the total decline between 1955-1959 and 1970-1974 was about the same for males and females—around 9 per cent, but the pace of the decline was quite different for the two sexes. Among males, there were decreases in each of the three periods, with the largest decrease in the most recent period. Among females, however, there was a drop of 12 per cent in the earliest period, no change in the middle period, and a small increase in the most recent period. Regarding differences between the sexes in mortality improvement, females fared better than males among infants, but for the other two age-groups the percentage changes were similar for males and females.

Trends in mortality from malignant neoplasms were the least favourable, for males, of the five groups of causes, and for females they fared second worst after accidents. Among males in the 1-74 year age-group, average death rates from malignant neoplasms rose 14 per cent between 1955-1959 and 1970-1974, and in the 75 years and over age-group they increased by 24 per cent. For females, average rates remained almost constant, decreasing 4 per cent in the 1-74 year age-group and rising 2 per cent in the 75 years and over age-group. Infant mortality from malignant neoplasms declined by 18 per cent over the entire period, but because of the very low mortality from this group of causes among infants (malignant neoplasms account for less than 1 per cent of infant deaths), small absolute changes in rates result in large percentage changes.

The cardiovascular diseases, here taken to include diseases of the heart and circulatory system, as well as cerebrovascular disease, were by far the largest group of causes of death, accounting for more than half the deaths to people over 45 years of age (see fig. II.6). Changes in the rates, however small in relative terms, are therefore of

[3] See World Health Organization, *International Classification of Diseases, 1955 Revision, vol. I* (1957) and *International Classification of Diseases, 1965 Revision, vol. I* (1967).

TABLE II.7. PERCENTAGE CHANGE IN DEATH RATES FROM 1955-1959 TO 1970-1974 BY SEX AND CAUSE OF DEATH FOR BROAD AGE-GROUPS, AVERAGES FOR 23 MORE DEVELOPED COUNTRIES

Cause of death and period	Under 1 year			1-74 years			75 years and over		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
All causes									
1955-1959 to 1960-1964 ..	−16.2	−15.5	−17.1	−4.8	−1.7	−8.6	−2.2	−0.5	−3.1
1960-1964 to 1965-1969 ..	−17.7	−17.4	−18.1	−2.1	+0.3	−5.3	−3.1	−1.1	−4.1
1965-1969 to 1970-1974 ..	−18.7	−18.4	−19.0	−5.7	−4.5	−7.7	−4.0	−1.7	−5.0
1955-1959 to 1970-1974 ..	−43.9	−43.1	−45.0	−12.2	−5.8	−20.0	−9.0	−3.2	−11.6
Rate 1970-1974a	1 812.6	2 033.0	1 579.3	607.9	821.8	430.3	10 518.4	12 379.1	9 460.7
Infectious diseases									
1955-1959 to 1960-1964 ..	−39.3	−38.5	−40.1	−35.4	−31.3	−41.8	−7.4	−1.8	−12.1
1960-1964 to 1965-1969 ..	+20.3	+23.1	+17.2	−32.5	−31.1	−34.2	−2.5	−2.3	0.0
1965-1969 to 1970-1974 ..	+51.8	+52.7	+50.9	−31.3	−33.5	−26.5	−2.1	−5.0	+4.0
1955-1959 to 1970-1974 ..	+10.9	+15.5	+5.8	−70.1	−68.5	−71.9	−11.5	−9.0	−8.6
Rate 1970-1974a	87.3	96.2	78.0	8.5	12.1	5.5	74.2	103.7	57.5
Malignant neoplasms									
1955-1959 to 1960-1964 ..	−1.5	−1.4	0.0	+2.5	+6.3	−1.3	+2.9	+6.3	+0.6
1960-1964 to 1965-1969 ..	−7.6	−8.7	−6.3	+2.6	+5.6	−0.5	+3.0	+7.1	+0.6
1965-1969 to 1970-1974 ..	−9.8	−11.1	−8.3	+0.0	+1.8	−2.0	+3.4	+8.4	+0.5
1955-1959 to 1970-1974 ..	−17.9	−20.0	−14.1	+5.3	+14.2	−3.7	+9.6	+23.5	+1.8
Rate 1970-1974a	5.5	5.6	5.5	149.9	188.7	119.4	1 352.0	1 853.3	1 067.0
Cardiovascular diseases									
1955-1959 to 1960-1964 ..	−9.0	−7.6	−10.8	−3.6	+0.3	−8.3	+0.7	+1.8	+0.2
1960-1964 to 1965-1969 ..	+12.4	+10.5	+15.9	−3.4	−0.4	−7.4	−1.6	−0.2	−2.1
1965-1969 to 1970-1974 ..	+25.0	+25.0	+24.2	−7.9	−6.1	−10.6	−2.7	−1.5	−3.1
1955-1959 to 1970-1974 ..	+27.8	+27.6	+28.3	−14.2	−6.2	−24.1	−3.6	+0.1	−5.0
Rate 1970-1974a	17.0	18.5	15.4	257.2	354.7	177.6	6 360.2	7 131.4	5 921.8
Respiratory diseases									
1955-1959 to 1960-1964 ..	−26.2	−25.5	−27.2	−6.1	−0.4	−14.9	+2.4	+7.3	−1.0
1960-1964 to 1965-1969 ..	−24.2	−23.6	−24.9	+4.3	+8.3	−1.8	+0.6	+6.8	−3.7
1965-1969 to 1970-1974 ..	−24.9	−24.5	−25.4	−4.5	−4.6	−3.7	−2.4	+4.2	−6.7
1955-1959 to 1970-1974 ..	−58.0	−57.0	−59.2	−6.4	+3.0	−19.5	+0.7	+19.4	−11.1
Rate 1970-1974a	196.0	217.0	173.7	38.6	59.3	22.3	919.6	1 294.0	706.8
Congenital malformations									
1955-1959 to 1960-1964 ..	−3.1	−2.9	−3.3						
1960-1964 to 1965-1969 ..	−7.5	−7.6	−7.4						
1965-1969 to 1970-1974 ..	−7.7	−7.7	−7.7						
1955-1959 to 1970-1974 ..	−17.2	−17.1	−17.4						
Rate 1970-1974a	312.8	331.4	293.0						
Accidents and violence									
1955-1959 to 1960-1964 ..	−5.5	−4.8	−6.5	−1.1	−1.7	+0.5	+0.8	−0.2	+1.8
1960-1964 to 1965-1969 ..	−4.1	−3.3	−4.9	+4.8	+4.0	+7.0	+0.9	+0.7	+1.3
1965-1969 to 1970-1974 ..	−8.6	−7.2	−10.8	+2.0	+1.2	+3.6	−4.9	−3.4	−5.5
1955-1959 to 1970-1974 ..	−17.2	−14.6	−20.7	+5.8	+3.6	+11.4	−3.2	−2.9	−2.6
Rate 1970-1974a	64.6	72.7	56.0	62.4	93.8	32.8	327.4	351.3	313.8

Source: World Health Organization data bank.

NOTE: Percentage changes are based on unweighted averages of age-specific death rates for 23 countries. Rates for age-group 1-74 years have been standardized to discount changes in the age distribution of the population.

[a] Rates are infant deaths per 100,000 live births; deaths at other ages per 100,000 population in each sex-age category.

considerable importance absolutely. In the period 1955-1959 to 1970-1974, mortality from the cardiovascular diseases in the 23 countries declined very substantially among females, but only slightly among males. The decreases in average rates for females were 24 per cent in the 1-74 year age-group and 5 per cent in the oldest age-group. Among males, however, there was a decline of only 6 per cent in the age-group 1-74 years, and no change in the 75 years and over group. The rate of decline for females was more or less constant in time, but for males the rates only started to decline between 1965-1969 and 1970-1974. Although there was an increase of 28 per cent in infant mortality from cardiovascular diseases between 1955-1959 and 1970-1974, this had a negligible effect on the total infant mortality rate because, as was the case for malignant neoplasms, cardiovascular diseases account for less than 1 per cent of infant deaths. It will be seen from the discussion of mortality from the cardiovascular diseases by country in subsection 2 below that the average rates which serve as the basis for the present discussion conceal very divergent trends, as is often the case.

Respiratory diseases are an important cause of death among the very young and the very old, accounting roughly for around 10 per cent each of all infant deaths and deaths in the 75 years and older group. Among females in the 23 countries, average death rates for respiratory diseases declined at all ages for each period studied. Over the entire period 1955-1959 to 1970-1974, the rates

TABLE II.8. PERCENTAGE CHANGE IN DEATH RATES BY AGE, SEX AND CAUSE OF DEATH, 1955-1959 TO 1970-1974, AVERAGES FOR 23 MORE DEVELOPED COUNTRIES

Cause of death	Age (years)							
	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74
All causes								
Males	−51	−29	−2	−16	−5	−9	−6	−2
Females	−56	−36	−26	−36	−22	−15	−16	−19
Infectious diseases								
Males	−73	−83	−84	−89	−78	−75	−68	−50
Females	−76	−83	−87	−89	−79	−68	−63	−52
Malignant neoplasms								
Males	−25	−4	—	−3	+9	+4	+10	+22
Females	−25	−4	−8	−15	−14	−4	—	−2
Cardiovascular diseases								
Males	−30	−53	−38	−23	−5	−4	−5	−6
Females	−35	−60	−53	−43	−26	−26	−24	−22
Respiratory diseases								
Males	−67	−52	−29	−25	−15	−18	−5	+20
Females	−69	−56	−42	−34	−13	+5	−13	−16
Accidents and violence								
Males	−17	−5	+17	+5	+11	−1	−2	−1
Females	−23	+7	+22	+25	+28	+20	+11	—
Other causes								
Males	−61	−44	−29	−24	−1	−12	−16	−23
Females	−62	−45	−44	−48	−30	−21	−22	−28

Source: World Health Organization data bank.

NOTE: Percentage changes are based on unweighted averages of age-specific death rates for 23 countries.

were reduced by 59 per cent for infants, by 20 per cent for females aged from 1 year to 74 years and by 11 per cent for those aged 75 years and over. Male rates in infancy also fell by nearly 60 per cent. But those for males aged 75 years and over rose throughout the study period, giving death rates in 1970-1974 some 19 per cent higher than in 1955-1959. In the intermediate age range, male rates were level between 1955-1959 and 1960-1964, rose by 8 per cent between 1960-1964 and 1965-1969, then declined by 5 per cent to 1970-1974. Once again, the proportionate decline in female mortality was, at all ages and for most time intervals, greater than that for males.

In 1955-1959 congenital anomalies (or malformations) accounted for some 12 per cent of infant deaths in the group of 23 countries. By 1970-1974 this proportion had risen to over 17 per cent. However, in the same period, the average mortality rate from congenital anomalies had declined by 17 per cent. In other words, although the infant mortality rate for these conditions had declined, the rates for other conditions, in particular respiratory diseases and certain diseases of early infancy, declined even faster. The decline in mortality from congenital anomalies was similar between the sexes and was fairly steady in time—a little slower between 1955-1959 and 1960-1964 than after 1960-1964.

Mortality from accidents and violence declined, on average, among infants in the 23 countries between 1955-1959 and 1970-1974. The decrease amounted to 15 per cent for males and 21 per cent for females. The increase noted earlier in the proportion of infant deaths due to this group of causes is the result of more rapid declines in infant mortality from respiratory diseases and certain diseases of early infancy. But in the 1-74 year age-group, there was an actual increase in average death rates from these causes over the study period of 4 per cent for males and 11 per cent for females. This was the only increase for females in the intermediate age-group. For the very old, death rates went down by approximately 3 per cent. This change occurred mainly between 1965-1969 and 1970-1974.

(ii) *Mortality by cause in detailed age-groups, 1-74 years*

In this section the 1-74 year age-group is divided into eight subgroups in order to place the mortality changes on the age spectrum. The age-groups are 1 to 4 years, and decennial age-groups from 5-14 years through 65-74 years. Table II.8 summarizes changes in mortality for the 23 more developed countries by comparing the average death rates in 1970-1974 with those in 1955-1959 by cause for each age-group and sex. Mortality rates from all causes combined showed the greatest decline among children aged between 1 and 4 years, larger decreases even than those seen previously for infants. A similar result was noted earlier in the discussion on changes in median age-specific death rates. For males as well as females, the reduction in mortality in this age-group brought the 1970-1974 death rates to below one half of the rates of 1955-1959. In all eight age-groups, death rates for females went down faster than those for males between 1955-1959 and 1970-1974, in most age-groups at least twice as fast in proportional terms. Only in age-groups 1-4 years, 5-14 years and 45-54 years were the female gains less than twice those of males.

The changes in average age-specific death rates from infectious diseases had a U-shaped age-pattern for each sex, with maximum declines among those aged 25-34 years. In this age-group both male and female rates declined by nearly 90 per cent. For malignant neoplasms, the maxi-

mum decline in death rates was observed in the 1-4 year age-group, and was the same for males and females—25 per cent. For males, there was little or no change in rates between 5 and 34 years, and increases in rates in age-groups beyond 35 years. There was a sizable increase of 22 per cent in the 65-74 year age-group. Because cancer mortality is high among older males, being the second most important cause of death in this age-group, a relative increase of this magnitude reflects large numbers of additional deaths. Female mortality from malignant neoplasms improved in all but the 55-64 year age-group. The greatest percentage decrease in rates, after that of the 1-4 year age-group already mentioned, was a decline of about 15 per cent among women aged 25-44 years. As will be seen in subsection 3 below, substantial decreases in mortality from neoplasms among women in this age-group occurred in many countries.

The decline in mortality from cardiovascular diseases noted earlier for persons aged 1-74 years is seen from table II.8 to have been a reduction in each, more detailed, age-group. Beginning with the 5-14 year age-group, where decreases were greatest for both males and females, the relative size of the decreases tended to diminish with increased age. Among males, improvement in mortality was minimal between 35 and 74 years of age, with declines of only around 5 per cent at these ages. Females, on the other hand, continued to show very impressive declines of around 25 per cent at these same ages, five times that of males.

There were large declines in respiratory disease mortality for males and females in age-groups 1-4 years through 25-34 years. The decreases were nearly 70 per cent among children aged 1-4 years, over 50 per cent in the 5-14 year age-group, and between 25 and 42 per cent in the next two age-groups. Beyond age 35, mortality improvement was slower, and there were even increases in rates among men aged 65-74 (for whom the rate rose by 20 per cent) and among women aged 45-54 (with a slight increase of 5 per cent). The increase for males at ages 65-74 is consistent with the increase noted for males aged 75 years and over in the previous subsection.

The decline in infant mortality from accidents and violence in the period 1955-1959 to 1970-1974 was accompanied by a decline of similar magnitude in mortality from these causes among children aged 1-4 years. The death rates from accidents in the 15-44 year age range increased for both sexes, but particularly among females for whom the rise was greater than 20 per cent, and extended beyond the 15-44 year age range to include those aged 5-14 years and 45-64 years as well. This was the only major cause group for which the female death rates did not improve relatively to those of the males.

Mortality from "other causes" declined in every age-group for both sexes, and the declines were in all cases greater for females. As mentioned earlier, some of the improvement shown by this diverse group of causes is probably due to improvement in certification of causes of death, which may result in the assignment of previously ill defined cases to specific items of the International Classification of Diseases.

(c) *Sex differentials in mortality by cause*

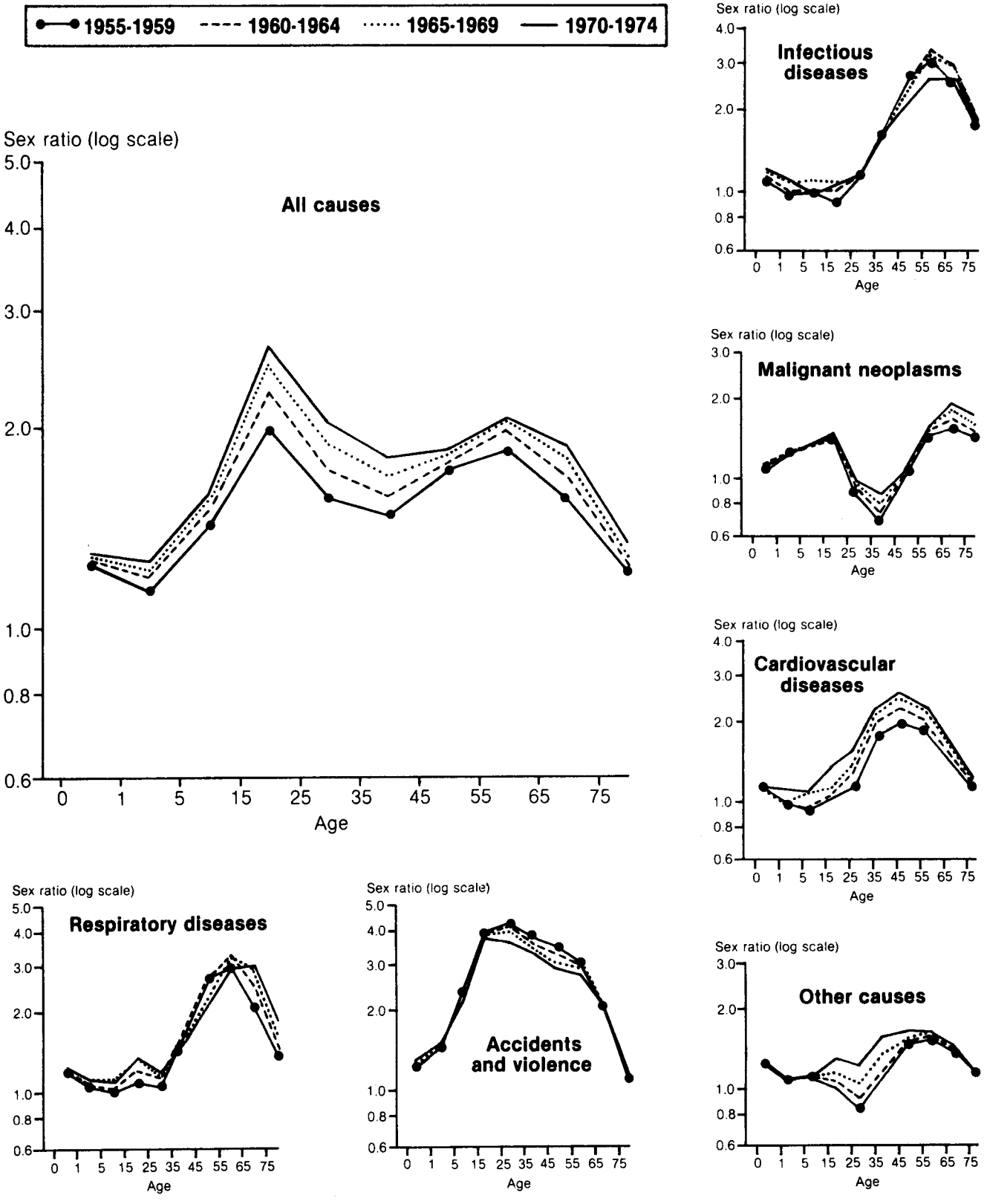
It has been seen in the previous subsections that, with the exception of mortality from accidents and violence, between 1955-1959 and 1970-1974 mortality rates changed less favourably for males than for females. In this section the ratios of male to female average death rates in the group of 23 countries are examined by age-group and cause of death to see how they have changed in the period under review. In figure II.7 these ratios have been plotted on seven charts, one representing all causes of death and the others depicting six broad cause-of-death groups, for four periods: 1955-1959, 1960-1964, 1965-1969 and 1970-1974.

In this group of countries, the sex ratio for all causes combined declines from about 1.25 in infancy to a minimum for children aged 1-4 years. It then rises to a maximum for young adults aged 15-24 years. It decreases again until the 35-44 year age-group, then increases to a second, although lower, peak at ages 55-64 years, and drops back once again in old age. This pattern of two peaks (in the 15-24 and 55-64 year age-groups) was observed for each 5-year period. The size of the ratios changed consistently with time: at each age they were higher in 1970-1974 than in 1955-1959, having increased progressively through the interim periods. The greatest changes in ratios occurred at ages 15-44 years (see fig. II.7), reflecting the unfavourable trends in male mortality relative to female mortality at these ages. In the three age-groups 15-24, 25-34 and 35-44, the ratios rose from 1.98, 1.55 and 1.46, respectively, in 1955-1959, to 2.63, 2.01 and 1.78, respectively, in 1970-1974. There was also a somewhat greater than average increase in the sex ratio in the 65-74 year age-group, which rose from 1.53 to 1.84.

The sex ratios of mortality for all causes together represent, of course, the combined ratios of each of the causes of death which contribute to over-all mortality. It is interesting, therefore, to note that although the sex ratios for all causes present a regular pattern with age and time, each group of causes has its own distinct pattern, and these have changed differently over time. For example, the sex ratios for deaths from infectious diseases have only one peak, at age 55-64. Before age 25, the curve of ratios is flat and only slightly above unity. The rise to the peak is followed by a sharp decline in the oldest age-groups. This pattern has been consistent throughout the period 1955-1959 to 1970-1974 with relatively minor variations within individual age-groups.

The sex ratios of mortality for all causes together were above unity in each age-group. This was not the case for malignant neoplasms, however, for which female death rates exceeded male death rates in the 25-44 year age range. The sex ratios for malignant neoplasms demonstrated peaks in two age-groups—15-24 years and 65-74 years. From age 15 upwards the sex ratios for deaths from malignant neoplasms increased regularly over time from 1955-1959 through 1970-1974. The greatest increases were in the 25-44 year age-group and the 65 years and over age-group. For persons aged 35-44 years, the sex ratio rose from 0.67 in 1955-1959 to 0.86 in 1970-1974, while for those aged 65-74 it rose from 1.54 to 1.92 in the same pe-

Figure II.7. Trends in ratios of male to female death rates by age and causes of death, averages for 23 more developed countries, 1955-1959 to 1970-1974.



Source: World Health Organization data bank.

NOTE: The 23 countries are identified in the text at the beginning of section C.

riod. If the trends in the 35-44 year age-group continue, the male death rates from malignant neoplasms will before long exceed those of females at every age. The rise in the sex ratios of mortality from malignant neoplasms in the oldest age-groups has contributed to the relative widening in the sex ratios for over-all mortality in these age-groups.

The important contribution of cardiovascular diseases to over-all mortality has already been emphasized. The sex ratios of mortality from this group of causes have only one age peak, at 45-54 years. For persons aged 5 years and over the sex ratios have increased regularly with time, and more or less equally in each age-group (somewhat less for persons aged 75 years and over than for other age-groups). In the 45-54 year age-group, for example, the sex ratio rose from 2.01 in 1955-1959, to 2.30 in 1960-1964, to 2.51 in 1965-1969 and, finally, to 2.63 in 1970-1974. The excess mortality of males can also be expressed in terms of a female lag in death rates of a given number of years. In the case of the cardiovascular diseases, this is illustrated in figure II.8 in which the age-specific death rates have been plotted for adult males and females. The curves are based on data for a slightly different group of 25 more developed countries, and refer for most of the countries to 1975 or 1976. The excess mortality of males is greatest at ages 45-49 and 50-54 years, as was found for the group of 23 countries. At ages 45-49 years for males, there is a lag in female death rates of approximately 8½ years, i.e., the death rate for males at 47.5 years (the central year) is not attained by females until 8½ years later, at age 56. This lag narrows progressively with increasing age thereafter, amounting to about 4.5 years at ages 65-69, and 2.5 years at ages 75-79.

In 1955-1959 the shape of the sex ratio curve of mortality by age for respiratory diseases was similar to that for cardiovascular diseases. The peak was a little later, probably at some age near the middle of the interval 45-64 years. In the period 1955-1959 to 1970-1974 the peak shifted so that in 1970-1974 it was in the 65-74 year age-group. The pattern presented in figure II.7 is therefore one of a declining sex ratio in the 45-54 year age-group and increasing ratios in the 65-74 and 75 years and over age-groups. At the peak ratio the male death rates from respiratory diseases were approximately three times the female rates.

The sex ratios for accidents and violence took the form of an inverted U-shaped curve with age. The peak was in the age range 15-44 years. This was the one group of causes for which there was a consistent decline in the sex ratios of death rates with time, particularly for persons aged 15-64. For example, in the 25-34 year age-group, the ratio fell from 4.38 in 1955-1959, to 4.26 in 1960-1964, to 4.02 in 1965-1969 and, finally, to 3.69 in 1970-1974. In the 45-54 year age-group the corresponding ratios were 3.50, 3.28, 3.04 and 2.89, respectively. The importance of accident mortality at younger ages already demonstrated in figure II.6 is further illustrated by the sex ratios shown in figure II.7 for mortality from all causes. The peak for persons aged 15-24 years is greatly influenced by the high sex ratios from accidents and violence.

The final chart in figure II.7 shows the pattern of sex ratios with age and time for all other causes. The main feature of these curves is the increase in sex ratios in the 15-44 year age-group. The ratios in the 25-34 year age-group are of particular interest because in 1955-1959, the ratio, 0.86, indicated that female rates were higher than those of males. By 1970-1974, the male rates in this age-group were some 25 per cent higher than the female rates.

In an earlier section in which changes in expectation of life at birth since 1950 were decomposed by three broad age-groups, the patterns were found to be quite different for males and females. A frequently observed pattern was that the contribution to increases in life expectancy from mortality declines in the under 30 age-group was of similar magnitude for males and females, but the two older age-groups continued to make substantial contributions to female advances, while contributions from males in these age-groups were much smaller and often negative. A similar conclusion regarding the deteriorating conditions of mortality among middle-aged and older males vis-à-vis females emerged from the comparison of median age-specific death rates with the regional model life tables. It becomes clear from the foregoing analysis of mortality by cause of death in a group of 23 more developed countries which causes are responsible for these differential trends among males and females. In the most important disease group at middle and older ages — the cardiovascular diseases — there were small declines in mortality among middle-aged and older males, but very impressive declines among females — some 25 per cent at ages 35-74. The second most important group of causes at middle and older ages, malignant neoplasms, also showed different trends by sex. The changes in mortality from this group of causes among females at these ages ranged from small decreases to a slight increase in the oldest age-group. Among males, in contrast, there were increases in every age-group from 35 years and over. In the two oldest age-groups (65-74 years, and 75 years and over), the increases of 22 and 24 per cent, respectively, were alarming. Finally, the differential trends in respiratory disease mortality further increased the longevity gap between the sexes. In the two oldest age-groups, where these diseases take a high toll in lives, male mortality increased by some 20 per cent, while among females it declined by 16 per cent at ages 65-74 years, and by 11 per cent at 75 years and over.

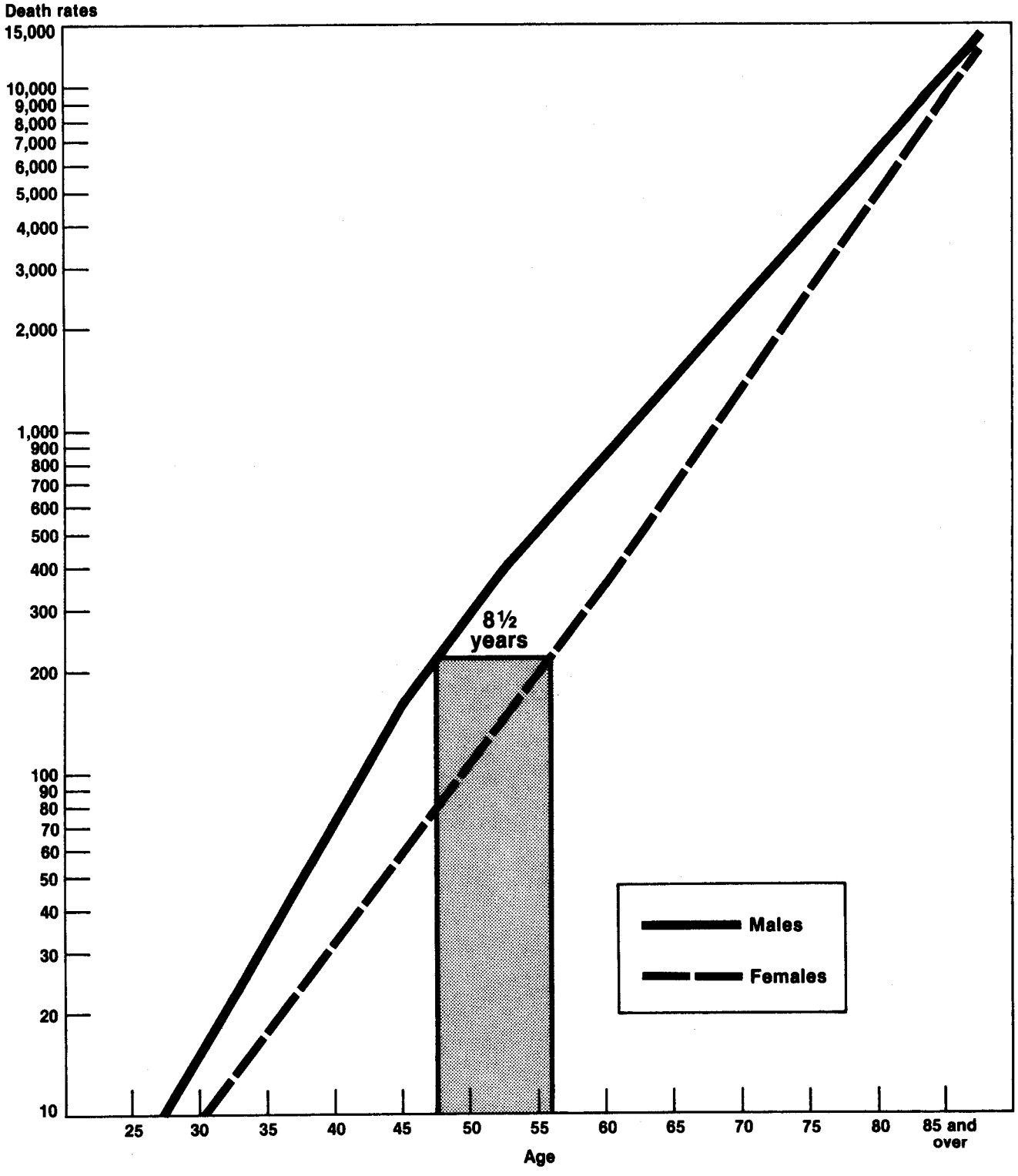
2. *Levels and trends of mortality from the cardiovascular diseases by country from 1960 to the mid 1970s*

In this and the following subsection, levels and trends of mortality are examined by country for the two disease groups which claim the largest number of adult lives in the more developed countries, namely, the cardiovascular diseases and neoplasms. The data base used in these two subsections differs from that of the previous subsection in two respects. First, the time coverage is different, data being given for the three individual years 1960, 1970 and 1976. Secondly, the data relate to a somewhat different and larger group of countries (28 countries compared with 23 countries in the first subsection), the additional countries having on average much higher mortality.[4]

[4] The 28 countries exclude Ireland and Northern Ireland which were in-

Figure II.8. Age-specific death rates from cardiovascular diseases among adults, averages for 25 more developed countries, mid 1970s

(Deaths per 100,000 population)



Source: Average rates calculated from country data in the World Health Organization data bank.

NOTE: Curves have been smoothed. For composition of cardiovascular diseases category, see note to table II.9.

When making comparisons of mortality levels and trends by causes of death among countries, the question arises to what extent the observed trends and differentials are real, and to what extent they are affected by factors which may impair the validity of the comparisons.[5] Among these factors are changes in diagnostic fashions, in coding of the death certificate, and in the International Classification of Diseases itself, which is revised every 10 years. In the discussions which follow on trends in mortality from the cardiovascular diseases and neoplasms, problems of non-comparability arising from differences in diagnostic fashions and in coding have been minimized because of the very broad cause-of-death groupings used. Another important factor affecting the validity of mortality analyses by causes of death, and which has already been mentioned in the preceding subsection, is improvements in death certification. This may result in a decrease in the proportion of total deaths classified as due to symptoms and ill-defined conditions (item B45 of ICD) and a corresponding artifactual increase in mortality from specific causes. Although it is difficult to assess the extent to which the data are affected by improvements in certification, one simple procedure which may be used to signal problems of non-comparability is to determine the percentage of total deaths attributed to symptoms and ill-defined conditions for the countries and dates being compared. This has been done in table IIA.4.

The text table which follows, based on table IIA.4, lists the countries showing sizeable declines in the percentage of total deaths in category B45 between 1960 and the mid 1970s, and gives the absolute change in percentage between the two dates.

	Change (percentage)	
	Males	*Females*
France	−6	−7
Greece	−11	−13
Poland	−8	−12
Spain	−7	
Yugoslavia	−8	−9

A second problem revealed by the data in table IIA.4 concerns the relative size of the B45 category. Large proportions of deaths in this category cast doubt on the accuracy of the cause-of-death data for the countries in question and affect the validity of intercountry comparisons. Countries shown in table IIA.4 as having 10 per cent or more of all deaths in category B45 at either of the two dates are listed below with their actual percentages of deaths. However, it cannot automatically be assumed that countries with low proportions of deaths in this category have particularly accurate statistics, as deaths from ill-defined conditions are sometimes arbitrarily assigned by countries to other categories.

Percentage of deaths from ill-defined conditions (item B45)

Belgium:	1960, males, 10.2, females, 13.9
France:	1960, males, 12.9, females, 16.3
Greece:	1960, males, 19.7, females, 25.2; 1975, males, 12.4
Poland:	1961, males, 14.6, females, 22.3; 1975, females, 10.6
Portugal:	1960, males, 12.7, females, 18.6; 1975, males, 12.2, females, 19.1
Spain:	1960, both sexes, 12.7
Yugoslavia:	1962, males, 23.2, females, 28.2; 1975, males, 15.2, females, 18.9

The group of cardiovascular diseases, which includes diseases of the heart and circulatory system and cerebrovascular disease, account for nearly half of all deaths in the more developed countries, and an even higher proportion of adult mortality. Their proportion of total deaths increases steadily with advancing age, exceeding 60 per cent in the 85 years and over age-group. Table II.9 presents death rates by country from the cardiovascular diseases for 1960, 1970 and 1976 for three adult age-groups—25-44 years, 45-64 years and 65-74 years. The rates for each of these age-groups are unweighted averages of the rates for the five-year age-groups included therein. The lowest and highest rate for each year are shown at the bottom of the table, and these rates are set in italics in the body of the table to facilitate identification of the countries to which they pertain. The average rates for all the countries are also given. In determining the countries with the lowest rates, the countries given in the text table above have not been taken into account for the year or years in which category B45 made up 10 per cent or more of all deaths.

Looking first at the data for males, the trends in the average rates are found to be consistent in all three age-groups. There was a slight increase in rates between 1960 and 1970, and a slight decrease between 1970 and 1976, resulting in a negligible net change over the period 1960-1976. The range of rates is greatest for the youngest age-group (varying from a factor of 2.9 to one of 3.5) and smallest for the oldest age-group (with a factor of about 1.8). As the major forms of cardiovascular disease are believed to result from long-term interaction between environmental factors (defined broadly to include the consequences of individual behaviour patterns), on the one hand, and biological-genetic factors, on the other, it is of interest that already, at ages 25-44 years, there should be a threefold variation in rates among countries.

There were very large declines in mortality from the cardiovascular diseases among males between 1960 and the mid 1970s in several countries. The country showing the greatest improvement was Japan, with percentage decreases of 5, 43 and 31 for ages 25-44, 45-64 and 65-74 years, respectively. Other countries with very favourable trends were the United States (with percentage decreases for the three age-groups ranging from 18 to 26), Canada (with decreases of 13 to 20 per cent) and Switzerland (with decreases of 13 to 32 per cent). Australia had more modest decreases, varying from 12 to 15 per cent, and smaller declines were recorded for Belgium, Italy, France and Scotland. If the changes in rates are examined separately for 1960 to 1970 and 1970 to the mid 1970s for these countries, it is seen that in Australia and Belgium, rates increased in the first interval and declined in the second.

cluded in the analysis in the previous section, but include the following additional countries: Bulgaria, Greece, Israel, Poland, Romania, Spain, Yugoslavia.

[5] For a detailed discussion on the assessment of the quality of cause-of-death data derived from vital statistics, see the following World Health Organization studies: H. Hansluwka, "Cancer mortality in Europe, 1970-1974", *World Health Statistics Report*, vol. 31, No. 2 (1978), pp. 161 ff.; *A Manual on Methods of Analysis of National Mortality Statistics for Public Health Purposes* (Geneva, 1977).

TABLE II.9. TRENDS IN AGE-SPECIFIC DEATH RATES FROM CARDIOVASCULAR DISEASES BY SEX FOR SELECTED AGE-GROUPS, SELECTED MORE DEVELOPED COUNTRIES, 1960 TO MID 1970s

(Rates per 100,000 population)

Major area, region and country	25-44 years				45-64 years				65-74 years				Rank based on rates for 45-64 years	
	Death rates			Percentage decline, 1960 to 1976[a]	Death rates			Percentage decline, 1960 to 1976[a]	Death rates			Percentage decline, 1960 to 1976[a]		
	1960	1970	1976		1960	1970	1976		1960	1970	1976		1960	1976
							Males							
Northern America														
Canada	59	49	47[b]	20.3	762	684	635[b]	16.7	2 732	2 493	2 389[b]	12.6	23	20
United States	81	74	60[c]	25.9	*909*	839	712[c]	21.7	3 085	2 988	2 531[c]	18.0	27	24
East Asia														
Japan	42	47	40	4.8	582	455	*334*	42.6	2 581	2 401	1 793	30.5	20	2
Europe														
Eastern Europe														
Bulgaria	35[d]	42	51	+45.7	*351*[d]	436	521	+48.4	1 929[d]	2 361	2 658	+37.8	2	12
Czechoslovakia	46	67	65[b]	+41.3	509	703	694[b]	+36.4	2 329	2 972	2 901[b]	+24.6	14	23
Hungary	43	69	72	+67.4	512	632	665	+29.9	2 516	2 955	2 886	+14.7	15	21
Poland	56	57	69[c]	+23.2	488	532	585[c]	+19.9	1 913	2 403	2 467[c]	+29.0	12	19
Romania	...	51	50	2.0	...	509	525	+3.1	...	2 710	2 656	2.0		14
Northern Europe														
Denmark	29	33	34	+17.2	498	506	548	+10.0	2 229	2 288	2 276	+2.1	13	18
Finland	*83*	92	*74*[b]	10.8	840	*1 001*	*962*[b]	+14.5	3 269	*3 419*	*3 277*[b]	+0.2	25	28
Norway	30	38	31	+ 3.3	455	553	515	+13.2	2 053	2 379	2 163	+5.4	8	11
Sweden	*25*	*26*	*26*	+ 4.0	465	448	479	+3.0	2 220	2 170	2 245	+1.1	10	7
United Kingdom														
England and Wales	52	54	47	9.6	665	696	678	+2.0	2 845	2 802	2 671	6.1	21	22
Scotland	68	69	57	16.2	851	853	844	0.8	*3 372*	3 246	3 159	6.3	26	27
Southern Europe														
Greece	22	26	29[c]	+31.8	252	298	327[c]	+29.8	1 094	1 270	1 363[c]	+24.6	1	1
Israel	38	39	29[c]	23.7	561	608	529[c]	5.7	2 395	2 696	2 434[c]	+1.6	18	15
Italy	41	40	37[b]	9.8	482	446	442[b]	8.3	2 298	2 160	1 979[b]	13.9	11	6
Portugal	39	43[e]	47[c]	+20.5	440	485[e]	511[c]	+16.1	2 336	2 552[e]	2 440[c]	+4.5	7	10
Spain	40	42	44[b]	+10.0	363	394	404[b]	+11.3	1 804	*1 946*	2 024[b]	+12.2	3	5
Yugoslavia	31[f]	43	46[c]	+48.4	370[f]	428	488[c]	+31.9	1 911[f]	1 990	2 226[c]	+16.5	4	8
Western Europe														
Austria	50[f]	51	47	6.0	556[f]	585	532	4.3	2 416[f]	2 719	2 613	+8.2	17	16
Belgium	43	44	38[c]	11.6	576	590	532[c]	7.6	2 405	2 515	2 325[c]	3.3	19	17
France	33	34	33[b]	—	403	*367*	366[b]	9.2	1 805	1 718	*1 693*[b]	6.2	6	3
Germany, Federal Republic of	38	42	38[c]	—	515	542	523[b]	+1.6	2 349	2 556	2 475[c]	+5.4	16	13
Netherlands	27	38	32	+18.5	387	534	491	+26.9	*1 758*	2 114	2 074	+18.0	5	9
Switzerland	38	33	*26*	31.6	457	396	397	13.1	2 155	1 958	1 852	14.1	9	4
Oceania														
Australia	59	57	50[c]	15.3	820	840	723[c]	11.8	3 223	3 331	2 789[c]	13.5	24	25
New Zealand	54[d]	64	54[c]	—	759[d]	773	735[c]	3.2	2 912[d]	2 909	2 696[c]	7.4	22	26
Lowest rate[g]	25	26	26		351	367	334		1 758	1 946	1 693			
Highest rate	83	92	74		909	1 001	962		3 372	3 419	3 277			
Average rate (unweighted)	45	49	45	—	549	576	561	+2.2	2 368	2 502	2 395	+1.1		
							Females							
Northern America														
Canada	23	21	18[b]	21.7	322	237	220[b]	31.7	1 695	1 331	1 210[b]	28.6	20	14
United States	*40*	*35*	27[c]	32.5	397	328	274[c]	31.0	1 845	1 628	1 296[c]	29.8	26	19

East Asia														
Japan	37	24	17	54.1	372	259	180	51.6	1 824	1 520	1 134	37.8	23	7
Europe														
Eastern Europe	34[d]	31	28	17.7	296[d]	320	323	+9.1	1 926[d]	2 141	2 113	+9.7	15	25
Bulgaria	25	25	25[b]	—	271	316	304[b]	+12.2	1 765	1 966	1 866[b]	+5.7	12	23
Czechoslovakia	35	34	31	11.4	361	332	336	6.9	2 134	2 081	1 906	10.7	22	26
Hungary	39	26	26[c]	33.3	296	253	248[c]	16.2	1 359	1 545	1 483[c]	+9.1	16	15
Poland	. . .	*35*	*33*	5.7	. . .	364	340	6.6	. . .	*2 334*	*2 164*	7.3	. . .	27
Romania														
Northern Europe	15	14	14	6.7	224	191	189	15.6	1 600	1 262	1 108	30.8	5	8
Denmark	28	28	22[b]	21.4	380	331	272[b]	28.4	2 252	1 948	1 644[b]	27.0	24	18
Finland	*12*	*10*	*12*	—	202	173	154	23.8	1 478	1 297	1 043	29.4	4	5
Norway	15	*10*	14	6.7	228	168	146	36.0	1 648	1 207	1 059	35.7	6	4
Sweden														
United Kingdom	29	23	20	31.0	304	268	255	16.1	1 771	1 526	1 385	21.8	17	16
England and Wales	37	32	30	18.9	*418*	*394*	*381*	8.9	*2 313*	1 894	1 732	25.1	27	28
Scotland														
Southern Europe	20	15	15[c]	25.0	176	170	162[c]	8.0	974	1 061	1 034[c]	+6.2	1	6
Greece	20	20	18[c]	10.0	340	362	320[c]	5.9	2 035	2 197	1 846[c]	9.3	21	24
Israel	30	22	18[b]	40.0	284	229	202[b]	28.9	1 761	1 416	1 250[b]	29.0	14	11
Italy	29	32[c]	27[c]	6.9	283	268[c]	264[c]	6.7	1 765	1 834[c]	1 574[c]	10.8	13	17
Portugal	39	30	25[b]	35.9	254	209	202[b]	20.5	1 415	1 267	1 291[b]	8.8	9	12
Spain	32[f]	26	28[c]	12.5	307[f]	281	300[c]	2.3	1 745[f]	1 628	1 746[c]	+0.1	18	22
Yugoslavia														
Western Europe	23[f]	20	19	17.4	257[f]	236	208	19.1	1 626[f]	1 655	1 432	11.9	10	13
Austria	23	19	16[c]	30.4	267	241	202[c]	24.3	1 605	1 471	1 307[c]	18.6	11	10
Belgium	18	15	13[b]	27.8	195	152	131[b]	32.8	1 106	926	854[b]	22.8	3	1
France	21	19	16[c]	23.8	252	217	189[c]	25.0	1 724	1 485	1 338[c]	22.4	8	9
Germany, Federal Republic of	13	15	13	—	*186*	179	146	21.5	*1 393*	1 244	1 027	26.3	2	3
Netherlands	15	11	*12*	20.0	240	*157*	*134*	44.2	1 574	*1 182*	*966*	38.6	7	2
Switzerland														
Oceania	33	33	27[c]	18.2	383	358	292[c]	23.8	1 896	1 926	1 527[c]	19.5	25	20
Australia	28[d]	*35*	31[c]	+10.7	321[d]	303	299[c]	6.9	1 744[d]	1 682	1 400[c]	19.7	19	21
New Zealand	12	10	12		186	157	134		1 393	1 182	966			
Lowest rate[g]	40	35	33		418	394	381		2 313	2 334	2 164			
Highest rate[g]	26	24	21	19.2	290	261	238	17.9	1 703	1 595	1 419	16.7		
Average rate (unweighted)														

Sources: For 1960, unweighted average rates for the three age categories shown have been calculated from age-specific death rates for five-year age-groups given in Samuel H. Preston, Nathan Keyfitz and Robert Schoen, *Causes of Death; Life Tables for National Populations* (New York, Seminar Press, 1972); for the 1970s, unweighted average rates have been similarly calculated from five-year age-specific death rates in the World Health Organization data bank.

NOTE: The composition of the cardiovascular diseases category, based on the Seventh (1955) and Eighth (1965) Revisions of the International Classification of Diseases, is as follows (Seventh Revision categories are from Preston, Keyfitz and Schoen, *op. cit.*, p. 6):

Seventh Revision

B22 Vascular lesions affecting central nervous system
B24 Rheumatic fever
B26 Chronic rheumatic heart disease
B26 Arteriosclerotic and degenerative heart disease
B27 Other diseases of heart
B28 Hypertension with heart disease
B29 Hypertension without mention of heart
A85 Diseases of arteries
A86 Other diseases of circulatory system

Eighth Revision

B25 Active rheumatic fever
B26 Chronic rheumatic heart disease
B27 Hypertensive disease
B28 Ischaemic heart disease
B29 Other forms of heart disease
B30 Cerebrovascular disease
A86 Diseases of arteries, arterioles and capillaries
A87 Venous thrombosis and embolism
A88 Other diseases of circulatory system

[a] If the rates in the 1960 and 1976 columns are foot-noted as pertaining to different years, the percentage change relates to the period designated by those years. For Romania, the percentage change is for 1970-1976.

[b] 1974.

[c] 1975.

[d] 1964.

[e] 1971.

[f] 1961.

[g] The lowest and highest rates appear in italics in the body of the table. The following countries, although recording the lowest death rates from cardiovascular diseases for one or more of the three years here considered, are excluded because they had 10 per cent or more of total deaths from senility, symptoms and other ill-defined conditions (see table IIA.4): France, Greece, Poland and Spain.

The countries in table II.9 have been ranked according to death rates from cardiovascular diseases for 1960 and 1976 from lowest to highest rate, based on the death rates for the 45-64 year age-group. At these ages, mortality from the cardiovascular diseases is already heavy, yet reflects relatively recent mortality conditions. Most of the countries with sizable reductions in cardiovascular disease mortality for males were those having higher than average mortality in 1960, e.g., the United States, Canada, Japan and Australia. Each of these countries ranked at least twentieth from having the lowest rates in 1960. Of these countries, Japan improved its ranking greatly, moving from twentieth to second place.

The number of countries showing increases in male mortality from the cardiovascular diseases between 1960 and the mid 1970s slightly outnumbered those with decreases, but the most striking feature of these increases is their magnitude. The countries with very large increases were mainly from Eastern and Southern Europe. In Eastern Europe, the percentage increase for the three age-groups ranged from 15 to 67 in Hungary, 38 to 46 in Bulgaria, 25 to 41 in Czechoslovakia and 20 to 29 in Poland. The relative deterioration in male mortality from the cardiovascular diseases in these countries becomes apparent from a comparison of their rankings in 1960 and the mid 1970s, based on the death rates at ages 45-64 years. Bulgaria moved from second lowest to twelfth lowest, for a drop of 10 places, while the ranking of Czechoslovakia, Poland and Hungary deteriorated by 9, 7 and 6 places, respectively.

When the rates for 1970 and the mid 1970s are compared the picture becomes more favourable. In a number of more developed countries which had substantial increase in mortality from the cardiovascular diseases in the 1960s, trends had changed towards the end of the decade or in the early 1970s, so that either the rates of increase had slowed, or mortality had actually begun to decline. This occurred in Czechoslovakia for all three age-groups between 1970 and 1974, as well as in Hungary, which had only slight increases in the two younger age-groups and a small decrease in the third between 1970 and 1976. In Poland, the trend appears to have slowed for the oldest age-group, which showed a death rate increase of only 2.7 per cent between 1970 and 1975.

Of the Eastern European countries experiencing large increases in mortality from the cardiovascular diseases, only Poland had a sizable decline in the proportion of deaths classified as due to symptoms and ill-defined conditions, from 14.6 per cent in 1961 to 6.8 per cent in 1975. Although a part of the increase in cardiovascular diseases mortality may therefore be due to improved certification of deaths, much of it is probably real, as adult male mortality from all causes increased substantially over a broad span of adult age-groups.

Of the Southern European countries, Yugoslvaia's percentage increases in death rates from the cardiovascular diseases among males were the largest, ranging from 17 to 48. Greece and Portugal also had sizable increases varying according to age-group from 25 to 32 per cent for the former, and from 5 to 21 per cent for the latter. The deterioration in mortality rates in Spain was more modest, ranging from 10 to 12 per cent. Despite large increases in death rates between 1960 and 1975, Greece remained in first place with the lowest rates at both dates. These rates, however, are implausibly low, and at least two factors may be contributing to their understatement. The first is the large percentage of deaths in category B45 at the earlier date—19.7. At the later date, 1975, the age-specific death rates for all causes were implausibly low, although it is not clear whether this was due to underregistration of deaths, a lack of correspondence between the numerator and denominator (i.e., number of deaths and population base) or some other problem of the data. Whatever the reason, it would also affect the death rates calculated for individual causes of death.

In three of the four Southern European countries recording increases in mortality from the cardiovascular diseases—Greece, Spain and Yugoslavia—the percentage of deaths classified as due to symptoms and ill-defined conditions declined substantially between 1960 and the mid 1970s, while in the fourth, Portugal, there was little change in this percentage. The decline was greatest for Greece—11 percentage points (from 19.7 per cent to 8.4 per cent), while Yugoslavia and Spain had declines of 8 and 7 percentage points, respectively. The figure for Spain refers to both sexes. The text table below compares the absolute changes in death rates for all causes with the changes in rates from the cardiovascular diseases for the three countries. The fact that death rates for all causes declined for most age-groups in these countries suggests that some of the recorded increases in rates from the cardiovascular diseases may be artifactual.

Absolute change in death rates per 100,000 population

	Greece (1960 to 1975)		*Spain (1960 to 1974)*		*Yugoslavia (1962 to 1975)*	
Age-group	*All causes*	*Cardio-vascular diseases*	*All causes*	*Cardio-vascular diseases*	*All causes*	*Cardio-vascular diseases*
25-44	− 15	+ 7	− 30	+ 4	− 5	+ 15
45-64	− 46	+ 75	− 86	+ 41	+ 2	+118
65-74	+114	+269	−225	+220	−112	+315

Sources: Rate changes for all causes calculated from table IIA.2 and Samuel H. Preston, Nathan Keyfitz and Robert Schoen, *Causes of Death; Life Tables for National Populations* (New York, Seminar Press, 1972), pp. 328, 648 and 780. Rate changes for cardiovascular diseases calculated from table II.9.

The remaining countries with increases in death rates from the cardiovascular diseases among males were the Netherlands, Denmark and Norway, which recorded increases varying according to age-group from 18 to 27 per cent, 2 to 17 per cent and 3 to 13 per cent, respectively. In Norway and the Netherlands, as well as in Finland, there were decided reversals in trend over the period, with rates moving downwards between 1970 and the mid 1970s. This was also true, although to a less extent, for one or more age-groups in England and Wales, Austria, Belgium and the Federal Republic of Germany.

The trends in mortality from the cardiovascular diseases among females were quite different from those observed for males. There were downward trends in the average death rates between 1960 and the mid 1970s in all three age-groups, the declines averaging some 19, 18 and 17 per cent for age-groups 25-44 years, 45-64 years and 65-74

years, respectively (table II.9). Decreases in rates occurred in both intervals, from 1960 to 1970 and 1970 to 1976.

In the analysis of trends in cardiovascular diseases mortality among males, it was found that 11 of the 28 countries included had increases between 1960 and the mid 1970s, while only eight countries registered clear downtrends. The situation for females has been much more favourable. In fact, the very large and ubiquitous declines in mortality from the cardiovascular diseases among females are among the most significant and impressive features of recent mortality trends in the more developed countries. Of the 28 countries in table II.9, more than 20 recorded consistent declines in female mortality from the cardiovascular diseases between 1960 and 1976. As was the case for males, Japan was the country with the greatest improvement, with percentage declines in death rates of 54, 52 and 38 for ages 25-44, 45-64 and 65-74 years, respectively. The mortality decline among Japanese women was so large, averaging 48 per cent for the three age-groups, that the country with the second largest decline, Switzerland, trailed far behind with an average decrease in rates of 34 per cent for the three age-groups. Italy and the United States also had very substantial percentage reductions averaging in the low thirties. Countries with percentage decreases averaging, for the three age-groups, in the middle or upper twenties included Canada, France, Sweden and Finland. In addition, Belgium, England and Wales, the Federal Republic of Germany, Spain and Australia had declines averaging 21 to 24 per cent.

In the discussion of trends in cardiovascular diseases among males, it was noted that in a number of countries, trends in the 1960s differed from those of the 1970s, being more favourable in the latter. Such tendencies can also be found among females in several countries, although the differences between the two periods are generally not as marked. Countries in which death rates from the cardiovascular diseases increased between 1960 and 1970 but declined thereafter for one or more age-groups include Austria, Czechoslovakia, Greece, Israel and Portugal. In Bulgaria, rates increased in the earlier interval but levelled off after 1970.

A feature of these changes in mortality has been the disparity in trends between the sexes. To be sure, there is a group of countries in which mortality declined substantially for males as well as females: Australia, Canada, Italy, Japan, Switzerland and the United States. But in most of the other countries the trends for males and females diverged. In Hungary, for example, where very large increases in male mortality from the cardiovascular diseases were recorded, there were modest declines in mortality for females. Other countries where male mortality increased while that of females showed reductions were Portugal, Spain, the Netherlands, Denmark and Norway. In several countries where male mortality had increased greatly—Bulgaria, Greece, Poland and Yugoslavia—female mortality showed little or no trend. It will be recalled that in the discussion on trends in male mortality from the cardiovascular diseases, the possible effects on the recorded death rates of transfers from the category of symptoms and ill-defined conditions to specific cause-of-death categories were mentioned. The same qualifications, of course, apply to the female data. But it seems unlikely that changes in diagnostic or coding fashions would cause recorded mortality from cardiovascular disease to move in opposite directions for males and females. The fact that many of the countries with the largest increases for males showed declines or level rates for females is some indication that the male increases are real.

3. *Levels and trends of mortality from neoplasms by country from 1960 to the mid 1970s*

The category of neoplasms in the present subsection includes benign as well as malignant neoplasms (cancer), in contrast to the first subsection which was based on data for malignant neoplasms only. The deaths classified as due to malignant neoplasms constitute the vast majority of all deaths from neoplasms in the more developed countries—some 98 per cent in the mid 1970s. Levels and trends in mortality from neoplasms by country are presented in table II.10, which has the same format as table II.9 for the cardiovascular diseases. Death rates are given for three age-groups—25-44 years, 45-64 years and 65-74 years. Also given are the lowest rate, highest rate and average rate (unweighted) for each age-group and year. As was the case for the cardiovascular diseases, countries with 10 per cent or more of total deaths in category B45 were ignored in determining the range of death rates and in the discussion of countries with the lowest rates.

The range of death rates for neoplasms differs, in relative terms, from that of the cardiovascular diseases in several respects, as table II.11 shows. For males and females alike, the relative range of death rates for neoplasms was the same in all three age-groups in the mid 1970s (1.8 and 1.7 for males and females, respectively) in contrast to the cardiovascular diseases where the range in the oldest age-group was much narrower than in the two younger age-groups. A second difference was the substantially narrower relative range of the death rates for neoplasms at ages 25-44 and 45-64 years compared with the range for cardiovascular diseases.

The average death rates from neoplasms for males remained virtually unchanged between 1960 and 1976 for the youngest age-group, while the two older age-groups had increases in rates which amounted to about 5 per cent at ages 45-64 years and nearly 16 per cent in the oldest age-group. A glance down the "percentage change" columns for males in table II.10 reveals a large number of countries with increases in death rates between 1960 and 1976. Table II.12 summarizes these data by giving the number of countries according to the size of the percentage change in death rates in five categories ranging from increases of 20 per cent or more to decreases of 20 per cent or more. It can be seen that mortality from neoplasms among males has deteriorated with each successive age-group, both in terms of number of countries with increases in rates, and size of the increases. For the 25-44 year age-group, 11 countries had increases in death rates, while for the 45-64 and 65-74 year age-groups, the countries with increases numbered 18 and 23, respectively. In the two younger age-groups, only a few countries had increases in rates amounting to 20 per cent or more, but in the 65-74 year age-group, nearly half the countries recorded changes

TABLE II.10. TRENDS IN AGE-SPECIFIC DEATH RATES FROM NEOPLASMS BY SEX FOR SELECTED AGE-GROUPS, SELECTED MORE DEVELOPED COUNTRIES, 1960 TO MID 1970s

(Rates per 100,000 population)

Major area, region and country	25-44 years				45-64 years				65-74 years				Rank based on rates for 45-64 years	
	Death rates			Percentage decline, 1960 to 1976[a]	Death rates			Percentage decline, 1960 to 1976[a]	Death rates			Percentage decline, 1960 to 1976[a]		
	1960	1970	1976		1960	1970	1976		1960	1970	1976		1960	1976
Males														
Northern America														
Canada	29	30	30[b]	+3.5	281	320	325[b]	+15.7	930	1 076	1 097[b]	+18.0	9	11
United States	36	35	32[c]	11.1	326	360	359[c]	+10.1	914	1 063	1 097[c]	+20.0	13	15
East Asia														
Japan	35	36	33	5.7	346	327	314	9.3	1 003	1 077	1 073	+7.0	18	9
Europe														
Eastern Europe														
Bulgaria	33[d]	32	34	+3.0	337[d]	294	295	12.5	1 033[d]	918	846	18.1	15	5
Czechoslovakia	37	41	*42*[b]	+13.5	435	438	*459*[b]	+5.5	1 293	*1 534*	*1 546*[b]	+19.6	25	28
Hungary	30	36	41	+36.7	340	356	398	+17.1	1 101	1 340	1 378	+25.2	16	23
Poland	30	38	39[c]	+30.0	296	372	398[c]	+34.5	746	1 123	1 161[c]	+55.6	10	24
Romania	. . .	34	36	+5.9	. . .	311	331	+ 6.4	. . .	*846*	*836*	1.2	. . .	12
Northern Europe														
Denmark	37	36	33	10.8	310	328	335	+8.1	1 050	1 154	1 172	+11.6	12	13
Finland	39	34	30[b]	23.1	452	418	393[b]	13.1	1 398	1 352	1 328[b]	5.0	26	21
Norway	34	33	*24*	29.4	247	258	268	+ 8.5	831	914	995	+19.7	3	3
Sweden	29	*27*	*24*	17.2	*241*	*239*	*252*	+ 4.6	935	922	1 018	+ 8.9	1	1
United Kingdom														
England and Wales	38	35	33	13.2	417	407	392	6.0	1 198	1 378	1 382	+15.4	23	20
Scotland	*40*	*42*	34	15.0	*456*	*453*	436	4.4	1 233	1 469	1 520	+23.3	27	26
Southern Europe														
Greece	30	28	30[c]	—	277	282	298[c]	+7.6	786	911	966[c]	+22.9	7	6
Israel	*27*	34	39[c]	+44.4	263	257	255[c]	3.0	*782*	909	866[c]	+10.7	5	2
Italy	36	40	38[b]	+5.6	349	382	397[b]	+13.8	902	1 183	1 145[b]	+26.9	19	22
Portugal	31	34[e]	37[c]	+19.4	246	272[e]	273[c]	+11.0	682	857[e]	781[c]	+14.5	2	4
Spain	27	30	31[b]	+14.8	270	286	298[b]	+10.4	820	896	1 020[b]	+24.4	6	7
Yugoslavia	27[f]	27	31[c]	+14.8	250[f]	272	298[c]	+19.2	711[f]	794	864[c]	+21.5	4	8
Western Europe														
Austria	33[f]	36	35	+6.1	422[f]	380	365	13.5	*1 403*[f]	1 496	1 386	1.2	24	17
Belgium	35	35	34[c]	2.9	389	414	413[c]	+6.2	1 105	1 326	1 489[c]	+34.8	22	25
France	32	41	41[b]	+28.1	387	405	447[b]	+15.5	1 088	1 233	1 306[b]	+20.0	21	27
Germany, Federal Republic of	34	34	33[c]	2.9	370	357	364[c]	1.6	1 187	1 359	1 383[c]	+16.5	20	16
Netherlands	38	33	29	23.7	345	395	384	+11.3	1 048	1 295	1 471	+40.4	17	19
Switzerland	30	30	30	—	332	347	367	+10.5	1 174	1 185	1 227	+ 4.5	14	18
Oceania														
Australia	29	33	30[c]	+3.5	279	322	324[c]	+16.1	893	1 079	1 102[c]	+23.4	8	10
New Zealand	36[d]	40	39[c]	+8.3	310[d]	342	343[c]	+10.7	900[d]	1 117	1 141[c]	+26.8	11	14
Lowest rate[g]	27	27	24		241	239	252		782	846	836			
Highest rate	40	42	42		456	453	459		1 403	1 534	1 546			
Average rate (unweighted)	33	34	34	+3.0	332	343	349	+5.1	1 005	1 136	1 164	+15.8		
Females														
Northern America														
Canada	46	38	36[b]	21.7	267	267	268[b]	+0.4	628	614	612[b]	2.6	17	19
United States	47	43	38[c]	19.2	268	269	272[c]	+1.5	575	593	585[c]	+1.7	18	21

East Asia														
Japan	47	40	36	23.4	252	225	200	20.6	586	579	549	6.3	12	5
Europe														
Eastern Europe														
Bulgaria	36[d]	32	35	2.8	*209*[d]	*199*	*191*	8.6	591[d]	508	477	19.3	5	3
Czechoslovakia	39	41	40[b]	+2.6	280	269	263[b]	6.1	740	711	701[b]	5.3	21	17
Hungary	51	44	*51*	—	284	269	295	+ 3.9	731	759	763	+ 4.4	22	25
Poland	43	42	40[c]	7.0	235	255	257[c]	+ 9.4	488	627	597[c]	+22.3	8	16
Romania	. . .	42	38	9.5	. . .	233	229	1.7	. . .	*482*	*459*	4.8	. . .	10
Northern Europe														
Denmark	*53*	*50*	49	7.6	*314*	*316*	*331*	+ 5.4	*786*	721	*773*	1.7	27	28
Finland	40	*29*	32[b]	20.0	236	216	217[b]	8.1	709	602	562[b]	20.7	9	7
Norway	44	43	33	25.0	232	227	246	+ 6.0	588	540	558	5.1	7	15
Sweden	43	38	34	20.9	264	247	238	9.9	640	624	620	3.1	15	13
United Kingdom														
England and Wales	46	44	41	10.9	273	296	309	+13.2	636	656	688	+ 8.2	20	26
Scotland	*53*	44	46	13.2	305	311	325	+ 6.6	721	711	721	—	26	27
Southern Europe														
Greece	33	33	33[c]	—	187	187	189[c]	+ 1.1	391	412	433[c]	+10.7	1	2
Israel	45	42	40[c]	11.1	284	288	270[c]	4.9	737	747	677[c]	8.1	23	20
Italy	43	39	37[b]	14.0	241	240	237[b]	1.7	588	593	559[b]	4.9	10	12
Portugal	37	42[e]	37[c]	—	201	210[e]	187[c]	7.0	450	504[e]	438[c]	2.7	4	1
Spain	32	32	32[b]	—	200	191	196[b]	2.0	499	494	509[b]	+ 2.0	3	4
Yugoslavia	38[f]	36	35[c]	7.9	195[f]	187	202[c]	+3.6	441[f]	426	467[c]	+ 5.9	2	6
Western Europe														
Austria	49[f]	43	39	20.4	304[f]	295	273	10.2	766[f]	*768*	711	7.2	25	22
Belgium	41	43	37[c]	9.8	273	261	267[c]	2.2	727	668	631[c]	13.2	19	18
France	41	33	33[b]	19.5	242	225	227[b]	6.2	599	554	565[b]	5.7	11	8
Germany, Federal Republic of	51	44	39[c]	23.5	286	283	277[c]	3.2	773	751	726[c]	6.1	24	23
Netherlands	44	42	36	18.2	266	272	243	8.7	681	664	625	8.2	16	14
Switzerland	41	38	*30*	26.8	252	248	228	9.5	691	637	605	12.5	13	9
Oceania														
Australia	42	38	34[c]	19.1	216	243	237[c]	+ 9.7	*518*	562	545[c]	+ 5.2	6	11
New Zealand	52[d]	42	46[c]	11.5	260[d]	282	283[c]	+ 8.9	597[d]	619	667[c]	+11.7	14	24
Lowest rate[g]	36	29	30		209	199	191		518	482	459			
Highest rate[g]	53	50	51		314	316	331		786	768	773			
Average rate (unweighted)	44	40	38	13.6	253	250	248	2.0	625	612	601	3.8		

Sources: For 1960, unweighted average rates for the three age categories shown have been calculated from age-specific death rates for five-year age-groups given in Samuel H. Preston, Nathan Keyfitz and Robert Schoen, *Causes of Death; Life Tables for National Populations* (New York, Seminar Press, 1972); for the 1970s, unweighted average rates have been similarly calculated from five-year age-specific death rates in the World Health Organization data bank.

NOTE: The neoplasms category includes all malignant and benign neoplasms (items B18 and B19 of the Seventh (1955) Revision of the International Classification of Diseases, and items B19 and B20 of the Eighth (1965) Revision).

[a] If the rates in the 1960 and 1976 columns are foot-noted as pertaining to different years, the percentage change relates to the period designated by those years. For Romania, the percentage change is for 1970-1976.

[b] 1974.

[c] 1975.

[d] 1964.

[e] 1971.

[f] 1961.

[g] The lowest and highest rates appear in italics in the body of the table. The following countries, although recording the lowest death rates from neoplasms for one or more of the three years here considered, are excluded because they had 10 per cent or more of total deaths from senility, symptoms and other ill-defined conditions (see table IIA.4): Greece, Poland, Portugal, Spain and Yugoslavia.

TABLE II.11. RELATIVE RANGE OF DEATH RATES FOR CARDIOVASCULAR DISEASES AND NEOPLASMS BY AGE-GROUP, MORE DEVELOPED COUNTRIES, MID 1970s[a]

Age-group (years)	Males		Females	
	Cardiovascular diseases	Neoplasms	Cardiovascular diseases	Neoplasms
25-44	2.9	1.8	2.8	1.7
45-64	2.9	1.8	2.8	1.7
65-74	1.9	1.8	2.2	1.7

Source: Calculated from tables II.9 and II.10.

[a] The relative range in a given sex-age category is the ratio of the highest to lowest rate for that category.

TABLE II.12. DISTRIBUTION OF 27 MORE DEVELOPED COUNTRIES BY SIZE OF CHANGES IN DEATH RATES FROM NEOPLASMS, 1960 TO 1976

(Number of countries)

Change in rates	Males			Females		
	Age-group (years)			Age-group (years)		
	25-44	45-64	65-74	25-44	45-64	65-74
Increases						
20 per cent or more	4	1	13	—	—	1
5-19 per cent	7	17	10	—	7	5
No change						
(−4 to +4 per cent)	7	4	2	6	10	9
Decreases						
5-19 per cent	6	5	2	13	9	11
20 per cent or more	3	—	—	8	1	1
TOTAL	27	27	27	27	27	27

Source: Tabulated from data in table II.10.

of this magnitude. It is possible that the recent deterioration at older ages in some countries reflects the presence of certain cohort-specific factors that had earlier raised rates for younger ages in these countries.[6] Patterns of cigarette smoking, for example, seem to affect a cohort's death rates from neoplasms at all adult ages.[7] The countries with the greatest increases in the youngest age-groups were Israel (44 per cent), Hungary (37 per cent), Poland (30 per cent) and France (28 per cent). Of these countries, only Israel did not consistently also show large increases for the other two age-groups. In the 45-64 year age-group, the greatest deterioration in death rates occurred in Poland (+35 per cent), Yugoslavia (+19 per cent), Hungary (+17 per cent), and Canada and France (+16 per cent each). Finally, in the oldest age-group, death rates increased the most in Poland (56 per cent), the Netherlands (40 per cent), Belgium (35 per cent) and Italy and New Zealand (27 per cent each).

Of the countries named above as having had large increases in mortality from neoplasms, France, Poland and Yugoslavia also had substantial declines in the relative size of category B45 between 1960 and 1976, as was noted in the discussion of mortality trends from the cardiovascular diseases. The qualifications mentioned in that discussion also apply here.

Looking once again at table II.12 one is struck by the small number of countries recording decreases in male mortality from neoplasms. The youngest age-group had the most favourable experience: three countries (Norway, the Netherlands and Finland) had death rate declines of 20 per cent or more. No decreases of this size were observed for the two older age-groups; for these only a few countries had modest decreases.

When the changes in death rates are examined for the two subperiods 1960-1970 and 1970-1976, a pattern similar to that observed for the cardiovascular diseases emerges for the oldest age-group, i.e., the mortality experience of the earlier period is much less favourable than that of the later period. Most of the countries which had large increases in mortality at ages 65-74 years between 1960 and 1970 had only slight increases or even modest declines between 1970 and 1976. Among the countries having this pattern were Canada, the United States, Czechoslovakia, Poland, Hungary, Italy, England and Wales, Scotland, Australia and New Zealand. For this age-group, therefore, the increases in mortality from neoplasms appear to be levelling off. The patterns of changes in death rates for the other two age-groups were more erratic.

Among men, the lungs are the leading site of cancer deaths in nearly all the more developed countries.[8] The table below shows mortality from lung cancer at ages 45-64 years as a percentage of mortality from all neoplasms for a year in the mid 1970s (1974, 1975 or 1976). It can be seen that the relative importance of lung cancer varies greatly

Country	Percentage	Country	Percentage	Country	Percentage
Australia	35	Germany, Federal Republic of	30	Poland	31
Austria	31	Hungary	29	Romania	29
Belgium	39	Israel	22	Spain	22
Bulgaria	32	Italy	30	Sweden	20
Canada	37	Japan	13	Switzerland	35
Czechoslovakia	34	Netherlands	45	United Kingdom	
Denmark	33	New Zealand	35	England and Wales	44
Finland	43	Norway	24	Scotland	46
France	22			United States	39

Source: Calculated from data in World Health Organization data bank.

among the countries from a very low 13 per cent in Japan to over 40 per cent in Finland, the Netherlands, England and Wales and Scotland. In fact, lung cancer deaths contribute a substantial proportion of the variation in mortality from all neoplasms combined in the more developed countries. Moreover, in many countries much of the increase in male mortality from neoplasms in recent years has been due to lung cancer. This is illustrated for selected countries in table II.13[9] in column (6) of the table, index numbers are given which compare the death rates for neoplasms of all sites in 1973-1975 with those of 1960-1964 for the 60-69 year age-group. Of the 12 countries in the table, the in-

[6] See, for example, R. A. M. Case, "Cohort analysis of cancer mortality in England and Wales, 1911-54, by site and sex", *British Journal of Preventive and Social Medicine*, vol. 10 (1956), pp. 172-199.

[7] Samuel H. Preston, "An international comparison of excesses in the death rates of older males", *Population Studies*, vol. 24, No. 1 (March 1970), pp. 14-18.

[8] The term "lung cancer" as used in this discussion refers to malignant neoplasms of the trachea, bronchus and lung.

[9] See also H. Hansluwka, "Cancer mortality in Europe, 1970-74", *World Health Statistics Quarterly*, vol. 31, No. 2 (1978), pp. 173-176; B. Benjamin, "Trends and differentials in lung cancer mortality", *World Health Statistics Report*, vol. 30, No. 2 (1977), tables 3 and 7.

TABLE II.13. CHANGES IN MORTALITY FROM ALL NEOPLASMS COMPARED WITH CHANGES IN LUNG CANCER MORTALITY, MALES AGED 60-69 YEARS, 1960-1964 TO 1973-1975, SELECTED MORE DEVELOPED COUNTRIES

Country	Death rates per 100,000 population				Absolute increase in lung cancer rates, 1960-1964 to 1973-1975 (4)-(3) (5)	Indices (1960-1964, all neoplasms = 100)	
	All neoplasms		Lung cancer				
	Average, 1960 and 1964 (1)	1973-1975 (2)	1960-1964 (3)	1973-1975 (4)		1973-1975, all neoplasms [(2)÷(1)] × 100 (6)	1973-1975, all neoplasms, if 1960-1964 lung cancer levels had prevailed $\left[\frac{(2)-[(4)-(3)]}{(1)}\right] \times 100$ (7)
Canada	663	742[a]	171	259[a]	88	112	99
Czechoslovakia	1 041	1 038[a]	360	361[a]	1	100	100
Denmark	771	814	204	291	87	106	94
Finland	999	943[a]	375	420[a]	45	94	90
France	847	926[a]	147	200[a]	53	109	103
Germany, Federal Republic of	912	890	262	275	13	98	96
Hungary	815	920	202	264	62	113	105
Netherlands	813	988	300	439	139	122	104
New Zealand	680[b]	789	210	275	65	116	106
United Kingdom							
England and Wales	923	943	416	430	14	102	101
Scotland	1 003	1 034	459	489	30	103	100
United States	707	780	205	288	83	110	99

Sources: Rates for neoplasms, all sites, 1960 and 1964, are averages of rates for 1960 and 1964 given in Samuel H. Preston, Nathan Keyfitz and Robert Schoen, *Causes of Death; Life Tables for National Populations* (New York, Seminar Press, 1972); lung cancer death rates 1960-1964 from B. Benjamin, "Trends and differentials in lung cancer mortality", *World Health Statistics Report*, vol. 30, No. 2 (1977), p. 133; 1973-1975 rates are averages of rates for the three years calculated from data from the World Health Organization data bank.

NOTE: "All neoplasms" includes benign as well as malignant neoplasms. Data for lung cancer refer to malignant neoplasms of the trachea, bronchus and lung.

[a] 1973-1974.

[b] 1964.

dices decreased for two countries, remained the same in one, and increased in all the others. Before calculating the index numbers for the last column of the table, which compares the same two periods, the lung cancer death rates for 1960-1964 were substituted for those of 1973-1975 in the 1973-1975 rates for all neoplasms. This was done in order to arrive at hypothetical index numbers which would result if the 1960-1964 lung cancer death rates had prevailed in 1973-1975. In comparing the two sets of index numbers, it is seen that the ones in column (6) are higher than those in column (7) for all but one country, for which it is the same. Thus, trends in lung cancer mortality between 1960-1964 and 1973-1975 affected over-all mortality from neoplasms adversely, sometimes quite substantially. In the Netherlands, for example, mortality from all neoplasms among males in their sixties would have increased only by 4 per cent, instead of the 22 per cent increase which actually occurred, had lung cancer mortality remained at its 1960-1964 level. In Denmark, the "all neoplasms" death rate would have declined by 6 per cent for this age-group rather than increasing by the same percentage. The average value of the index for these 12 countries in 1973-1975 would have been 100 had lung cancer mortality not changed, compared to its actual value of 107.

The trends in mortality from neoplasms among females between 1960 and mid 1970s were, on the whole, more favourable than those of the males, with average death rates declining in each of the three broad age-groups shown in table II.10. The largest decline, some 14 per cent, occurred in the youngest of the age-groups, while the 45-64 and 65-74 year age-groups recorded only slight declines amounting to 2 per cent and 4 per cent, respectively. As seen from table II.12, in the 25-44 year age-group, eight countries had declines in death rates of 20 per cent or more, 13 had decreases ranging from 5 to 19 per cent, and the remaining countries showed little or no change.[10] The eight countries with declines exceeding 20 per cent were Canada, Japan, Finland, Norway, Sweden, Austria, the Federal Republic of Germany and Switzerland. The United States, France, the Netherlands and Australia also had large decreases in rates, of 18 or 19 per cent. In the two older age-groups, mortality trends were similar. Five or six countries had increases in death rates, nine or 10 showed little or no change and the remaining countries had declines. Of the countries with increases in death rates, several had increases for both of the older age-groups. These were England and Wales, Poland, Australia and New Zealand. Poland had a rather large increase, of some 22 per cent in the 65-74 year age-group. The countries with declines in death rates of 5 per cent or more for both of the older age-groups were Austria, Bulgaria, Czechoslovakia, Finland, France, Japan, the Netherlands and Switzerland. Of these, the largest decreases were recorded for Bulgaria, Finland and Japan, which had declines in death rates of around 20 per cent in one or the other age-group.

Although lung cancer was not a leading cause of mortality from neoplasms among females in the mid 1970s, it was of importance because of its large increase in many countries. As can be seen from column (6) of table II.13, increases in lung cancer mortality of 75 per cent or more between 1960-1964 and 1973-1975 were common in the 60-69 year age-group. Mortality from lung cancer has in-

[10] At these ages, death rates are low, and small absolute changes result in substantial percentage changes.

creased even more sharply among younger women in many countries, probably as a result of increases in cigarette smoking.

The leading site of mortality from neoplasms among women in the more developed countries is the breast. The concentration of mortality at this site, however, is much weaker than that of the lungs for males. In the mid 1970s, mortality from breast cancer among females aged 45-64 years constituted some 20 to 30 per cent of female deaths from all neoplasms, as shown in the table below. Japan, with only 8 per cent in this category once again stands out as having an atypical pattern of mortality by cause.[11] The leading cancer site for Japanese women in this age-group is the stomach, with 29 per cent of all neoplasm deaths at this site in 1976.

Country	*Percentage*	*Country*	*Percentage*	*Country*	*Percentage*
Australia	23	Germany, Federal Republic of	21	Poland	16
Austria	20	Hungary	19	Romania	15
Belgium	27	Israel	26	Spain	18
Bulgaria	19	Italy	23	Sweden	22
Canada	26	Japan	8	Switzerland	28
Czechoslovakia	18	Netherlands	29	United Kingdom England and Wales	26
Denmark	25	New Zealand	23	Scotland	23
Finland	21	Norway	22	United States	24
France	24				

Source: Calculated from data in World Health Organization, *World Health Statistics Annual*, vol. I for 1977 (Geneva, 1977), table 7, and *ibid.*, for 1978 (Geneva, 1978), table 7.

D. Intercountry comparison of relation between gross national product and mortality level

The statistical association between a population's socio-economic level, as measured by such indicators as income, occupation and social class, and the mortality level is well documented.[12] Socio-economic mortality differentials are found both within and among countries. The present section examines, for the more developed countries, the inter-country relationships between socio-economic level, as measured by the gross national product, and two indicators of mortality level—the infant mortality rate and expectation of life at birth—while the next section treats mortality differentials within countries.

1. *Gross national product and the infant mortality rate*

The negative relationship between the infant mortality rate and the level of economic development has generally been quite strong, historically as well as cross-sectionally, and the former has often been considered a reliable barometer of the latter. That this relationship was still very close in the more developed countries in the mid 1970s can be seen from the scatter diagram in figure II.9, in which infant mortality levels in the mid 1970s are plotted for 31 more developed countries, as a function of their gross national product per head in United States dollars in 1974. The infant mortality rates ranged from a high of 86.8 infant deaths per 1,000 live births for Albania in 1965 (the most recent year for which data were available), and 39.8 for Yugoslavia, with the second highest rate, to a low of 8.3 in Sweden. Albania and Yugoslavia had the lowest and third lowest *per capita* GNP ($530 and $1,310, respectively), while Sweden had the second highest ($7,240). A curve of the form $y = ax^b$, with x and y representing GNP *per capita* and the infant mortality rate, respectively, was fitted to these data. The equation of the curve is:

$$y = 5854.28x^{-0.71}$$

The coefficient of correlation between the infant mortality rate and GNP per head was -0.89, indicating a close relationship between these two variables. The degree of correlation is particularly impressive, as the average GNP per head does not take into account differences among countries in the internal distribution of income, or differential levels of government spending on health and welfare items, both of which could be expected to influence mortality levels. An extrapolation of these data suggests that a doubling of the GNP from $8,000 to $16,000 would be accompanied by a decrease in infant mortality from 9.9 to 6.0 per 1,000 live births. At such high levels of GNP, however, advances in medical knowledge and technology are probably more important than increments in income, *per se*, as factors in mortality decline. Figure II.9 strongly suggests that the limiting infant mortality rate under the present state of the art of medicine is around 8, and it is of interest that Japan and Finland, countries with only modest GNP ($4,070 and $4,700, respectively) were very close to attaining this figure in the mid 1970s.

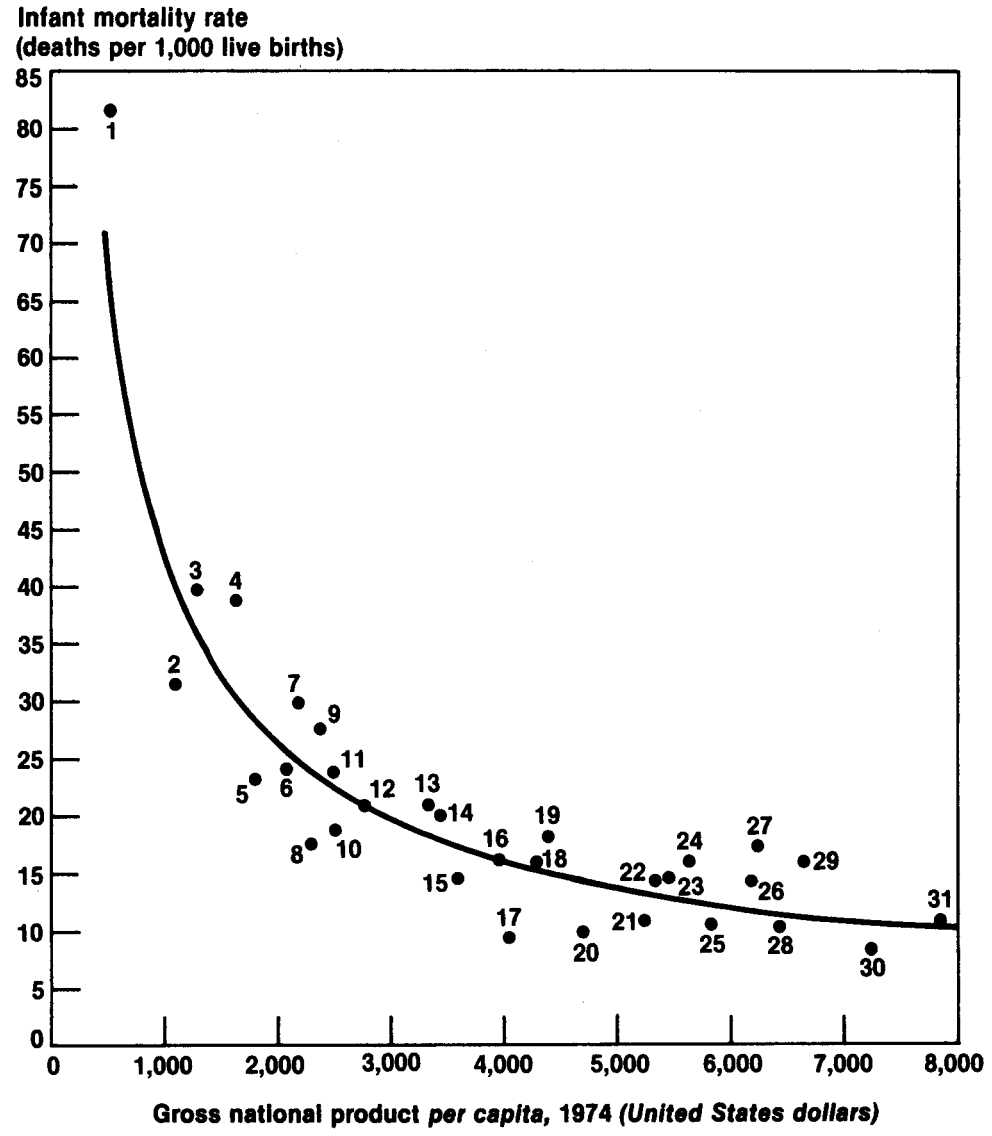
2. *Gross national product and expectation of life at birth*

One might expect the association between expectation of life at birth and GNP to be much weaker than that found between infant mortality and GNP. In the comparison of infant mortality with GNP, the two measures pertained, for the most part, to the same calendar year or to years that were only a few years apart at the most. In other words, the economic indicator and the mortality experience were for the same period. The situation is quite different with respect to expectation of life at birth, which is a summary measure of mortality at all ages in a given year or several adjacent years. In the more developed countries, where 65 to 75 per cent of all deaths are of persons 65 years and older, health and economic conditions of some five, six or

[11] According to W. P. D. Logan, the persistently low death rates from breast cancer in Japan "are so far without explanation though the hypothesis that the oriental diet protects and the western diet contributes to breast cancer may be the right one". ("Cancer of the female breast; international mortality trends", *World Health Statistics Report*, vol. 28, No. 6 (1975), p. 235.)

[12] See, for example, *The Determinants and Consequences of Population Trends: New Summary of Findings on Interaction of Demographic, Economic and Social Factors, vol. I* (United Nations publication, Sales No. E.71XIII.5), pp. 137-140; Samuel H. Preston, "The changing relation between mortality and level of economic development", *Population Studies*, vol. 29, No. 2 (July 1975), pp. 231-248; Aaron Antonovsky and Judith Bernstein, "Social class and infant mortality", *Social Science and Medicine*, vol. II (1977), pp. 453-470.

Figure II.9. Relation between infant mortality rate (mid 1970s) and *per capita* GNP (1974), more developed countries



Sources: Infant mortality rates from United Nations, *Demographic Yearbook*, various issues; gross national product from *World Bank Atlas; Population*, Per Capita *Product, and Growth Rates* (Washington, D.C., World Bank, 1976), p. 5.

Countries: 1. Albania; 2. Romania; 3. Yugoslavia; 4. Portugal; 5. Bulgaria; 6. Greece; 7. Hungary; 8. Ireland; 9. USSR; 10. Spain; 11. Poland; 12. Italy; 13. Czechoslovakia; 14. Israel; 15. United Kingdom; 16. German Democratic Republic; 17. Japan; 18. New Zealand; 19. Austria; 20. Finland; 21. Netherlands; 22. Australia; 23. France; 24. Belgium; 25. Norway; 26. Canada; 27. Federal Republic of Germany; 28. Denmark; 29. United States; 30. Sweden; 31. Switzerland.

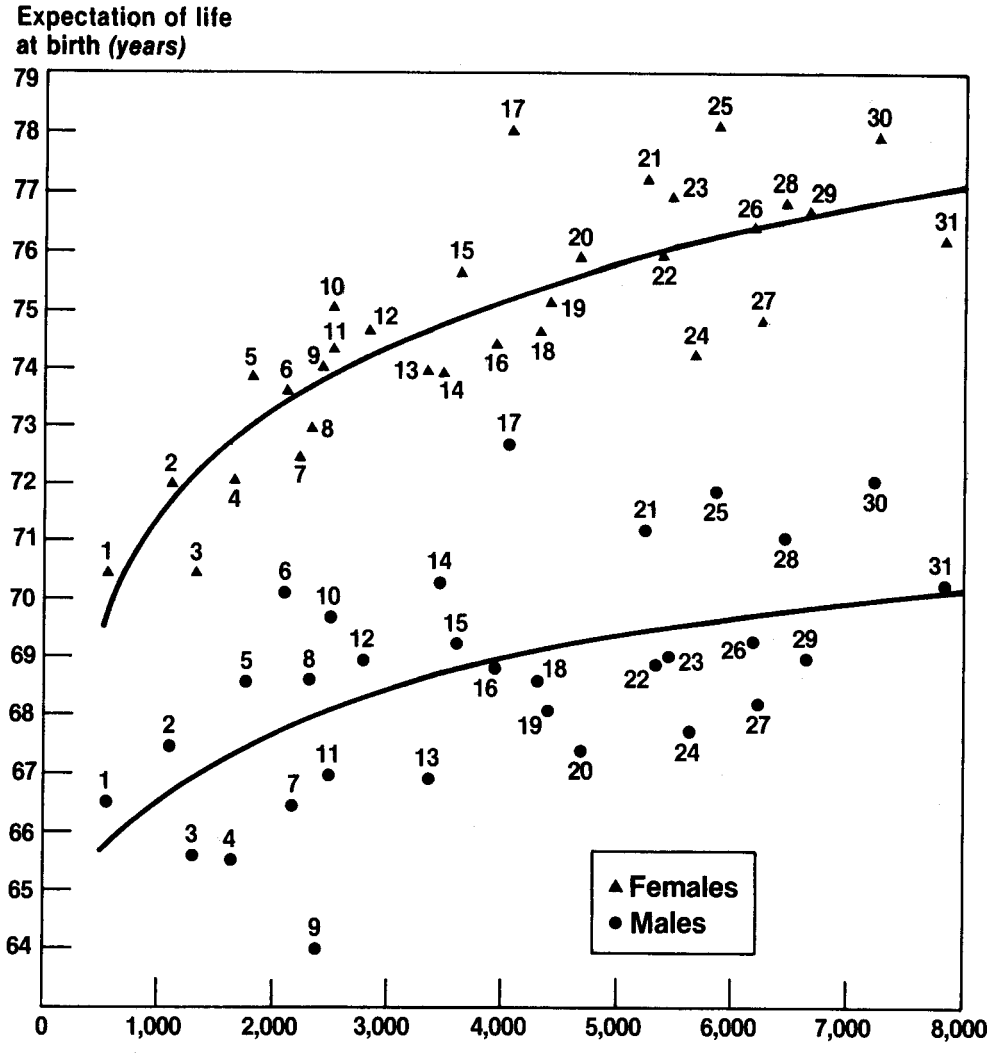
even seven decades earlier would be expected to have left their imprints on the survivors, and to weaken the relationship between life expectancy and the value of a socio-economic indicator for a current year. Furthermore, it is clear that certain personal habits deleterious to health are encouraged or facilitated by affluence among the adult population. It is of interest, therefore, that the correlation between life expectancy for females in the more developed countries in the mid 1970s, and GNP per head for 1974, was found to be nearly as high as that of infant mortality and GNP—+0.86 for the former compared with −0.89 for the latter. The relationship between male life expectancy and GNP, however, was much weaker, with a correlation coefficient of only +0.57. These relationships are depicted in figure II.10, where curves of the form $y = ax^b$, with x representing GNP and y representing expectation of life at birth, have been fitted to the data points for males and females. The equations of the curves are as follows:

$$\text{Males:} \quad y = 55.25x^{0.03}$$

$$\text{Females:} \quad y = 55.07x^{0.07}$$

Females, therefore, appear to benefit much more from better socio-economic conditions than do males. The disparity

Figure II.10. Relation between expectation of life at birth (early to mid 1970s) and *per capita* GNP (1974), more developed countries



Sources: Expectation of life at birth from table IIA.1; gross national product from *World Bank Atlas; Population,* Per Capita *Product, and Growth Rates* (Washington, D.C., World Bank, 1976), p. 5.

Countries: 1. Albania; 2. Romania; 3. Yugoslavia; 4. Portugal; 5. Bulgaria; 6. Greece; 7. Hungary; 8. Ireland; 9. USSR; 10. Spain; 11. Poland; 12. Italy; 13. Czechoslovakia; 14. Israel; 15. United Kingdom; 16. German Democratic Republic; 17. Japan; 18. New Zealand; 19. Austria; 20. Finland; 21. Netherlands; 22. Australia; 23. France; 24. Belgium; 25. Norway; 26. Canada; 27. Federal Republic of Germany; 28. Denmark; 29. United States; 30. Sweden; 31. Switzerland.

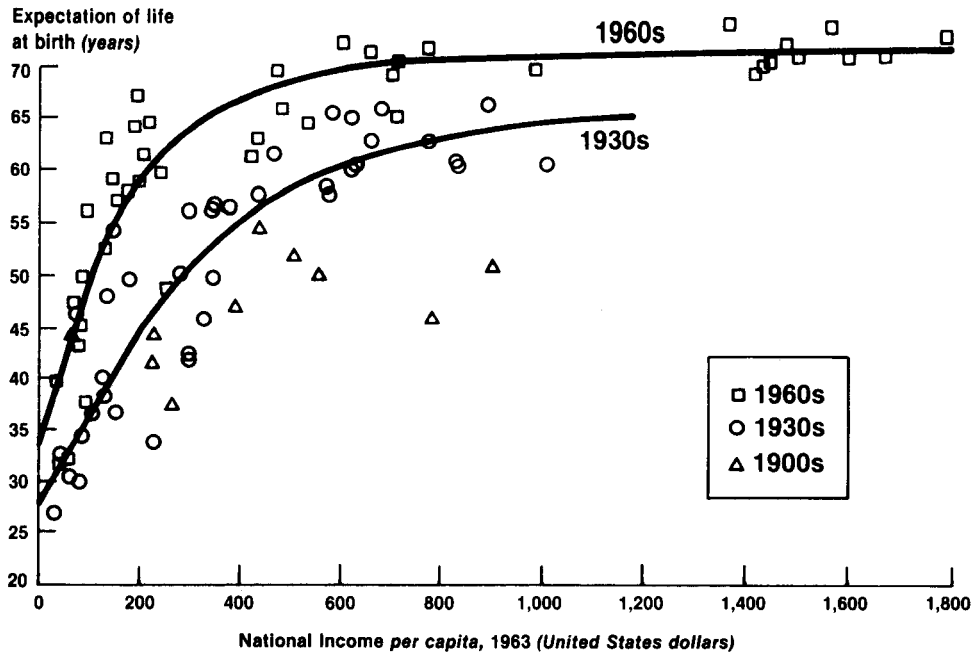
is even more pronounced than portrayed by these data when it is realized that women, for historical and socio-cultural reasons, are by far the poorer members of society. It may be that, while both sexes profit equally from the positive factors associated with affluence (e.g., comfortable, well-equipped dwellings and high-quality medical care, *inter alia*), its negative aspects ("overnutrition", cigarette smoking, high levels of stress) accrue in much greater proportion to males.

Among the outliers in figure II.10, Japan is outstanding in its unusually high life expectancy in relation to its GNP for males and females alike. While it ranked only fifteenth from highest in GNP, it had the highest life expectancy for males, and the second highest for females. Japan's favourable position is probably due to a fortuitous meeting of a number of factors, genetic as well as environmental, and epidemiological studies have been attempting to sort these out.[13]

It is seen from figure II.10 that life expectancy for males in the USSR is unusually low—only 64 years in 1971-1972—in relation to estimated GNP of $2,380 while that of females, 74 years, is close to the level of the Eastern European countries. Expectation of life at birth for Soviet males was actually higher in the mid 1960s—66 years—

[13] Several of these studies are discussed in Abraham M. Lilienfeld, *Foundations of Epidemiology* (New York, Oxford University Press, 1976), chap. 5.

Figure II.11. Relation between expectation of life at birth and national income for countries in the 1900s, 1930s and 1960s



Source: Samuel H. Preston, "The changing relation between mortality and level of economic development", *Population Studies*, vol. 29, No. 2 (July 1975), p. 235.

after which it deteriorated, even though GNP per head was increasing substantially.[14] While increased mortality from the cardiovascular and cerebrovascular diseases appears to have contributed the most to this unfavourable trend,[15] the underlying reasons for the increasing mortality have not been conclusively established.

In a multicountry study on the relationship between expectation of life at birth and national income per head among all countries for which such data were available, less developed as well as more developed, it was found that a given value of national income was associated with a much higher life expectancy in the 1960s than in the 1930s (figure II.11). For the annual income range between $100 and $500, the difference amounted to some 10 to 12 years of life expectancy (e.g., an income of $400 was associated with a life expectancy of approximately 55 years in the 1930s and 66 years in the 1960s), but became progressively less with increasing income above this level. At the uppermost income levels, where the more developed countries are located, the difference was about five years. Evidence was also found of a similar upward shift of this relationship between the 1900s and 1930s, and concluded that "exogenous" factors, such as the importation of medical and public health technologies, played a far greater role in mortality improvement than did increases in income *per se*.[16]

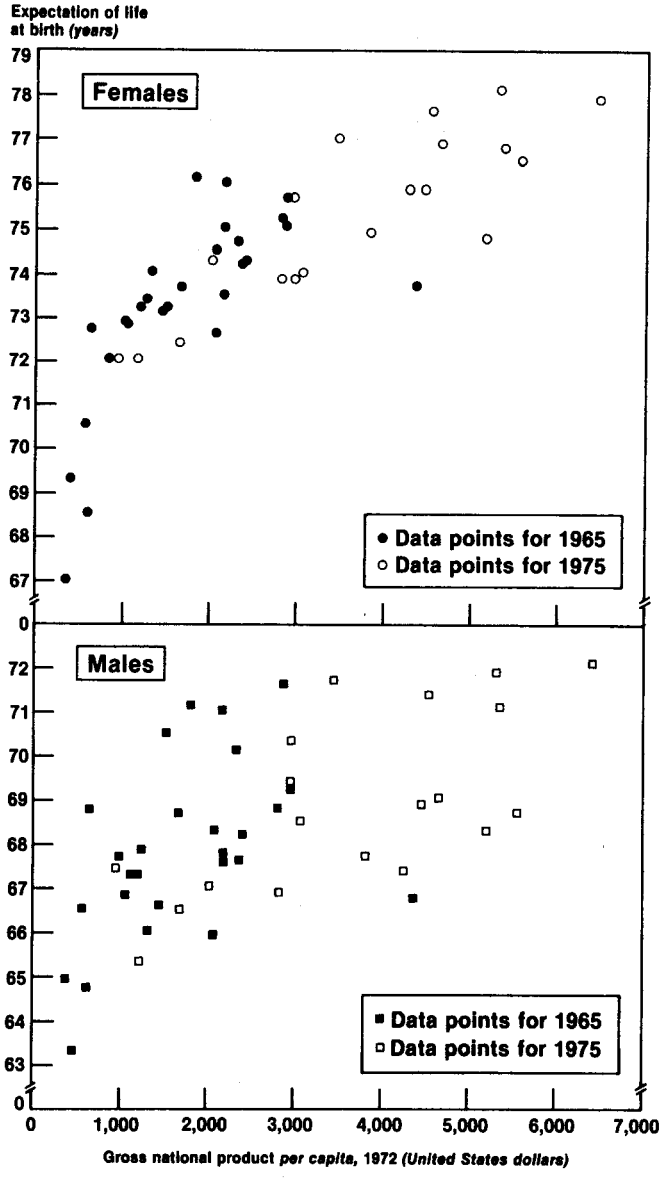
An analysis similar to Preston's comparing 1975 with 1965 has been undertaken for the more developed countries only, but substituting gross national product per head for national income. These data are plotted for males and females separately in figure II.12. Visually, the data points for 1975 appear to lie along the same curve as those of 1965, but with higher levels of income and life expectancy for most countries at the later date. When the regression lines were plotted separately for the 1965 and 1975 data, there was actually a very slight downward shift in the GNP/life expectancy relationship, i.e., life expectancy for a given GNP in 1975 was a fraction of a year lower than in 1965. This may well be an artifact of the data, as there were only 19 data points for 1975 compared with 27 for 1965, and the 19 countries included may represent a biased sample. Nevertheless, it does appear that the shift to a higher life expectancy for a given income, which occurred between the 1900s and the 1930s, and between the 1930s and the 1960s, has not continued, at least at the upper income levels, between 1965 and 1975. During that decade increases in income in the more developed countries were very large while increases in life expectancy were only modest. For the 19 countries plotted in figure II.12 for which data were available for both 1965 and 1975, GNP in constant 1972 United States dollars more than doubled in 10 countries and increased by 50 to 99 per cent in an addi-

[14] Between 1965 and 1970, for example, GNP per head in terms of constant 1972 United States dollars was estimated to have increased by nearly 50 per cent, from $1,346 to $1,958. These figures are based on World Bank estimates of *per capita* GNP given in *World Bank Atlas*, 1967 and 1972 editions, and converted to 1972 dollars by implicit price deflators given in United States of America, Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States, 1978* (Washington, D.C., 1979), p. 441.

[15] John Dutton, Jr., "Changes in Soviet mortality patterns, 1959-77", *Population and Development Review*, vol. 5, No. 2 (June 1979), pp. 278-281.

[16] Samuel H. Preston, "The changing relation between mortality and level of economic development", *Population Studies*, vol. 29, No. 2 (July 1975), pp. 231-248.

Figure II.12. Relation between expectation of life at birth and *per capita* GNP, 1965 and 1975, more developed countries



Sources: Values for expectation of life at birth refer to years around 1965 and 1975, and are from official life tables. *Per capita* gross national product for 1965 and 1975 from *World Bank Atlas; Population,* Per Capita *Product and Growth Rates,* 1967 and 1977 editions, respectively (Washington, D.C., World Bank), converted to 1972 dollars by implicit price deflators given in United States of America, Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States, 1978* (Washington, D.C., 1979), p. 441.

tional five countries. The average increase in life expectancy for these countries in the decade was only 0.9 year for males and 1.8 years for females. The trends described here suggest that a technological ceiling on achievable longevity gains is now operating in low-mortality regions.[17]

E. Social and economic differentials in mortality

1. *Introduction*

(a) *Background*

In this section some major social and economic factors are considered that have been found to be related differentially to mortality at various stages of life, beginning in the perinatal period and extending through adulthood. From the first systematic investigation of mortality conducted by

[17] *Concise Report on the World Population Situation in 1977: New Beginnings and Uncertain Ends* (United Nations publication, Sales No. E.78.XIII.9), p. 18.

Graunt upon the London Bills of Mortality,[18] the work in France by Moheau in the eighteenth century,[19] and the extensive efforts of Farr [20] in England in the nineteenth century, the examination of social and economic differentials in mortality has come to occupy an important role in demographic, medical, statistical and epidemiological studies. In recent years international organizations have displayed a strong interest in differential mortality, as evidenced, for example, by the 1979 Meeting on Socio-Economic Determinants and Consequences of Mortality co-sponsored by the United Nations, the World Health Organization and a number of other international agencies and organizations.[21]

In the mid 1960s several comprehensive reviews of the major social and economic features relating to mortality were made by Antonovsky[22] and Benjamin.[23] Only recently Antonovsky and Bernstein[24] reviewed the differentials in infant mortality by social class or economic groupings. In these reviews and in most research reports, large and persistent mortality differentials are found between population groups which differ from each other in certain characteristics such as occupation, education, marital status and social class. Less conclusive results are found for rural/urban distinction.[25]

The long-standing interest in studying differential mortality lies in the fact that significant differences in risk exist and, indeed, persist among certain segments of populations. The identification of factors responsible for so-called "excess mortality" in these population groups is seen as a necessary first step leading to programmes of research, prevention and control. Moreover, an extensive knowledge of mortality differentials can lead to a fuller understanding of international variations in mortality, as well as improved strategies for forecasting future mortality trends.

Yet there are some serious obstacles in attempting to study social and economic differentials in mortality on a comparative basis. A few of these problems can be mentioned. *One*, there is a paucity of suitable data on such factors available cross-nationally, in spite of the fact that death statistics are routinely collected, processed and tabulated in the more developed countries. For example, although data on the number of deaths by occupation and age were published in the United Nations *Demographic Yearbook* until the late 1960s, the required data on rates that are needed for comparative analysis were available for only a handful of countries.[26] Although the most recent United Nations *Principles and Recommendations for a Vital Statistics System* still recommends tabulations of deaths cross-classified by age and type of occupation (as well as literacy status or educational attainment) for each sex,[27] these are usually not prepared nor are rates calculated. *Two*, the data, when available, have serious limitations due to lack of standardized definitions employed in classifying social and economic variables and the different types of studies from which data have been derived. *Three*, a more general issue for any study of mortality differentials, especially of social and economic characteristics, concerns the complex interplay of causal factors that may be implicated in differential mortality. This has led some experts to decry the use of official statistics or even studies based in part on such statistics for examining differential mortality and to urge instead more intensive, *ad hoc* studies on limited population groups or on specified topics of social or epidemiological concern.

It is with such considerations that this review of mortality differentials has been prepared to include the social and economic factors that are most commonly examined in relation to such differentials: occupational classifications, social class and urban/rural distinctions. Because the relevance of these factors to mortality differs considerably with age, separate treatment is given to (1) adult mortality, mainly from 15 to 64 years of age, and (2) perinatal and infant mortality. It should be noted that, in selecting these age categories, the majority of deaths that occur in the more developed countries are thereby excluded. For, among these countries over two thirds of the deaths that normally occur each year are to persons 65 years of age and over. None the less, the factors associated with mortality in early life or in the prime, economically active ages are also related to mortality risk at the older ages.

In considering the ways in which social and economic factors affect the risk of dying, it should be recognized that these factors are seldom directly related to specific disease states or events leading to death. An exception, of course, would be accidental deaths that occur in the course of the persons practising their particular occupations. Instead, the factors, tend to be related in complex ways to certain diseases and, in addition, often intervene between ill-health and medical care that might avert death. Thus, the social and economic factors may serve as surrogate measures of a range of cultural, behavioural, medical and environmental factors to which individuals are exposed, and which can influence the risk of dying. For example, socio-economic status may be related to diet; stress; physical exertion; acquired habits, such as alcohol consumption or smoking; personal hygiene; housing conditions; environmental pollution; as well as knowledge, access to and utilization of health care and medical services. Interestingly, certain

[18] John Graunt, *Natural and Political Observations Made upon the Bills of Mortality*, Walter F. Willcox, ed. (Baltimore, Johns Hopkins Press, 1939; originally published in 1662).

[19] See Jean Daric, "Mortalité, profession et situation sociale", *Population*, vol. 4, No. 4 (octobre-décembre 1949), pp. 671-694.

[20] William Farr, *Vital Statistics: A Memorial Volume of Selections from the Reports and Writings of William Farr*, M. Susser and A. Adelstein, eds. (Metuchen, N.J., Scarecrow Press, 1975).

[21] See "Report of the Meeting on Socio-Economic Determinants and Consequences of Mortality, Mexico City, 19-25 June 1979", *Population Bulletin of the United Nations, No. 14—1980* (New York, 1980).

[22] Aaron Antonovsky, "Social class, life expectancy and overall mortality", *Milbank Memorial Fund Quarterly*, vol. 45, No. 2 (April 1967), pp. 31-73.

[23] Bernard Benjamin, *Social and Economic Factors Affecting Mortality*, Confluence surveys of research in the social sciences, vol. 5 (The Hague, Mouton, 1965).

[24] Aaron Antonovsky and Judith Bernstein, "Social class and infant mortality", *Social Science and Medicine*, vol. 11 (1977), pp. 453-470.

[25] See, for example, Nora Federici and others, "Urban/rural differences in mortality, 1950-1970", *World Health Statistics Report*, vol. 29, No. 5-6 (1976), pp. 249-378.

[26] See *Demographic Yearbook, 1967* (United Nations publication, Sales No. E/F.68.XIII.1), tables 27 and 28.

[27] United Nations publication, Sales No. E.73XVII.9, p. 71.

mortality measures (e.g., infant mortality rates) are themselves often used as indices of social and economic development.

The socio-economic factors that affect mortality do so in the context of a set of prior conditions which include genetic inheritance, foetal influences, cumulative environmental exposure and health states throughout life. Moreover, with increasing age, the maturation process gives way to the degenerative process that fundamentally influences the resistance of the human organism to disease, disability and inevitable death. As these biological processes unfold, the social and economic characteristics may also undergo changes (through changes in income, residence, marital status etc.), so that there is an ongoing interaction between sets of changing factors.

(b) *Source of data*

The primary sources of information for examining differential mortality is the death record itself, which contains data on the age, sex, marital status, occupation and place of residence of the deceased. In addition, medical information on the causes and conditions contributing to the death is also recorded. In the case of a stillbirth, additional information about the mother (e.g., occupation, place of residence etc.) and the condition of the foetus usually are obtained. From the data on place of residence of the deceased (or the parents), information about the social and economic conditions of life can be inferred. A number of different strategies involving linking records (such as death and birth records for infant deaths, and census and death records) and follow-back surveys can add considerably more information about the decedent and the conditions related to the death. These are reviewed in the following subsection and, as relevant, in the course of the discussion.

It is in the very nature of the death certificate itself that problems occur in terms of reliability. The vital information about the deceased can be provided only by next of kin or another surrogate, who may be ignorant of the facts or disinclined to provide accurate information. Moreover, practices regarding the party responsible for completing this portion of the certificate and the actual type of data required differ greatly between countries. The procedures followed in completing the medical information on the certificate also vary, although the codes used for identifying medical entities usually follow the World Health Organization's International Classification of Diseases. Additional problems result when these practices change over time, as for example in the case of the revisions of ICD that are normally undertaken every 10 years. Finally, it should be noted that the completion of the certificate is only one source of inconsistency; others arise when variations in coding, processing and tabulation are considered. For example, in the United States, the usual occupation of the decendent is normally required in completing the certificate, but for some time this has not been coded on a national basis.

The study of differentials in the relative risk of dying requires the calculation of rates in which the number of deaths that occur is related to the population exposed to the risk of death. Although some important information can be ascertained from consideration only of the numerators of such rates (so-called numerator analysis), especially in the provision of services designed to deal with matters related to deaths, for comparative purposes a relative measure is needed. This is particularly so when the population exposed to risk is changeable, as is the case with most of the social and economic characteristics. Unfortunately, the provision of appropriate figures on base populations—the necessary denominator data—remains a serious problem in such studies. It is primarily for this reason that a variety of alternative approaches have been developed for the study of these factors. Before discussing these approaches, it should be noted that this problem is not as serious in studies of perinatal or infant mortality, in which the number of live births to which the deaths relate are used as a denominator. But even here, strict comparability between the numerator and denominator is frequently lacking.

(c) *Types of investigations*

A common type of investigation dealing with social and economic differentials is that on the aggregate level in which summary mortality data for specified geographical areas are related to relevant data for those areas from census enumerations or other official sources. Within countries these data can be for geographical subunits (e.g., regions, provinces, states, city census tracts), or combinations or parts of such areas (e.g., urban and rural localities, urban localities of different size, metropolitan and non-metropolitan areas, and derived social or economic areas). These ecological studies often involve mapping procedures or multivariate statistical methods. usually including regression analysis. The relevant characteristics of the geographical areas are examined in the context of the aggregate deaths that have occurred in these territories. Numerous examples of such research exist for different types of areas—regions,[28] urban and rural areas,[29] city districts.[30] Many investigations have also been made with countries as the units of analysis, as in the analysis of mortality indicators and gross national product in section D above. Often a number of social and economic indicators are considered, and such analyses may be set within the context of time-series studies, in which social and economic development is examined with respect to mortality decline.[31] A main drawback of any aggregate study is that inferences must be made on the basis of grouped properties of the areal units, thus introducing the possibility of so-called "ecological fallacies".

A second major type of investigation makes use of data for deceased individuals (in contrast to aggregate data) that

[28] N. Federici, "The impact of socio-economic factors on mortality; an attempt of analysis on some Italian data", in International Union for the Scientific Study of Population, *International Population Conference, London, 1969*, vol. II (Liège, 1971), pp. 950-972.

[29] K. G. Basavarajappa and J. Lindsay, *Mortality Differences in Canada, 1960-1962 and 1970-1972*, Statistics Canada (Ottawa, 1976).

[30] E. G. Stockwell, "Socioeconomic status and mortality in the United States", United States Public Health Service, *Public Health Reports*, vol. 76 (1961), pp. 1081-1086; G. C. Myers and K. G. Manton, "Methodological explorations of urban ecological and mortality structures", *International Journal of Epidemiology*, parts I and II (1977).

[31] See, for example, Eui Hang Shin, "Economic and social correlates of infant mortality: a cross-sectional and longitudinal analysis of 63 selected countries", *Social Biology*, vol. 22, No. 4 (Winter 1977), pp. 315-325.

are available directly from the death certificate itself or are obtained from other sources of information about the deceased person. Although this approach is usually referred to as an individual level of analysis, it invariably entails calculation of summary rates that require additional information about populations theoretically exposed to risk. It is useful to distinguish between several different types of studies classifiable mainly on the basis of how information about the deceased is obtained. These are: (1) the classical occupational mortality study; (2) follow-back studies; (3) matched (linked) record studies; (4) census and special surveys; (5) prospective or cohort studies; and (6) mixed approaches.

The prototypical investigations of occupational mortality conducted at periodic intervals by the Registrar General of England and Wales since 1851 are the most widely known approach using death certificate information.[32] Deaths by occupation, age and sex are related to the appropriate populations determined from census enumerations. Rates are thus calculated for social and economic subcategories of the population, and mortality differentials assessed. A requirement for this type of study is that numerator and denominator data be available for roughly corresponding time periods, usually a period of several years for mortality data and a central point in the period for census data. The use of several years of death data increases the number of events, which may be very limited for certain ages and subcategories of the population. It also allows for perturbations in the number of deaths that may occur due to epidemics of one type or another (e.g., influenza).

In the next three approaches, the death certificate again provides a starting point, but additional retrospective information about the decedent is obtained from other sources. In the first case—the follow-back study—information is solicited from a surviving spouse (if one exists) or relatives. The United States National Mortality Survey is an example of this approach.[33] In the second type of study, further data regarding the decedent and/or his family are obtained from other records, such as prior census returns. Examples are the 1960 United States Matched Records Study of Mortality[34] and the Norwegian Occupational Mortality Study.[35] A census enumeration or special survey can also be used to obtain, in part, general retrospective data on deaths that may have occurred over a fixed interval of time among members of the household or a delineated set of relatives of household members. A particular type of survey of this genre has come to be termed multiplicity surveys, in which deaths to a specific network of related persons are recorded.

A prospective study involves a set of individuals identified from a census, community survey, membership in some organization (e.g., health insurance programme), persons exposed to certain hazards. They are followed subsequently for a specified length of time and deaths to the cohort are recorded. The French study conducted by the Institut national de la statistique et des études économiques (INSEE) is an investigation of this type.[36] The on-going Longitudinal Study in England has been designed in part to provide a basis for similar studies. It may be noted that this study utilizes linked records in a prospective manner.

Finally, there have been a number of major investigations in which a variety of these methodological procedures have been utilized in concert. The Pan American Health Organization (PAHO) Inter-American Investigation of Mortality made use of physicians' records as well as a survey of families of the deceased.[37] In the United States 1960 Matched Record Study both follow-back surveys and matching of the death record with census records were used.[38] In other investigations, the aggregate socio-economic characteristics of the decedent's place of residence (often an urban subarea such as a census tract) is assigned to the individual case. In most situations, the same average aggregate characteristic is assigned, but more sophisticated procedures based on other known characteristics or on a probability distribution are possible. It should be noted that this research approach may differ significantly from the more common procedure of correlating the average values of mortality for areas with average values for selected socio-economic characteristics for the areas.

2. *Findings: adult mortality*

(a) *Occupation*

Table II.14 contains mortality data for males by major occupational categories for those countries in which fairly standard classifications are reported. The procedure followed in most cases is that developed and refined by the Registrar General for England and Wales (United Kingdom). It should be noted that the data reported cover a wide span of years. Ratios of age-specific death rates have been calculated to provide a basis of comparison of each occupational category with the death rates for all occupational categories combined. Where available, summary age-standardized measures (standardized mortality ratio or the comparative mortality figure) are given for each occupation.

It is clear that for every country persons in the non-manual occupations experience lower mortality than persons in manual occupations for the age range covered. This is especially true of the professional and managerial occupations. The category of farmers, or of farmers and

[32] United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality, 1970-72*, Series DS, No. 1 (London, HMSO, 1978).

[33] Mary Grace Kovar and James A. Weed, "Considerations in using individual socioeconomic characteristics in the analysis of mortality", in *Proceedings of the Social Statistics Section* [of the American Statistical Association], *1977, part I* (Washington, D.C., American Statistical Association, 1978), pp. 1-10.

[34] E. M. Kitagawa and P. M. Hauser, *Differential Mortality in the United States: A Study of Socioeconomic Epidemiology* (Cambridge, Mass., Harvard University Press, 1973).

[35] Norway, Statistisk sentralbyrå, *Yrke og Dødelighet, 1970-1973*, Statistiske Analyser, Nr. 21 (Oslo, 1976).

[36] G. Calot and M. Febvay, "La Mortalité différentielle suivant le milieu social", *Etudes et conjoncture*, vol. 11 (1965), pp. 75-159; G. Desplanques, "La Mortalité des adultes suivant le milieu social, 1955-1971", Collections de l'INSEE, D-44 (April 1976).

[37] Ruth R. Puffer and Carlos V. Serrano, *Patterns of Mortality in Childhood:* Report of the Inter-American Investigation of Mortality in Childhood, Scientific Publication No. 262 (Washington, D.C., Pan American Health Organization, 1973).

[38] E. M. Kitagawa and P. M. Hauser, *Differential Mortality in the United States: A Study of Socioeconomic Epidemiology* (Cambridge, Mass., Harvard University Press, 1973)

TABLE II.14. MORTALITY RATIOS OF RATES BY OCCUPATION CATEGORY,[a] MALES 25-64 YEARS OF AGE, SELECTED MORE DEVELOPED COUNTRIES

(Age-specific death rates per 100,000 population in parentheses)

Occupational category	*Country and age-groups*				
	Australia, 1971[b]				
	25-34	*35-44*	*45-54*	*55-64*	*SMR*[c] *15-64*
Professional	70	70	75	90	88
Managerial	61	74	79	90	92
Clerical	71	84	103	96	100
Sales	71	84	91	96	99
Service	105	108	120	107	121
Transport and communications	141	132	122	121	137
Craftsmen and labourers	116	112	108	104	119
Farmers and fishermen	104	92	88	86	98
Miners	182	134	107	163	162
TOTAL	100	100	100	100	100
Death rates	(147)	(295)	(809)	(2 465)	
	England and Wales, 1971[d]				
	25-34	*35-44*	*45-54*	*55-64*	*SMR*[c] *15-64*
Professional	71	73	71	77	75
Managerial	64	65	72	75	73
Clerical	95	108	110	96	99
Sales	87	85	91	91	90
Service	110	116	119	116	116
Skilled	99	106	109	118	113
Semi-skilled	120	119	115	113	115
Unskilled	213	177	150	129	139
Farmers and fishermen	109	84	84	92	91
Miners	89	118	130	152	144
TOTAL	100	100	100	100	100
Death rates	(100)	(231)	(720)	(2 056)	
	France, 1955[e]				
	25-34	*35-44*	*45-54*		
Professional	82	68	56		
Managerial	64	54	55		
Clerical	86	93	93		
Shopkeepers	123	98	102		
Craftsmen	77	80	75		
Operatives	100	100	97		
Labourers	145	150	125		
Farmers	73	80	72		
Miners	132	130	109		
Fishermen	177	180	123		
TOTAL	100	100	100		
Death rates	(220)	(440)	(1 040)		
	Japan, 1955[e]				
	25-34	*35-44*	*45-54*	*55-64*	
Professional	68	77	79	94	
Managerial	51	52	57	58	
Clerical	86	97	102	95	
Sales	83	94	99	91	
Service	68	75	79	80	
Transport	97	92	88	98	
Craftsmen and labourers	101	101	103	103	
Farmers and fishermen	113	112	107	106	
Miners	205	178	149	157	
TOTAL	100	100	100	100	
Death rates	(232)	(346)	(780)	(1 798)	

TABLE II.14 (*continued*)

(Age-specific death rates per 100,000 population in parentheses)

Occupational category	*Country and age-groups*				
	New Zealand, 1961[f]				
	25-34	*35-44*	*45-54*	*55-64*	*SMR*[c] *15-64*
Professional	66	66	79	106	89
Managerial	86	78	89	120	102
Clerical	92	87	105	111	105
Sales	51	77	81	98	86
Service	131	147	128	112	117
Transport and communications	132	130	135	172	150
Craftsmen and labourers	100	108	104	115	109
Farmers and fishermen	104	83	83	119	103
Miners	135	70	138	126	123
TOTAL	100	100	100	100	100
Death rates	(133)	(243)	(682)	(1 903)	
	Norway, 1970-1973[g]				
	20-34	*35-44*	*45-54*	*55-64*	*CMF*[h] *(20-69)*
Professional and managerial	67	81	94	107	101
Teachers	50	45	70	78	75
Technical	55	58	86	87	86
Clerical	71	70	98	107	106
Sales	75	101	123	109	111
Service	93	94	102	111	107
Transport	93	105	102	111	110
Metalworkers	101	103	93	113	105
Woodworkers	82	90	88	86	86
Farmers	89	76	73	79	94
Farm workers	144	115	91	74	87
Forest workers	—	—	97	61	79
Fishermen	200	159	137	100	121
Mining	—	—	124	115	133
TOTAL	100	100	100	100	100
Death rates	(110)	(228)	(560)	(1 299)	
	United States, 1950[i]				
	25-29	*30-34*	*35-44*	*45-54*	*SMR*[c] *55-64*	*20-64*
Professional	62	66	74	89	96	88
Managerial	69	66	77	87	93	89
Clerical	68	66	77	88	89	84
Sales	57	71	84	100	106	96
Service	113	128	136	134	117	118
Craftsmen	86	87	93	94	103	99
Operatives	98	97	99	97	95	96
Labourers	211	229	210	173	143	163
Farmers	148	103	100	91	91	96
TOTAL	100	100	100	100	100	
Death rates	(194)	(239)	(437)	(1 094)	(2 045)	

— Less than 20 deaths.

[a] Ratios of the age-specific death rates for each occupational category to the age-specific death rates for all occupational categories combined.

[b] G. L. Dasvarma, "Causes of death among males of various occupations", in N. D. McGlashan, ed., *Studies in Australian Mortality*, University of Tasmania Environmental Studies, Occasional Paper No. 4 (1977), pp. 63-71.

[c] The standardized mortality ratio (SMR) is the ratio of observed deaths in a given occupational category to the number of deaths to be expected if the age-specific death rates for all occupations together prevailed in that occupation. SMRs for married females are generally calculated on the basis of husband's occupation.

[d] United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality, 1970-72*, Series DS, No. 1 (London, HMSO, 1978), tables 4.5 and 5C.

TABLE II.14 (*continued*)

[e] *Demographic Yearbook, 1967* (United Nations publication, Sales No. E/F.68.XIII.1), table 28.

[f] J. F. Copplestone, *Occupational Mortality Among Male Population other than Maori, 20 to 64*, New Zealand, Department of Health, National Health Statistics Centre, Special Report No. 28 (Wellington, Government Printer, 1967), table 3-11.

[g] Norway, Statistisk sentralbyrå, *Yrke og Dødelighet, 1970-1973*, Statistiske Analyser, Nr. 21 (Oslo, 1976).

[h] The comparative mortality figure (CMF) is the ratio of the direct standardized death rate, in which the age-specific death rates in a given occupational category have been applied to the population in the standard, to the crude death rate for the standard population.

[i] Lillian Guralnick, "Mortality by occupation and industry among men 20 to 64 years of age: United States, 1950", United States Public Health Service, National Vital Statistics Division, *Vital Statistics, Special Reports*, vol. 53, No. 2 (September 1962), table 2.

fishermen when they are combined, generally has below average mortality. Miners, in contrast, usually have very high over-all mortality, which can be attributed to direct job hazards. Service workers usually have higher levels than other non-manual workers, as the former category can consist of a broad range of different occupations, some of which may be menial. Death rates for sales workers are close to the over-all levels. Among manual workers, labourers are invariably at higher risk than any of the other groups, although transport workers are also at high risk in several countries.

With increasing age there is a steady convergence of the rates towards the over-all level. This is true of professionals and managers, who at younger ages have the lowest mortality, as well as manual workers, who have the highest reported rates. None the less, differences, although clearly reduced with increased age, still remain even within the oldest age category, 55-64 years. The absolute differences between rates in the older age intervals are considerably larger than in the younger ages, of course, because the rates themselves are larger.

The explanation for the relative convergence in the rates between occupational categories may rest on several factors. One, the numbers of persons in the higher non-manual occupations at the youngest ages are usually very small; therefore, the rates themselves may show considerable statistical instability. This of course would not explain the convergence with age for the manual groups. Two, selective mortality of the manual workers may leave the fittest surviving into the older ages. The converse would be true of non-manual workers. Three, the most plausible explanation would seem to lie in the causes of death that predominate at different ages—from external causes (such as accidents) at the younger ages, which affect manual workers more, to degenerative diseases at the older ages, which affect persons somewhat more equitably. A final explanation could be attributed to cohort differences themselves. Although Antonovsky reported that mortality differences between social classes were more prominent among the middle-aged[39]—clearly not true of these data—time series and longitudinal data of the French type appear not to substantiate this conclusion. In the latter case, the mortality rates by occupation are narrowed with age, but still persist, even at age 75.[40]

In table II.15 Scottish data for deaths in the period 1959-1963 can be presented by standardized mortality ratios for two broad age intervals only. Table II.16 gives the most recent information from the French longitudinal study begun in 1954. These data relate to the experience of the cohort at ages 35, 55 and 75. The same conclusions can be reached from data for these two countries, although they are presented in a somewhat different manner. There is clear evidence of differentials between workers in manual and non-manual occupations. The pattern with increasing age is a convergence towards the over-all levels. Finally, we can note the following ratios of death rates for white males 25 to 64 years of age in the United States for 1960:[41]

Professional	80
Managerial	91
Clerical and sales	102
Service	137
Craftsmen	97
Operatives	107
Labourers	119
Farm workers	76
TOTAL	100

These data conform to patterns already noted, with manual and service workers showing higher ratios than all the other occupational categories.

The causes of death that account for these differentials in broad occupational categories can be examined for several countries. In-depth studies of particular diseases that may be associated with specific occupations are, of course, one of the features of occupational mortality investigations, but even general data of the type shown here can provide interesting information on what underlies occupational differentials. Tables II.17 to II.22 provide data for studies from Australia, England and Wales, Finland, France, Japan and New Zealand. Comparisons between the countries are difficult to make due to the different cause-of-death classifications that can be reported on and the fact

[39] Aaron Antonovsky, "Social class, life expectancy and overall mortality", *Milbank Memorial Fund Quarterly*, vol. 45, No. 2 (April 1967), pp. 31-73.

[40] "Mortalité masculine en France selon la condition sociale", *Population*, vol. 29, No. 1 (1974).

[41] E. M. Kitagawa and P. M. Hauser, *Differential Mortality in the United States: A Study of Socioeconomic Epidemiology* (Cambridge, Mass., Harvard University Press, 1973), table 3.2.

TABLE II.15. STANDARDIZED MORTALITY RATIO[a] BY OCCUPATIONAL CATEGORY, MALES 20-64 YEARS OF AGE, SCOTLAND, 1959-1963

Occupational category	Age-group 20-44	45-64	20-64
Professional and technical	72	81	79
Managerial	48	67	65
Clerical	85	92	91
Sales	91	98	97
Service	108	108	108
Skilled	87	99	97
Semi-skilled	106	98	99
Labourers	178	137	142
Farmers	64	56	57
Miners	115	110	111
Fishermen	225	121	133

Source: Scotland, Registrar General, *Occupational Mortality, 1959-1963* (Edinburgh, 1970), tables 3 and 5.

[a] For a definition of standardized mortality ratio, see table II.14, footnote *c*.

TABLE II.16. DEATH RATES BY OCCUPATIONAL CATEGORY, MALES AGED 35, 55 AND 75 YEARS, FRANCE
(Deaths per 1,000 population)

Occupational category	Age 35	55	75
Professional and managerial	1.0	8.2	64
Teachers	1.0	7.9	60
Clergy (Catholic)	1.2	9.3	70
Technicians	1.6	10.1	65
Lower-salaried staff (public)	1.2	9.4	73
Lower-salaried staff (private)	1.7	10.9	70
Clerical (public)	2.0	12.4	77
Clerical (private)	2.2	12.4	70
Sales	2.2	12.4	71
Foremen	1.7	11.5	79
Skilled (public)	1.8	11.4	71
Skilled (private)	2.4	15.2	94
Semi-skilled (public)	2.5	14.2	80
Semi-skilled (private)	2.8	16.1	91
Labourers	4.1	19.4	91
Farmers	1.8	12.1	82
Farm workers	2.8	16.1	93
TOTAL	2.8	14.8	80

Source: "Mortalité masculine en France selon la condition sociale", *Population*, vol. 29, No. 1 (1974), table 1.

that the over-all standardized mortality ratios by cause (which equal 100) are in some cases calculated on the basis of rates for all males at these ages, thus including persons not in the labour force.

Deaths from malignant neoplasms appear to be differentially distributed in all these countries, with manual workers generally at much higher risk than those in other occupations. Mortality from diseases of the circulatory system, which include the various cardiovascular diseases, is also greater among the manual occupations, although in Australia deaths from cerebrovascular diseases are more equitably distributed. The greatest differentials, however, are for accidents. As might be expected, miners, farmers and fishermen are at much higher risk from accidental deaths. Suicidal deaths, which are shown separately for France and Japan, interestingly are very high for labourers and farm workers in France, and for farmers and miners in Japan, though this may reflect differential reporting by occupational category.

The general conclusion to be reached from these data is that the relative mortality risks by occupational categories differ consistently for each of the major cause-of-death categories reported here. Manual workers are clearly at greater risk than non-manual workers in nearly every case, whether the causes are chronic diseases or accidents.

A somewhat different approach to cause-specific mortality differentials by occupation has been taken in the research by Damiani and Massé and their associates[42] in which they relate 1968-1970 deaths among persons 45-64 years of age in *départements* of France to the proportion of males in different occupations. Using a variety of statistical procedures, their results tend to confirm strongly the findings of the longitudinal study that have been presented in table II.20.

(b) *Social class*

The grouping of occupations into a more limited set of hierarchically arranged (and usually numbered or lettered) social classes for examining relative mortality began with the analysis of infant mortality data for 1911 in England and Wales.[43] Since then these social class groupings have been employed in England, Wales and Scotland in analyses of census data and a wide range of other data, including, of course, mortality levels. Numerous changes have occurred in the classification through reassignments of occupations and other criteria for allocation. In the 1971 classification, class III was subdivided into manual and non-manual categories. None the less, the classification does provide a standardized procedure that is completely understandable at any particular point of time and has even proved to be a relevant index for examining trends.

The basic data on social class examined in the present analysis come from the classifications used in the various research efforts. Caution should be used in making cross-national comparisons, as there are major differences in classifications between countries. These will be noted in the discussion. None the less, such indices do provide a useful means of examining mortality variations in relation to social class categories based mainly on occupations. It is often asserted that the social class variations reflect factors that are intrinsic to occupations and, therefore, provide a truer test of social conditions among persons in these groups.

[42] P. Damiani, H. Massé and M. Stupfel, "Mortalité par cause et facteurs socio-démographiques", *Journal de la Société de statistique de Paris*, vol. 119, No. 2 (1978), pp. 1-9; H. Massé, "Liaison entre la mortalité par cause et la catégorie socio-professionelle", *Journal de la Société de statistique de Paris*, vol. 118 (1977), pp. 1-5.

[43] R. Leete and J. Fox, "Registrar General's social classes: origins and uses", *Population Trends*, No. 8 (1977), pp. 1-7.

TABLE II.17. STANDARDIZED MORTALITY RATIOS[a] BY OCCUPATIONAL CATEGORY AND CAUSE OF DEATH, MALES 15-64 YEARS OF AGE, AUSTRALIA, 1970-1972

Occupational category	*B19*	*B28*	*B30*	*B46*	*BE47*	*BE48*	*All causes*
Professional	98	108	102	83	66	50	88
Managerial	104	108	106	69	78	59	92
Clerical	108	123	121	89	69	43	100
Sales	110	114	114	77	84	40	99
Service	120	120	132	114	107	91	121
Transport and communications	133	137	140	110	192	145	137
Craftsmen and labourers	121	115	114	114	133	131	119
Farmers and fishermen	93	96	84	88	120	144	98
Miners	130	148	127	162	166	482	162

Source: G. L. Dasvarma, "Causes of death among males of various occupations", in N. D. McGlashan, ed., *Studies in Australian Mortality*, University of Tasmania Environmental Studies, Occasional Paper No. 4 (1977), table 3.1.

NOTE: The cause-of-death categories are as follows: B19, malignant neoplasms; B28, ischaemic heart disease; B30, cerebrovascular disease; B46, arteriosclerosis; BE47, motor vehicle accidents; BE48, all other accidents.

[a] For a definition of standardized mortality ratio, see table II.14, footnote *c*.

TABLE II.18. STANDARDIZED MORTALITY RATIOS[a] BY OCCUPATIONAL CATEGORY AND CAUSE OF DEATH, MALES 15-64 YEARS OF AGE, ENGLAND AND WALES, 1970-1972

Occupational category	*140-209*	*390-458*	*460-519*	*520-577*	*800-999*	*All causes*
Professional	72	83	41	75	75	75
Managerial	74	83	33	77	70	73
Clerical	87	113	81	96	74	99
Sales	89	96	72	91	87	90
Service	114	116	117	154	120	116
Skilled	120	112	120	100	103	113
Semi-skilled	118	112	123	107	118	115
Unskilled	140	119	190	153	203	139
Farmers and fishermen	92	82	90	92	135	91
Miners	120	137	244	136	150	144

Source: United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality 1970-72*, Series DS, No. 1 (London, HMSO, 1978), table 5D and microfiche table 1.

NOTE: The cause-of-death categories are as follows: 140-209, malignant neoplasms; 390-458, diseases of circulatory system; 460-519, diseases of respiratory system; 520-577, diseases of digestive system; 800-999, accidents, poisonings and violence.

[a] For a definition of standardized mortality ratio, see table II.14, footnote *c*.

TABLE II.19. COMPARATIVE MORTALITY FIGURES[a] BY OCCUPATIONAL CATEGORY AND CAUSE OF DEATH, MALES 35-64 YEARS OF AGE, FINLAND, 1971-1975

Occupational category	*Cancer*	*Circulatory diseases*	*Respiratory diseases*	*Accidents and violence*	*All causes*
Professional	71	85	52	55	76
Managerial and clerical	89	90	58	64	84
Sales	103	114	96	81	108
Service	112	105	108	99	107
Transport and communications	103	104	80	90	99
Manufacturing	113	104	117	119	109
Farmers and fishermen	92	99	101	106	97
Miners	152	120	. . .	137	132

Source: Finland, Central Statistical Office, *Statistical Report*, No. VÄ 1979:3 (Helsinki, 1979), table 1.

[a] For a definition of comparative mortality figure, see table II.14, footnote *h*.

TABLE II.20. MORTALITY RATIOS OF RATES BY OCCUPATIONAL CATEGORY AND CAUSE OF DEATH, MALES 35-75 YEARS OF AGE, FRANCE, 1955 TO 1971

Occupational category	*Tuber-culosis*	*Malignant neoplasms*	*Coronary and other heart diseases*	*Alcoholism and cirrhosis of liver*	*Accidents*	*Suicides*	*All causes*
Professional and managerial	19	56	83	20	47	29	50
Teachers	27	49	81	26	33	40	49
Clergy	20	55	87	19	53	11	57
Technicians	37	81	101	30	57	47	65
Lower-salaried staff	41	72	99	38	50	51	64
Clerical	53	96	91	78	73	58	81
Sales	54	88	99	86	68	71	82
Skilled	73	103	85	83	92	76	87
Semi-skilled	78	114	90	107	129	102	101
Labourers	125	116	90	171	204	176	135
Farmers	59	75	74	74	76	140	77
Farm workers	76	89	74	114	183	198	106

Source: "Mortalité masculine en France selon la condition sociale", *Population*, vol. 29, No. 1 (1974), table IV.

TABLE II.21. MORTALITY RATIOS OF RATES BY OCCUPATIONAL CATEGORY AND CAUSE OF DEATH, MALE WORKERS 15 YEARS OF AGE AND OVER, JAPAN, 1970

Occupational category	*Tuber-culosis (all forms)*	*Malignant neoplasms*	*Heart disease*	*Cerebro-vascular disease*	*Cirrhosis of liver*	*Accidents*	*Suicides*	*All causes*
Professional and technical	102	95	104	82	81	66	66	88
Managers and officials	45	78	65	47	72	31	62	58
Clerical	120	115	98	71	105	64	86	90
Sales	151	123	123	105	155	82	98	111
Service workers	161	101	111	100	153	84	111	104
Protective service workers	57	67	66	48	73	61	53	57
Transport and communications	98	118	93	90	119	171	84	109
Craftsmen, production process workers and labourers	87	79	76	76	93	113	84	83
Farmers, lumbermen and fishermen	109	114	119	138	94	132	188	129
Miners and quarrymen	353	144	112	154	171	468	164	197

Source: Mortality ratios calculated from death rates given in Japan, Ministry of Health and Welfare, *Vital Statistics by Occupation and Industry for 1970, Special Report on Vital Statistics* (Tokyo, 1974), table 2-5, as cited in chapter 8 of a forthcoming country monograph for Japan to be published by the Economic and Social Commission for Asia and the Pacific.

TABLE II.22. STANDARDIZED MORTALITY RATIOS[a] BY OCCUPATIONAL CATEGORY AND CAUSE OF DEATH, MALES 20-64 YEARS OF AGE, NEW ZEALAND, 1959-1963 (EXCLUDING MAORIS)

Occupational category	*140-205*	*330-334 400-468*	*001-002 474-527*	*530-578*	*800-962*	*All other*	*All causes*
Professional	100	96	52	100	66	86	89
Managerial	101	114	75	123	70	90	102
Clerical	106	123	91	92	40	96	105
Sales	90	92	70	104	71	78	86
Service	105	115	130	175	115	145	117
Transport	155	147	157	126	187	117	150
Craftsmen and labourers	114	110	118	97	107	97	109
Farmers and fishermen	101	101	77	91	123	111	103
Miners	109	102	225	67	238	79	123

Source: J. F. Copplestone, *Occupational Mortality Among Male Population other than Maori, 20 to 64*, New Zealand, Department of Health, National Health Statistics Centre, Special Report No. 28 (Wellington, Government Printer, 1967), table 3.

NOTE: The cause-of-death categories are as follows: 140-205, malignant neoplasms; 330-334, 400-468, diseases of circulatory system; 001-002, 474-527, diseases of respiratory system; 530-578, diseases of digestive system; 800-962, accidents.

[a] For a definition of standardized mortality ratio, see table II.14, footnote *c*.

Table II.23 contains data on mortality ratios for males in five countries—Australia, England and Wales, Finland, Norway and the United States. In the case of England and Wales and the United States, it is clear that a fairly uniform gradient exists, indicating an inverse relationship of mortality with social class. Although no summary measure is presented for Australia, the distribution by age suggests that social grade I has somewhat higher mortality than II,

TABLE II.23. MORTALITY RATIOS OF RATES BY SOCIAL CLASSIFICATION,[a] MALES 25-64 YEARS OF AGE, SELECTED MORE DEVELOPED COUNTRIES

(Age-specific death rates per 100,000 population in parentheses)

Social classification	*Country and age-group*										
	Australia, 1971[b]										
	15-24		*25-34*		*35-44*		*45-54*		*55-65*		
I	86		72		78		81		94		
II	83		71		68		77		86		
III	83		85		87		91		92		
IV	164		164		150		138		124		
TOTAL	100		100		100		100		100		
Death rates	(199)		(147)		(295)		(809)		(2 465)		
	England and Wales, 1970-1972[c]										
	15-19	*20-24*	*25-29*	*30-34*	*35-39*	*40-44*	*45-49*	*50-54*	*55-59*	*60-64*	*SMR*[d]
I	106	67	65	69	72	73	69	73	83	82	77
II	94	81	74	74	74	73	78	79	80	88	81
III Non-manual	80	76	89	92	99	100	106	106	99	96	99
III Manual	97	85	87	92	94	100	100	101	108	115	106
IV	157	123	120	114	117	115	114	114	111	112	114
V	170	158	204	190	180	162	153	142	131	123	137
TOTAL	100	100	100	100	100	100	100	100	100	100	100
Death rates	(89)	(95)	(92)	(110)	(165)	(294)	(537)	(920)	(1 551)	(2 600)	
	Finland, 1970[e]										
	15-19	*20-24*	*25-29*	*30-34*	*35-39*	*40-44*	*45-49*	*50-54*	*55-59*	*60-64*	*CMF*[f]
I	234	118	52	48	62	59	63	78	83	90	78
II	163	95	81	87	82	89	96	104	98	102	95
III	97	91	96	87	88	94	93	95	97	102	92
IV	184	164	229	232	221	195	164	141	133	122	148
V (Farmers)	140	123	113	103	90	74	86	86	90	90	87
TOTAL	100	100	100	100	100	100	100	100	100	100	100
Death rates	(122)	(149)	(178)	(239)	(364)	(568)	(879)	(1 326)	(1 996)	(2 943)	
	Norway, 1970-73[g]										
	20-34		*35-44*		*45-54*		*55-64*		*CMF*[f] *20-69*		
A	56		64		87		96		91		
B	92		105		107		112		111		
C	97		98		100		104		102		
D	147		144		117		103		112		
E (Farming and forestry)	115		83		76		78		81		
TOTAL	100		100		100		100		100		
Death rates	(110)		(228)		(560)		(1 299)				
	United States, 1950[h]										
	20-24		*25-34*		*35-44*		*45-54*		*55-64*	*Total*[i]	
I	45		50		66		85		94	79	
II-IV	80		82		91		96		100	94	
V	130		145		148		130		109	131	
TOTAL	100		100		100		100		100	100	
Death rates	(200)		(220)		(440)		(1 090)		2 470)	(810)	

[a] Ratios of the age-specific death rates for each social class category to the age-specific death rates for all categories combined.

[b] G. L. Dasvarma, "Causes of death among males of various occupations", in N. D. McGlashan, ed., *Studies in Australian Mortality*, University of Tasmania Environmental Studies, Occasional Paper No. 4 (1977), pp. 63-71.

[c] United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality 1970-72*, Series DS, No. 1 (London, HMSO, 1978), table 4.3

[d] For a definition of standardized mortality ratio, see table II.14, footnote *c*.

[e] S. Näyhä, "Social group and mortality in Finland", *British Journal of Preventive and Social Medicine*, vol. 31 (1977), pp. 231-237.

[f] For a definition of comparative mortality figure, see table II.14, footnote *h*.

[g] Norway, Statistisk sentralbyrå, *Yrke og Dødelighet, 1970-1973*, Statistiske Analyser, Nr. 21 (Oslo, 1976), table 6.

[h] Lillian Guralnick, "Socioeconomic differences in mortality by cause of death: United States, 1950, and England and Wales, 1949-53", in International Union for the Scientific Study of Population, *International Population Conference, Ottawa, 1963* (Liège, 1964), pp. 287-313.

[i] Not standardized.

but a gradient is generally evident. In Finland and Norway, the classification has been constructed in such a way that farmers are assigned to special group V in Finland and social class E in Norway (in contrast to Australia and England and Wales), although it clearly was not the intent in either case to consider farmers, *per se*, as having a lower social status than unskilled labourers. It is not surprising, therefore, that mortality for these classes is lower than for the fourth lowest category. In both Norway and Finland the second group has higher over-all mortality than the

third group. The second groups in both cases consist of clerical, sales and service workers and are basically a combination of social classes II and III (non-manual) in England and Wales.

In examining patterns by age it appears that for intervals in which younger males aged 15-19 and 20-24 years are included, the pattern is U-shaped with class. By the age of 25 years, the patterns in all countries follow an inverse gradient. There is clearly a convergence by age with the highest social groupings showing increasing ratios and the lower social groups with the highest over-all mortality showing reduced ratios with age. As before, we can but speculate that these converging patterns may represent both the reduced importance of social distinctions for mortality of different causes as persons age and to an undetermined extent effects of selective attrition.

Muhsam[44] created a socio-economic status index which is peculiar to the Israeli context, for studying differential mortality. He assigns persons to strata on the basis of where they were born and the time of movement into the country. Although he assigns numbers to the strata, he acknowledges that the index is somewhat arbitrary; it nevertheless describes associated rankings by education and housing conditions rather well. When mortality is examined, the rank order is completely mixed, with European-born Israelis having higher rates than those born in the Near Eastern region. Native-born Israelis seem to have lower mortality risk for the most part. Explanations are suggested that bear on health care, diet and style of life, which may have a strong effect on coronary heart disease, the factor primarily responsible for the differential.

It was noted earlier that comparisons based on social class are felt to reveal factors relating to conditions of life that are external to occupational risk *per se*, although certainly including them as well. A more direct means of assessing these factors is to examine mortality levels for married females based on the occupation of the husband. Although implicit in this approach are assumptions regarding the employment of females, the nature of their employment vis-à-vis the husband, and the extent to which a married woman's conditions of life are related to the occupation of the husband, the approach is still of some merit.

Table II.24 provides data in the form of standardized mortality ratios for Scotland in 1959-1963 for women married and single, and males as well. The male ratios by social class are similar to the data presented earlier for other countries, especially England and Wales, except that only the lowest social class has mortality above the average. For married females, the pattern is somewhat different in that social class II shows much lower ratios than class I, and wives of class IV husbands have much higher ratios than the husbands. On the other hand, class V women actually have lower SMRs than males. In contrast, the mortality of single women shows a nearly perfect inverse gradient by class. For England and Wales, similar data are available for 1970-1972 (table II.25). The over-all standardized mortality ratios by social class for married women

[44] H. V. Muhsam, "Differential mortality in Israel by socioeconomic status", *Eugenics Quarterly*, vol. 12 (1965), pp. 227-232.

TABLE II.24. STANDARDIZED MORTALITY RATIOS[a] BY SOCIAL CLASS FOR MALES, MARRIED FEMALES (BY HUSBAND'S OCCUPATION) AND SINGLE FEMALES 20-64 YEARS OF AGE, SCOTLAND, 1959-1963.

	Males			*Married females*			*Single females*		
Social class	*20-44*	*45-64*	*20-64*	*20-44*	*45-64*	*20-64*	*20-44*	*45-64*	*20-64*
I	73	85	83	39	86	76	71	65	66
II	81	87	87	49	62	60	80	85	84
III	87	99	97	82	100	95	91	97	96
IV	106	98	99	107	171	155	110	105	105
V	178	137	142	157	118	123	178	145	149

Source: Scotland, Registrar General, *Occupational Mortality, 1959-1963* (Edinburgh, 1970), table 5.

[a] For a definition of standardized mortality ratio, see table II.14, footnote *c*.

TABLE II.25. MORTALITY RATIOS OF RATES BY SOCIAL CLASS FOR MARRIED WOMEN (BY HUSBAND'S OCCUPATION) AND SINGLE WOMEN 15-74 YEARS OF AGE, ENGLAND AND WALES, 1970-1972

	Married women							*Single women*						
Social class	*15-24*	*25-34*	*35-44*	*45-54*	*55-64*	*65-74*	*SMR[a] 15-64*	*15-24*	*25-34*	*35-44*	*45-54*	*55-64*	*65-74*	*SMR[a] 15-64*
I	76	79	82	83	83	99	82	132	96	76	115	117	141	110
II	82	81	80	83	91	103	87	105	63	69	69	83	112	79
III Non-manual	85	92	93	91	92	96	92	91	72	76	86	102	134	92
III Manual	97	100	108	111	120	140	115	80	83	81	92	126	200	108
IV	115	119	121	120	118	117	119	107	96	103	107	121	175	114
V	182	163	161	143	128	113	135	323	180	139	137	125	160	138
TOTAL	100	100	100	100	100	100		100	100	100	100	100	100	
Death rates per 100,000 population	(34)	(52)	(147)	(405)	(936)	(2 398)		(44)	(120)	(270)	(589)	(1 190)	(2 752)	

Source: United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality, 1970-72*, Series DS, No. 1 (London, HMSO, 1978), microfiche tables 2 and 3.

[a] For a definition of standardized mortality ratio, see table II.14, footnote *c*.

TABLE II.26. STANDARDIZED MORTALITY RATIOS[a] BY SOCIAL CLASS AND CAUSE OF DEATH, MALES 15-64 YEARS OF AGE, ENGLAND AND WALES, 1970-1972

Social class	*000-136*	*140-209*	*390-458*	*460-519*	*520-577*	*E800-999*	*All causes*
I	61	75	86	37	83	78	78
II	63	80	89	53	91	78	82
III Non-manual	88	91	110	80	97	83	99
III Manual	86	113	106	106	92	94	107
IV	126	116	110	123	109	122	113
V	197	131	118	187	152	197	135

Source: United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality, 1970-72*, Series DS, No. 1 (London, HMSO, 1978), table 4A.

NOTE: The cause-of-death categories are as follows: 000-136, infective and parasitic diseases; 140-209, malignant neoplasms; 390-458, diseases of circulatory system; 460-519, diseases of respiratory system; 520-577, diseases of digestive system; E800-999, accidents, poisonings and violence.

[a] For a definition of standardized mortality ratio, see table II.14, footnote *c*.

TABLE II.27. COMPARATIVE MORTALITY FIGURES[a] BY SOCIAL GROUP AND CAUSE OF DEATH, MALES 15-64 YEARS OF AGE, FINLAND, 1969-1972

Social group	*A49*	*A51*	*A59-60*	*A83*	*A85*	*A89-96*	*AE138*	*AE141*	*AE147*	*All causes*
I	204	53	126	84	86	(44)	79	62	62	78
II	96	89	114	110	105	62	106	88	74	95
III	58	124	80	91	93	96	82	113	80	92
IV	87	153	82	125	129	202	150	186	195	148
V	54	82	98	90	96	97	83	52	90	87

Source: S. Näyhä "Social group and mortality in Finland", *British Journal of Preventive and Social Medicine*, vol. 31 (1977), table 5.

NOTE: The cause-of-death categories are as follows: A49, cancer of intestine; A51, cancer of lung; A59-60, leukaemia; A83, ischaemic heart disease; A85, cerebrovascular disease; A89-96, respiratory diseases; AE138, motor vehicle accidents; AE141, accidental falls; AE147, suicide.

[a] For a definition of comparative mortality figures, see table II.14, foot-note *h*.

TABLE II.28. COMPARATIVE MORTALITY FIGURES[a] BY SOCIAL CLASS AND CAUSE OF DEATH, MALES 20-69 YEARS OF AGE, NORWAY, 1970-1973

Social class	*000-136*	*140-207*	*390-458*	*460-519*	*520-577*	*E800-999*	*All causes*
A	—	89	102	62	—	54	91
B	126	111	120	104	112	77	111
C	89	107	102	104	92	100	102
D	—	107	102	141	132	109	112
E	—	79	72	72	86	94	81

Source: Norway, Statistisk sentralbyrå, *Yrke og Dødelighet, 1970-1973*, Statistiske Analyser, Nr. 21 (Oslo, 1976), table VII.

NOTE: The cause-of-death categories are as follows: 000-136, infective and parasitic diseases; 140-207, malignant neoplasms; 390-458, diseases of circulatory system; 460-519, diseases of respiratory system; 520-577, diseases of digestive system; E800-999, accidents, poisonings and violence.

— Less than 20 deaths

[a] For a definition of comparative mortality figure, see table II.14, footnote *h*.

TABLE II.29. STANDARDIZED MORTALITY RATIOS[a] BY SOCIAL CLASS AND CAUSE OF DEATH, MALES 20-64 YEARS OF AGE, SCOTLAND, 1959-1963

Social class	*140-205*	*330-334*	*420*	*421,422*	*490-502*	*E800-962*	*E963-999*	*All causes*
I	77	94	100	83	46	78	68	83
II	82	92	104	78	51	75	91	87
III	100	98	101	92	93	87	84	97
IV	99	99	94	101	105	111	108	99
V	143	129	115	152	194	173	186	142

Source: Scotland, Registrar General, *Occupational Mortality, 1959-1963* (Edinburgh, 1970), table 6.

NOTE: The cause-of-death categories are as follows: 140-205, malignant neoplasms; 330-334, vascular lesions; 420, arteriosclerotic heart disease; 421, 422, degenerative heart disease; 490-502, bronchitis and pneumonia; E800-962, all accidents; E963-999, violence.

[a] For a definition of standardized mortality ratio, see table II.14, footnote *c*.

are very close to those presented earlier for males. An inverse gradient is found for each age, except the last two intervals, 55 to 74 years of age. There is also a pattern towards convergence of the rates with age, as is true for males. For single females, the patterns differ in two respects. One, the highest social class has higher rates than all but the two lowest classes, which may reflect the strains of professional life for females. Two, younger single women follow a positive class gradient through class III—manual.

TABLE II.30. STANDARDIZED MORTALITY RATIOS[a] BY SOCIO-ECONOMIC GROUP AND CAUSE OF DEATH, MALES 20-64 YEARS OF AGE, UNITED STATES, 1950

Socio-economic group	*140-205*	*330-334 400-468*	*470-527*	*E800-962*	*E963 970-979*	*All causes*
I	89	98	62	50	90	83
II	92	96	55	69	85	85
III	106	104	80	82	98	97
IV	119	95	121	105	95	100
V	129	130	203	184	120	152
VI (Agriculture)	80	88	101	123	126	96

Source: Lillian Guralnick, "Mortality by occupation level and cause of death among men 20 to 64 years of age: United States, 1950", United States Public Health Service, National Vital Statistics Division, *Vital Statistics, Special Reports*, vol. 53, No. 5 (September 1963), table 1.

NOTE: The cause-of-death categories are as follows: 140-205, malignant neoplasms; 330-334, 400-468, major cardiovascular diseases; 470-527, diseases of respiratory system; E800-962, accidents; E963, 970-979, suicide.

[a] For a definition of standardized mortality ratio, see table II.14, footnote *c*.

Data on major causes of death similar to those presented by occupational categories are available for examining variations by social classifications. Tables II.26 to II.30 contain such data for males for those countries in which they are available. Figure II.13 also provides the data for England and Wales for males, and for females based on husband's occupation.

The over-all inverse pattern of mortality by social class clearly holds for most of the major cause-of-death categories reported for these countries. For certain cancer sites or types, however, such as that of the intestine or leukaemia, positive gradients have been observed in Finland (table II.27) as well as England and Wales.[45] But these variations are suppressed when all cancer sites are aggregated. For the cardiovascular (circulatory) category, the negative relationship generally holds, although the differences are mainly apparent in the high mortality levels for the lowest social class category (excluding farmers). Norway is an exception in this regard. Deaths from accidents and other external causes show a strong inverse gradient for each country.

The data shown in figure II.13 for England and Wales enable us to make a comparison of mortality for married females and males by underlying cause of death. In most cases, the inverse gradient for males is found for married women as well. A notable exception is for malignant neoplasms, in which females show little gradient by class. This may be due to the often reported positive relationship between social class and mortality from breast cancer. The absence of a gradient is also found for female mortality from diseases of the nervous system and sense organs and, interestingly, mortality from accidents, poisonings and violence. A positive gradient is found for mental disorders as a cause of death, although the number of such deaths is very small.

(c) *Education*

Only a few studies have permitted the examination of mortality differences by educational status and these are mainly limited to infant or perinatal mortality. Education is not an item recorded on most death certificates and, therefore, data that are available come from follow-back surveys or linkage investigations in which special efforts were made to obtain this information. The 1960 Matched Records Study of Mortality in the United States is one study in which education was extensively examined in the belief that it is the most appropriate indicator of socio-economic status.[46] Indeed, it does have the clear advantage of pertaining equally well to females as to males and to persons at all the adult ages, even those past the prime working ages. The study showed that mortality ratios based on death rates of Americans 25 years and over ranged from 104 for white males with 5-7 years of school completed to 80 for males who had completed four years of college or more (table II.31). For white females the differences were even greater. The study also indicated that differences were generally greater for persons 25-64 years of age than among older persons. An even stronger inverse association of mortality with education was found for non-white males and females.

TABLE II.31. MORTALITY RATIOS OF RATES BY EDUCATION, WHITE MALES AND FEMALES 25 YEARS OF AGE AND OVER, UNITED STATES, 1960

Years of school completed	*Males*	*Females*
Elementary, 0-4	102	127
Elementary, 5-7	104	108
Elementary, 8	102	105
High school, 1-3	101	87
High school, 4	98	92
College, 1-3	98	73
College, 4 or more	80	71
TOTAL	100	100

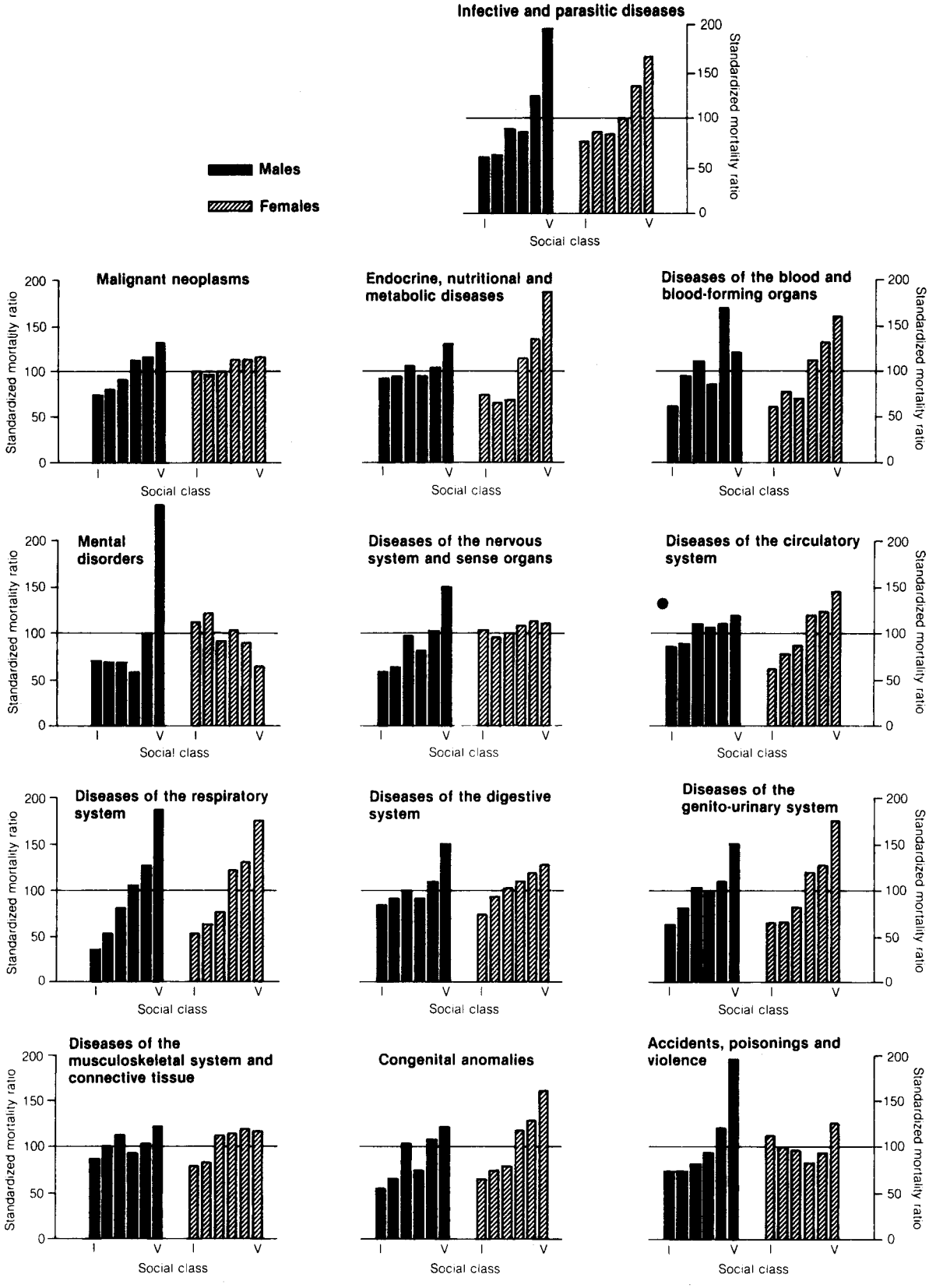
Source: E. M. Kitagawa, "Social and economic differentials in the United States, 1960", in International Union for the Scientific Study of Population, *International Population Conference, London, 1969* (Liège, 1971), pp. 157-166.

Additional support for the finding of a strong inverse relationship between mortality and educational attainment comes from the United States National Mortality Survey, a

[45] United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality 1970-72*, Series DS, No. 1 (London, HMSO, 1978), figure 4.9.

[46] E. M. Kitagawa and P. M. Hauser, "Education differentials in mortality by cause of death: United States, 1960", *Demography*, vol. 5 (1968), pp. 318-323; and *Differential Mortality in the United States: A Study of Socioeconomic Epidemiology* (Cambridge, Mass., Harvard University Press, 1973).

Figure II.13. Mortality by social class and cause of death: standardized mortality ratios for men and married women (by husband's occupation) aged 15-64 years, England and Wales, 1970-1972



Source: United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality, 1970-72,* Series DS, No. 1 (London, HMSO, 1978), p. 41.

TABLE II.32. MORTALITY RATIOS OF RATES BY EDUCATION AND AGE, MALES AND FEMALES, UNITED STATES, 1962-1963
(Age-specific death rates per 10,000 population in parentheses)

	Males					*Females*				
Educational attainment	*25-44*	*45-54*	*55-64*	*65 and over*	*Total 25 and over*	*25-44*	*45-54*	*55-64*	*65 and over*	*Total 25 and over*
Elementary or none	155	129	112	107	175	152	122	117	105	181
High school	100	87	91	84	58	88	91	82	90	56
College or more	59	74	73	86	50	88	81	86	90	64
TOTAL	100	100	100	100	100	100	100	100	100	100
Death rates	(29)	(99)	(233)	(735)	(189)	(17)	(53)	(119)	(538)	(135)

Source: E. S. Mathis, "Socio-economic characteristics of deceased persons", United States Public Health Service, *Vital and Health Statistics*, Series 22, No. 9 (1969).

follow-back sample study. Data for 1962-1963 from this study (table II.32) showed the youngest age category (25-44) to have the largest differential, especially among males. The differentials converge with age, but the overall rate differentials clearly show the relatively disadvantaged mortality risk for those with low educational attainment. That this differential persists into the older ages suggests strongly that social and economic differentials play an important role in mortality throughout the life span.

In a prospective study conducted in a county in Maryland (United States) of deaths occurring in an eight-year period to persons from whom information was obtained in a 1963 special local census, Comstock and Tonascia found a strong inverse relationship with education.[47] Removing the effects of additional variables (cigarette smoking, marital status, adequacy of housing) increased the specificity of the association between mortality and education. The inverse relationship was particularly strong for mortality from rheumatic and arteriosclerotic heart diseases. In contrast, there was a significant positive relationship with diabetes and suicide.

A recent investigation in Finland, in which records for those persons who died during the period 1971-1975 were matched with 1970 census data, permits an investigation of mortality differentials by education and cause of death. Table II.33 shows strong differences by educational level attained, especially between those with only primary education and those with secondary and higher education. The results are similar for both males and females, although differences are greater among males. With respect to underlying cause of death, the differences by education are substantial with little variation between the different causes.

(d) *Income*

The investigation of the relationship between income and mortality is beset by even greater problems than are experienced in dealing with other social and economic variables for the simple reason that ill-health that can lead to death may also lead directly to changes in income. Thus, a two-way relationship is not only possible, but probably can be expected. A recent analysis of data for 1971-1973 from the Longitudinal Study in England indicates, for those persons who have been "normally active", standardized mortality ratios of 84 for the employed, 323 for those who have been sick, and 113 for the unemployed. Among the "inactive", the retired had an SMR of 160 and the permanently sick one of 393. Income also varies considerably over the life cycle and its long-term effects therefore are difficult to assess quantitatively. None the less, its importance is clear. As Ciocco and associates note, "The fact that mortality is inversely related to income level constitutes one of the oldest vital statistics findings and was a major stimulus to the public health movement".[48] As was demonstrated in section C above, this association is strong on a country level as well.

Most of the studies using income as a variable have been conducted in the United States. In studies of a cohort of American males insured under social security in 1955 and followed up through 1959, consistent support was found for higher mortality risks among persons with low reported income.[49] Caution should be exercised in interpreting these findings as well as those of other studies, in that selection criteria may seriously confound the results.[50] An inverse relationship of mortality with family income was also reported in the 1960 United States investigation, especially for males (table II.34). The income differentials tended to be greater than educational differentials for white males, but smaller for females.

In the recent study of occupational mortality in England and Wales, an effort was made to allocate income information from another source, the 1971 Income Survey, to social classes and to compare this with mortality differences. The following tabulation emerged:[51]

Social class	*Mean weekly income*	*SMR*
I	£44.14	77
II	£34.02	81
III Non-manual	£24.12	99
III Manual	£27.05	106
IV	£22.46	114
V	£22.09	137

[47] G. W. Comstock and J. A. Tonascia, "Education and mortality in Washington County, Maryland", *Journal of Health and Social Behavior*, vol. 18 (1977), pp. 54-61.

[48] A. Ciocco, T. Mancuso and D. J. Thompson, "Four years' mortality experience of a segment of the United States working population", *American Journal of Public Health*, vol. 55 (1965), p. 594.

[49] *Ibid.*

[50] See, for example, A. J. Fox and P. F. Collier, "Low mortality rates in industrial cohort studies due to selection for work and survival in the industry", *British Journal of Preventive and Social Medicine*, vol. 10 (1976), pp. 88-91.

[51] United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality, 1970-72*, Series DS, No. 1 (London, HMSO, 1978), figure 6.4.

TABLE II.33. COMPARATIVE MORTALITY FIGURES[a] BY EDUCATION AND CAUSE OF DEATH, MALES AND FEMALES 30-69 YEARS OF AGE, FINLAND, 1971-1975

Years of school completed	*Cancer*	*Circulatory diseases*	*Respiratory diseases*	*Accidents and violence*	*All causes*
			Males		
Under 8 and unknown	107	107	114	115	109
9-11	74	84	52	74	79
12	78	84	46	55	77
13 and over	64	64	30	52	61
TOTAL	100	100	100	100	100
			Females		
Under 8 and unknown	102	109	113	106	107
9-11	95	72	53	82	79
12	97	63	87	79	77
13 and over	96	55	48	97	72
TOTAL	100	100	100	100	100

Source: Finland, Central Statistical Office, *Statistical Report*, No. VÄ 1979:3 (Helsinki, 1979), table 3.

[a] For a definition of comparative mortality figure, see table II.14, footnote *h*.

TABLE II.34. MORTALITY RATIOS OF RATES BY FAMILY INCOME, WHITE MALES AND FEMALES 25 YEARS OF AGE AND OVER, UNITED STATES, 1960

Income	*Males*	*Females*
Under $2,000	114	105
$2,000 - 3,999	103	102
$4,000 - 5,999	97	100
$6,000 - 7,999	91	101
$8,000 - 9,999	100	95
$10,000 or more	89	92
TOTAL	100	100

Source: E. M. Kitagawa, "Social and economic differentials in mortality in the United States, 1960", in International Union for the Scientific Study of Population, *International Population Conference, London, 1969* (Liège, 1971), table 1.

It can be seen that whereas mortality differences were large between social classes III non-manual and V, the mean income difference was quite small. The steep jump in income to social class II, then to I, was accompanied by a large difference in the standardized mortality ratio.

(c) *Trends in social and economic differentials*

Establishing a trend based on scattered data for a few countries at different points in time is a hazardous enterprise at best, but the importance of the topic warrants the effort as long as it is accompanied by caution. It is possible to review what others have speculated on with respect to trends and in the case of one country at least, England and Wales, to examine data that have been scrupulously documented over an extended time period. Furthermore, the studies of geographical variations in mortality over time (for example, rural/urban and regional differences) often provide important clues as to economic and social factors that may be responsible for the changes.

A considerable amount of attention has been given to the subject of whether or not social and economic differentials have declined in the past few decades. Certainly, it matters greatly what type of differential is being examined and how it is measured—by specific rate changes or the compositional contributions to over-all rates. Moreover, it is usually beneficial to consider both short-term and long-term trends. A number of these points will emerge in the discussion that follows.

Stockwell and associates[52] have recently re-examined earlier views on socio-economic differentials for the United States and whether the gap was closing or not. They note that, earlier, it was thought that the mixed results from studies of mortality differentials indicated a weakening of the strong inverse relationship, but that studies in the 1960s showed this not to be the case. This was especially true of studies focusing on the ecological units of analysis rather than individual data. Yeracaris and Kim,[53] in a study of three United States cities—Birmingham, Buffalo and Indianapolis—examined 1960 and 1970 data for subareas in the central city and the suburbs and found, in fact, that socio-economic differentials in mortality were even greater in 1970 than in 1960. Furthermore, for the leading causes of death—heart diseases and malignant neoplasms—mortality rates were strongly related inversely to socio-economic status in both the city and the suburban rings, especially for males.

On a somewhat larger areal unit of analysis, Lerner and Stutz[54] studied the relative mortality, in terms of death rates and life expectancies, for the 10 highest and the lowest *per capita* income states and three geographical regions in the United States for the period 1959-1961 to 1969-1971. The higher-income states are mostly highly urban and industrialized, while the low-income states are more rural. The authors conclude that although over-all mortality declined significantly during the period, the mortality gap between high-income and low-income states actually widened. This arose mainly because the declines in mortality experienced for the low-income states lagged behind those in the high-income states, due largely to substantial reductions in major cardiovascular diseases in the latter. The gap also widened for death rates from diabetes, accidents and tuberculosis, but was reduced for malignant neo-

[52] Edward G. Stockwell and others, "Research on the relationship between socioeconomic status and mortality in the United States: 1960-1975", in *Proceedings of the Social Statistics Section* [of the American Statistical Association], *1977, part I* (Washington, D. C., American Statistical Association, 1978).

[53] C. A. Yeracaris and J. H. Kim, "Socioeconomic differentials in selected causes of death", *American Journal of Public Health*, vol. 68 (1978), pp. 342-351.

[54] M. Lerner and R. N. Stutz, "Have we narrowed the gaps between the poor and the nonpoor? part II, Narrowing the gaps, 1959-1961 to 1969-1971: mortality", *Medical Care*, vol. XV (1977), pp. 620-635.

plasms, in which the low-income states had made greater progress. They offer the interesting suggestion that such aggregate results may possibly mask the fact that low-income persons living in high-income states could have benefited the most from the many federal health programmes directed towards reducing disparities. If this is correct then the conclusions reached on the basis of an ecological approach may be somewhat fallacious, but none the less it does direct attention to the lack of relative progress in bringing about comparable mortality improvements in low-income areas generally.

Gardner[55] has examined 1958-1964 mortality levels at ages 45-74 years for county boroughs in England and Wales. He found socio-economic factors to be strongly related to mortality, but of no greater importance than air pollution or such "natural" factors as latitude, water hardness or average rainfall. With respect to specific causes of death, the socio-economic measures were especially important in explaining variations in male chronic bronchitis and cancer of the stomach for both males and females. These results confirm well established relationships long noted in England and Wales, which contribute to significant regional differences in mortality levels.[56] Regional differences in mortality still persist according to a recent report which surmises that there exists "a geographic influence on mortality patterns over and above the influence of factors measured by social class".[57]

Federici[58] has studied life table mortality values for the period 1960-1962 by regions of Italy, and their relationship to selected average socio-economic variables. She found infant and early childhood mortality to be closely associated with level of schooling and degree of crowding, particularly for females, but the association with *per capita* income was much weaker. The results for adults were rather surprising. Among females there was virtually no relationship between the socio-economic variables considered and mortality levels, while for males there was a moderate relationship, but in the opposite direction to what would be expected, i.e., higher income and level of education were associated with higher mortality. Two possible explanations were offered for this phenomenon, the first being selectivity, in that lower-class adults belonged to socio-economic groups which had experienced heavy mortality during infancy and childhood. The second explanation was that certain degenerative diseases of middle and old age affected the more affluent to a greater degree than the poorer classes. In terms of historical studies (1881-1961) of these relationships, it appears that, whereas some relationship in a negative direction has existed in the past, the results generally are uncertain and much less clear today.

Considerable attention has traditionally been given to differences between rural and urban areas, not only because of the environmental differences between these types of areas but also because of what the differentials may signify in altered life styles as societies increasingly shift to more urban residence. Federici and others,[59] reviewing the data for eight countries, found some support for a narrowing of the mortality differential over time, although male rates were still greater in urban than in rural areas. For females, the findings differ among these countries. Moreover, there is evidence for at least three countries not included in their report—Canada, France and the United States—that relative mortality varies very little by rural areas and urban localities of different sizes, but the small differentials that do exist favour the urban areas. In the case of Canada, only for males was higher mortality observed with increasing size of place, and this was largely attributable to differentials in cancer deaths (table II.35). Over the time period

TABLE II.35. MORTALITY RATIOS OF AGE-STANDARDIZED RATES BY SIZE-CLASS OF LOCALITY, MALES AND FEMALES, CANADA, 1960-1962 AND 1970-1972

(Death rates per 100,000 population in parentheses)

Size-class of locality	*Males*		*Females*	
	1960-1962	*1970-1972*	*1960-1962*	*1970-1972*
Less than 2,500	92	96	102	102
2,500-4,999	107	105	105	106
5,000-9,999	112	103	110	99
10,000-29,999	102	106	98	103
30,000-99,999	100	106	98	101
100,000 and over	103	101	98	98
TOTAL	100	100	100	100
Death rates	(897)	(851)	(644)	(545)

Source: K. G. Basavarajappa and J. Lindsay, *Mortality Differences in Canada, 1960-1962 and 1970-1972*, Statistics Canada (Ottawa, 1976), tables 7 and 8.

1960-1962 to 1970-1972 the gap narrowed for both sexes. In one country included in the report of Federici and others, Greece, other evidence suggests that both urban males and urban females have higher life expectancy at all ages than their rural counterparts.[60] In sum, it would seem that there is little consistency to the patterns of differential mortality between rural and urban areas in more developed countries. The gap is narrowing and perhaps shifting in favour of more urban environments.

A common observation regarding trends in differential mortality, largely based on Antonovsky's review,[61] emphasizes that the class mortality differential has come to be for the most part restricted to the higher mortality of the lowest class as compared to the rather similar lower levels of mortality of the other classes. The data reported for England and Wales presented in table II.36 show that while social class V has much higher mortality than the other classes, classes III and IV also now have above average mortality, and that the ratios for highest classes I and II have over time become increasingly lower. This would tend to refute the view that it is only the lowest class that

[55] M. J. Gardner, "Using the environment to explain and predict mortality", *Journal of the Royal Statistical Society*, Series A, vol. 136 (1973), pp. 421-440.

[56] W. J. Martin, "Study of sex, age and regional differences in the advantage of rural over urban mortality", *British Journal of Preventive and Social Medicine*, vol. 10 (1956), pp. 88-91.

[57] United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality, 1970-72*, Series DS, No. 1 (London, HMSO, 1978), p. 179.

[58] N. Federici, "The impact of socio-economic factors on mortality; an attempt of analysis on some Italian data", in International Union for the Scientific Study of Population, *International Population Conference, London, 1969*, vol. II (Liège, 1971), pp. 950-972.

[59] N. Federici and others, "Urban/rural differences in mortality, 1950-1970", *World Health Statistics Report*, vol. 29, No. 5-6 (1976).

[60] V. G. Valaoras, *Urban-rural Population Dynamics of Greece*, National Statistical Service of Greece and Centre of Planning and Economic Research (Athens, 1974).

[61] Aaron Antonovsky, "Social class, life expectancy and overall mortality", *Milbank Memorial Fund Quarterly*, vol. 45, No. 2 (April 1967), pp. 31-73.

TABLE II.36. MORTALITY FOR MALES AGED 15 (20) TO 64 (65) YEARS BY SOCIAL CLASS, ENGLAND AND WALES, 1910-1912 TO 1970-1972

Period	Social class				
	I	*II*	*III*	*IV*	*V*
1910-1912	88	94	96	93	142
1921-1923	82	94	95	101	125
1930-1932	90	94	97	102	111
1949-1953	98	86	101	94	118
1959-1963	76	81	100	103	143
1970-1972	77	81	104	114	137

Source: United Kingdom, Office of Population Censuses and Surveys, *Occupational Mortality, 1970-72*, Series DS, No. 1 (London, HMSO, 1978), table 8.1.

NOTE: All figures as originally reported. Comparative mortality figures for 1910-1912 and 1921-1923, standardized mortality ratios thereafter. For definitions of these terms, see foot-notes to table II.14.

is disadvantaged with respect to the over-all levels of mortality. Indeed, the range of the ratios between the highest and lowest classes seems to have widened between 1949-1953 and 1959-1963 and remained quite high in the most recent period.

Another observation and the most interesting from several points of view is that during a transition from high to low rates of mortality, which has been characteristic of the more developed nations, the gap will get larger and then contract. The argument focuses on the fact that it is the upper classes that first come to benefit from medical and health factors that tend to lower mortality and only later do the lower classes come to share in these advances. Thus, in the latter stages of reduced over-all mortality, the gap should be greatly reduced and equality at last attained.

This hypothesis seems quite reasonable in light of advances in medical technology and therapeutic procedures that have arrested most of the communicable diseases, but how does it fit the case of the chronic diseases, which have experienced much more modest mortality declines, or even increases? Some support for the hypothesis can be found in a recent article by Marmot and others,[62] which presents data on death rates from coronary heart disease by class in England and Wales over the period 1931 to 1971. In 1931 coronary heart disease rates for males were higher in classes I and II than for the older classes (except at ages 35-44 years), but in 1961 and 1971 the rates were higher for classes IV and V. For females, the rates were consistently higher over time and at all ages 35-64 years for the lower classes than for the upper classes. Noting the somewhat paradoxical situation that while coronary heart disease is usually thought to be associated with affluence, and that affluence had clearly increased over time, it is nevertheless the lower, less affluent, classes that had higher mortality risk in the recent period, the authors speculate that the over-all male mortality declines from various cardiovascular diseases in the past few years in their country may reflect the behavioural modifications in nutrition, exercise and smoking found among the upper classes.

On the national scale, a recent comparative study of counties in Finland, Sweden and Norway revealed considerable variation between these countries and also within them in 1970-1971 standardized death rates among males and females aged 5-64 and 65 years and over.[63] Finland has much higher mortality levels than the other two countries, especially for males. The authors found that housing density (as measured by number of persons per room in 1960) was highly correlated with mortality levels within each country, especially for males. Urbanization (the proportion of total population residing in urban areas) was correlated positively with mortality in Sweden and Norway, but inversely related in Finland. A more detailed ecological study of the latter country by municipalities led to the conclusion that the socio-economic variables that reflect levels of living (housing density, cars *per capita*, occupational level and farm mechanization) explained a great deal more of the over-all differences in mortality levels than factors such as level of health care and natural environmental and genetic diversity of the population. A general conclusion reached is that the over-all level of living may be of considerably more importance in explaining mortality differentials in a less developed area (e.g., Finland) than in the more advanced Norway or Sweden. In a later study, the same team of investigators found that morbidity differences, in contrast to mortality, probably could not be attributed to social and economic differentials between the countries.[64]

Some studies have attempted to examine short-term fluctuations in mortality levels as they may be affected by over-all economic conditions. The focus of attention in such studies has usually been on cyclical fluctuations in national economies that can be determined by various indices of either prosperity or depression. A recent article by Eyer[65] comes to the conclusion, on the basis of data for the United States, that mortality increases during business booms and decreases during depressions, quite the opposite of what is generally believed to be the case. Of the 24 death-rate peaks in the United States between 1870 and 1975, 22 occurred in the year of a low in unemployment or in the years on either side of such a low. Moreover, these peaks in mortality include higher death rates for nearly all major causes of death—heart disease, cancer, influenza etc. His conclusion is that the predominant factor in the twentieth century at least partly responsible for this pattern is stress induced by overwork, and community disorganization caused by migration. Although this conclusion may be somewhat dubious, the extent to which such patterns exist in countries with free market economies would seem to merit further research.

3. *Findings: perinatal and infant mortality*

Infant mortality has been found to be particularly sensitive to socio-economic and environmental conditions, and, as mentioned earlier, infant mortality rates are often used

[62] R. G. Marmot and others, "Changing social-class distribution of heart disease", *British Medical Journal* (21 October 1978), pp. 80-87.

[63] T. Valkonen and V. Notkola, "Influence of socioeconomic and other factors on the geographic variation of mortality in Finland, Sweden and Norway", *Yearbook of Population Research in Finland*, vol. XV (1977), pp. 9-30.

[64] A. Karisto, V. Notkola and T. Valkonen, "Socioeconomic status and health in Finland and other Scandinavian countries", *Social Science and Medicine*, 12C (1978), pp. 83-88.

[65] J. Eyer, "Prosperity as a cause of death", *International Journal of Health Services*, vol. 7, No. 1 (1977), pp. 125-150.

as indices of social and economic development. Many of the studies relating to social class differentials in infant mortality that have been conducted since the end of the Second World War have recently been reviewed by Antonovsky and Bernstein.[66] In the pages which follow, their conclusions are reported and further examined in the light of additional data, and some time-series data not included in their article are presented.

In their review of data from 26 different studies of both the individual and ecological type for Europe and the United States, Antonovsky and Bernstein conclude that strong social class differentials still persist with respect to infant mortality and its two components—neonatal and post-neonatal mortality.[67] They note that over-all infant mortality rates have continued to decline during the past few decades for most of the world's more developed nations, with greater declines for post-neonatal than for neonatal mortality. The gap between social classes I and V (as measured in their report by a ratio) appears to have somewhat narrowed, but this is mainly due to the more rapid decline in post-neonatal mortality, which makes up a greater share of total infant mortality. When the components are examined separately, in fact, the gaps between the highest and lowest social classes remain unchanged. It is generally acknowledged that post-neonatal mortality is due in greater measure to "exogenous" factors, such as the social and economic conditions of a family's existence, whereas neonatal mortality is influenced more by "endogenous" factors, e.g., prenatal and maternal care and factors relating to delivery. Thus, it is argued that the closer in time one comes to birth itself, the less the apparent influence of social and economic factors. By this reasoning, social class differentials for deaths occurring in the first week of life should be smaller than in the later neonatal period. The data presented in the article seem to bear this out along with evidence that mortality in the first week of life is becoming an ever larger portion of total neonatal deaths, due mainly to the more rapid decline of deaths in the later neonatal period.

Perinatal mortality, which includes deaths during the late foetal period (28 or more weeks of gestation) and the early neonatal period, is characterized even more than neonatal mortality by the preponderance of endogenous factors. In fact, a main reason for combining these two components of mortality is just that—their causes are so closely related. A recent cross-national study of perinatal mortality by the World Health Organization[68] calls attention to the importance of deaths in the period both preceding birth and in the first week thereafter, and the extent to which such deaths are influenced by social and economic factors, as well as biological factors such as birth weight, length of gestation, parity etc. Table II.37 contains data on ratios of perinatal mortality rates by occupation of the father (when this can be determined) for four countries. It may be noted that the influence of the rates for the unassigned category greatly affects the over-all rates and thus produces below average ratios for many of the occupational categories. Nevertheless, it is clear from these data that the risk of death in the perinatal period is much greater for families in which the husband is a manual worker than for those in which he is a professional or manager. In most countries, perinatal mortality is also quite high among agricultural workers. These same data have also been prepared by social class categories for England and Wales, and are as follows:

TABLE II.37. MORTALITY RATIOS OF PERINATAL MORTALITY RATES BY FATHER'S OCCUPATIONAL CATEGORY, SELECTED COUNTRIES, AROUND 1973

Occupational category	*Austria*	*Hungary*	*New Zealand*	*England and Wales*[a]	
				Total	*Legitimate*
Professional and technical	80	87	79	77	78
Managerial	86	60	70	77	81
Clerical	84	105	90	96	98
Sales	84	107	80	90	90
Service	88	102	100	97	98
Production	96	100	104	106	110
Agriculture	95	109	91	94	99
Unassigned	151	70	150	127	91
TOTAL	100	100	100	100	100
Rates per 1,000 births	(21.4)	(29.1)	(17.3)	(19.6)	(18.9)

Source: World Health Organization, *Social and Biological Effects on Perinatal Mortality, vol. I, Report on an International Comparative Study. Sponsored by the World Health Organization* (in press), chap. 8.

[a] Based on mother's occupation if father's occupation not known.

Social class	*Ratios of perinatal mortality rates*
I	75
II	82
III Non-manual	92
III Manual	104
IV	115
V	142
Unassigned	91
TOTAL	100
Rate per 1,000 births	(18.9)

The inverse gradient by social class is pronounced and, in fact, is nearly as large as that for infant mortality.

In the same study by WHO, educational data for both the mother and the father were reported with respect to perinatal mortality for several countries. In each case the data show a consistent trend of lower mortality with increased educational attainment. The differentials are greater with respect to the late foetal death component than the early neonatal portion. Similar findings with respect to infant mortality rates and educational attainment in the United States have been reported in several studies—the investigation by Kitagawa and Hauser[69] and the National Infant Mortality Study of 1964-1966.[70]

[66] Aaron Antonovsky and Judith Bernstein, "Social class and infant mortality", *Social Science and Medicine*, vol. 11 (1977), pp. 453-470.

[67] Neonatal mortality refers to deaths occurring during the first four weeks, or first month, of life, while post-neonatal mortality refers to deaths occurring in the remainder of the first year of life.

[68] World Health Organization, *Social and Biological Effects on Perinatal Mortality, vol. I, Report on an International Comparative Study Sponsored by the World Health Organization* (in press).

[69] E. M. Kitagawa and P. M. Hauser, *Differential Mortality in the United States: A Study of Socioeconomic Epidemiology* (Cambridge, Mass., Harvard University Press, 1973).

[70] B. MacMahon, M. G. Kovar and J. Feldman, "Infant mortality rates: socioeconomic factors, United States", *United States Public Health Service, Vital and Health Statistics*, Series 22, No. 14 (1972).

Differentials in infant mortality by rural and urban areas of residence of the mother at the time of birth and, in some cases, distributions by size of place have often been studied. In general, the most frequently observed patterns are higher rates for rural than for urban areas and an inverse gradient by size of place. This stands in contrast to over-all mortality patterns, which are often found to be distributed in just the opposite direction, as noted earlier in this chapter. A study of Austrian data for 1961[71] is typical in showing a marked inverse relationship of infant mortality rates with size of place (with Vienna, however, having a higher rate than other cities with over 100,000 population), but no significant differences for perinatal mortality. The differences were mainly due to variations in post-neonatal mortality.

Data on infant mortality for France in the period 1972-1974 reveal that rural communes had considerably higher levels than France as a whole and much higher rates than the Paris agglomeration.[72] The differentials were particularly large with respect to causes of death related to delivery and early infancy, presumably factors more involved in neonatal mortality, although the study did not make this distinction.

Canadian data for 1960-1962 and 1970-1972 permit an examination of changes in infant mortality rates by size of place (table II.38). For both males and females, infant

TABLE II.38. INFANT MORTALITY RATES BY SIZE OF LOCALITY, MALES AND FEMALES, CANADA, 1960-1962 AND 1970-1972
(Infant deaths per 1,000 live births)

	Males		Females	
Size of locality	*1960-1962*	*1970-1972*	*1960-1962*	*1970-1972*
Less than 2,500	38.8	23.4	30.6	17.9
2,500-4,999	35.0	22.1	28.1	15.9
5,000-9,999	36.8	20.4	27.6	16.2
10,000-29,999	31.0	20.9	24.1	17.0
30,000-99,999	28.4	18.2	22.5	15.1
100,000 and over	25.8	17.3	19.3	13.0
TOTAL	31.0	19.6	23.9	15.1

Source: K. G. Basavarajappa and J. Lindsay, *Mortality Differences in Canada, 1960-1962 and 1970-1972*, Statistics Canada (Ottawa, 1976), tables 7 and 8.

death rates have an inverse relationship with respect to size of place for both time periods. During the interval, rates sharply declined, but the declines were greater for smaller places. Thus, there has been a general convergence of the rates by size of place.

In England and Wales, the relationship between rates of infant mortality and size of place has been positive, although the differences are not large.[73] The infant mortality rate for conurbations in 1973 was 19 per 1,000 births, and for rural areas it was 14; the perinatal mortality rates were 22 and 19, respectively. In Scotland, similar results have also been found, as can be seen in table II.39, in which variations between rural and urban areas and social class are presented. Over-all mortality is greater in urban areas and this is true of neonatal and post-neonatal rates. Interestingly, the infant mortality rates for social classes I and II are greater in the rural areas, but for the lower classes the urban rates are much higher. The urban lower classes, therefore, would seem to be particularly disadvantaged. Stillbirth ratios are higher in rural areas for classes I, II and IV, but for classes III and V the urban ratios are higher.

TABLE II.39. INFANT, NEONATAL AND POST-NEONATAL DEATH RATES AND STILLBIRTH RATIOS, BY SOCIAL CLASS AND URBAN/RURAL RESIDENCE, SCOTLAND, 1975
(Neonatal and post-neonatal rates per 1,000 live births; stillbirth ratios per 1,000 live and stillbirths)

Residence and social class	*Infant*	*Neonatal*	*Post-neonatal*	*Stillbirth*
Urban				
I	9.4	7.4	2.0	7.5
II	12.2	8.2	4.0	7.3
III	16.1	11.3	4.8	11.4
IV	16.4	11.5	4.9	12.6
V	25.9	14.3	11.6	14.5
TOTAL	17.5	11.9	5.6	11.1
Rural				
I	9.7	9.7	—	9.6
II	13.5	10.5	3.0	8.9
III	14.3	10.7	3.6	9.4
IV	12.9	6.7	6.2	14.8
V	19.2	19.2	—	13.6
TOTAL	15.1	10.9	4.2	11.1

Source: Scotland, Registrar General, *Annual Report, 1975, part I, Mortality Statistics* (Edinburgh, HMSO, 1977), table F2.7.
— Less than 20 deaths.

The trends in infant mortality rates and their components are presented in table II.40 for France by occupational categories and in table II.41 for Scotland by social classes. The decline in the infant death rate in France in the 10-year interval between birth cohorts 1955-1960 and 1966-1970 is very substantial in terms of both the numerical and percentage change, especially in cases where the father's occupation is manual. This has brought about a narrowing of the differential between the highest and lowest occupational categories (the decline being very marked in the post-neonatal period), but large differentials still persist. Neonatal mortality has made up an increasing portion of the over-all infant mortality rate for all categories.

The changes in rates since 1939 in Scotland also reveal large numerical and percentage declines in infant mortality and its components. This has resulted in a steadily declining gap between social classes I and V over this extended period of time. As in the case of England and Wales, the over-all decline in infant mortality has been largely due to the more substantial reductions in post-neonatal mortality. In the case of Scotland, however, the gap between the highest and lowest social classes has declined for post-neonatal mortality to an even greater extent and this has produced a major decline for the infant mortality rate differences by class.

The change in perinatal mortality by social class in England and Wales between 1950 and 1973 has recently been

[71] H. Czermak and H. Hansluwka, "La Mortalité des nourrissons en Autriche", *Médicine et hygiène*, vol. 20 (1962), pp. 805-808.

[72] M. H. Bouvier, B. Garros and J. Lion, "La Mortalité des jeunes en milieu rural", *Cahiers de sociologie et de démographie médicales*, vol. 18 (1978), pp. 20-34.

[73] P. Lambert, "Perinatal mortality: social and environmental factors", *Population Trends*, No. 8 (1976), pp. 4-8.

TABLE II.40. INFANT, NEONATAL AND POST-NEONATAL MORTALITY RATES BY FATHER'S OCCUPATIONAL CATEGORY FOR BIRTH COHORTS 1956-1960, 1961-1965 AND 1966-1970, FRANCE

(Rates per 1,000 live births)

Occupational category of father	*Infant*			*Neonatal*			*Post-neonatal*		
	1955-1960	*1961-1965*	*1966-1970*	*1955-1960*	*1961-1965*	*1966-1970*	*1955-1960*	*1961-1965*	*1966-1970*
Professional and managerial	17.0	14.7	12.2	12.4	10.9	9.1	4.6	3.8	3.1
Lower salaried staff	19.7	16.1	14.1	13.8	12.0	10.8	5.9	4.1	3.3
Clerical	24.9	20.2	17.2	16.7	14.4	12.8	8.2	5.8	4.4
Shopkeepers	25.4	20.5	17.7	17.4	14.8	13.3	8.0	5.7	4.3
Skilled and foremen	28.1	22.5	18.9	17.7	15.5	13.4	10.4	7.0	5.6
Semi-skilled	32.9	26.7	21.7	19.6	17.2	14.8	13.3	9.5	6.9
Labourers	44.8	36.2	30.4	23.1	20.4	18.4	21.7	15.8	12.0
Farmers	31.2	23.1	18.7	20.8	16.7	13.8	10.4	6.4	4.9
Farm workers	35.3	27.7	23.9	21.0	18.2	16.4	14.3	9.5	7.5
Miners	48.3	36.6	28.3	22.6	20.6	18.1	25.7	16.0	10.2

Source: S. Hémery and M.-C. Gérard, "La Mortalité infantile en France suivant le milieu social", in International Union for the Scientific Study of Population, *International Population Conference, Liège, 1973* (Liège, 1973), vol. 3, pp. 171-184.

TABLE II.41. TRENDS IN INFANT, NEONATAL AND POST-NEONATAL MORTALITY BY SOCIAL CLASS, SCOTLAND, 1939-1976

(Rates per 1,000 live births)

Year	*Social class*					*Social class*					*Social class*				
	I	*II*	*III*	*IV*	*V*	*I*	*II*	*III*	*IV*	*V*	*I*	*II*	*III*	*IV*	*V*
	Infant death rates					*Neonatal death rates*					*Post-neonatal death rates*				
1939	33.5	39.9	68.8	68.2	84.8	25.9	25.1	38.6	34.8	39.9	7.6	14.8	30.2	33.4	44.9
1946	22.2	37.8	51.3	60.4	73.0	16.7	25.0	29.3	31.1	36.9	5.5	12.8	22.0	29.3	36.1
1951	18.4	22.8	36.4	41.0	54.0	14.6	15.2	22.1	23.3	29.7	3.8	7.6	14.3	17.7	24.3
1956	16.6	19.1	27.2	32.6	38.2	11.0	13.5	19.0	22.0	22.1	5.6	5.6	8.2	10.6	16.1
1961	18.0	17.1	25.1	27.4	34.5	13.3	13.2	17.7	19.5	21.6	4.7	3.9	7.4	7.9	12.9
1966	11.1	13.5	22.0	26.6	37.3	8.8	9.5	14.6	17.5	21.9	2.3	4.0	7.4	9.1	15.4
1971	16.5	13.7	18.7	22.3	29.1	11.8	10.7	12.7	15.5	17.1	4.7	3.0	6.0	6.8	12.0
1976	10.8	10.0	13.8	13.5	21.0	8.6	7.0	9.7	9.8	13.5	2.2	3.0	4.1	3.7	7.5

Source: Scotland, Registrar General, *Annual Report, 1976, part 1, Mortality Statistics* (Edinburgh, HMSO, 1977), table F1.4.

the subject of two reports.[74] The following rates have been calculated on the basis of 1,000 legitimate births:

Social class	*1950*	*1973*	*Percentage decline*
I	25.4	13.9	45.3
II	30.4	15.6	41.3
III	33.6	19.2	42.9
IV	36.9	21.8	40.9
V	40.4	26.8	33.7

[74] *Ibid.*; J. Hellier, "Perinatal mortality 1950 and 1973", *Population Trends*, No. 10 (1977), pp. 13-15.

It is clear that perinatal mortality rates have declined for all classes, but at a somewhat slower rate for the lower classes. Thus, the gap between the classes was greater in 1973 than in 1950, as measured by the ratio of the lowest to the highest class. Standardizing the rates to examine how important certain factors have been in bringing about the changes revealed that shifts in maternal age accounted for more of the decline than did changes in parity or shifts in the social classes. However, even in combination, these factors only accounted for a fourth of the over-all reduction. Other factors relating to the health of the mother, as well as medical care for the mother and the new-born, clearly have been influential in bringing about the mortality reductions.

ANNEX

TABLE IIA.1. TRENDS IN EXPECTATION OF LIFE AT AGES 0, 30 AND 65 YEARS, MALES AND FEMALES, MORE DEVELOPED COUNTRIES, 1950 TO MID 1970s

(Years)

Region, country and period	Males			Females		
	Expectation of life at			Expectation of life at		
	0	30	65	0	30	65
Northern America						
Canada						
1950-1952	66.33	41.60	13.31	70.83	44.94	14.97
1955-1957	67.61	41.98	13.36	72.92	46.17	15.60
1960-1962	68.35	42.24	13.53	74.17	46.98	16.07
1965-1967	68.75	42.29	13.63	75.18	47.68	16.71
1970-1972	69.34	42.50	13.72	76.36	48.51	17.47
United States[a]						
1950-1954	65.9	40.0	12.9	71.7	44.9	15.2
1955-1959	66.5	40.3	12.7	72.7	45.6	15.4
1960-1964	66.8	40.5	12.9	73.4	46.2	16.0
1965-1969	66.8	40.4	12.9	74.0	46.5	16.3
1970-1974	67.5	40.9	13.2	75.2	47.4	17.1
1975-1976	68.9	41.8	13.7	76.6	48.6	18.0
East Asia						
Japan						
1949-1950	56.19	36.72	11.16	59.61	39.95	13.18
1952-1954[a]	62.4	39.7	12.4	66.3	43.1	14.7
1955-1959[a]	64.12	39.72	11.64	68.47	43.40	13.94
1960-1964[a]	66.49	40.58	11.87	71.47	44.72	14.36
1965-1969[a]	68.65	41.57	12.36	73.93	46.10	15.14
1970-1974[a]	70.37	42.77	13.08	75.70	47.40	15.95
1975	71.76	43.82	13.76	76.95	48.42	16.64
1976-1977[a]	72.42	...	...	77.65	...	...
Europe						
Eastern Europe						
Bulgaria						
1946-1947	53.3	38.2	11.7	56.4	41.0	12.7
1956-1957	64.17	42.64	13.40	67.65	45.05	14.48
1960-1962	67.82	43.00	13.54	71.35	45.60	14.74
1965-1967	68.81	43.06	13.40	72.67	45.99	14.74
1969-1971	68.58	...	...	73.86	...	...
Czechoslovakia						
1949-1951	60.93	39.65	12.11	65.53	42.95	13.36
1955-1959[a]	66.71	41.07	12.58	71.69	44.93	14.29
1960-1964[a]	67.65	41.13	12.29	73.36	45.73	14.62
1965-1969[a]	67.01	40.57	11.98	73.42	45.82	14.69
1970-1973[a]	66.51	39.94	11.80	73.34	45.78	14.77
1974-1975[a]	66.8	...	...	73.7	...	...
German Democratic Republic						
1952-1953	65.06	41.50	12.62	69.07	44.20	13.91
1955-1958	66.13	41.74	12.67	70.68	45.03	14.41
1960-1964[a]	67.79	42.09	13.03	72.76	45.89	15.08
1965-1968[a]	68.94	42.36	13.15	74.02	46.46	15.51
1970-1974[a]	68.56	41.43	12.10	73.89	45.84	14.67
1975-1976[a]	68.67	41.37	12.07	74.23	46.04	14.73
Hungary						
1948-1949	58.75	39.58	12.56	63.24	42.70	13.73
1955	64.96	41.45	12.57	68.87	44.04	13.84
1959-1960	65.18	40.90	12.05	69.57	44.22	13.64
1965-1968[a]	66.97	41.38	12.30	71.95	45.36	14.33
1970-1972[a]	66.58	40.74	12.11	72.32	45.42	14.51
1974	66.54	40.56	12.17	72.42	45.60	14.84
Poland						
1948	55.6	38.6	12.3	62.5	42.9	14.2
1952-1953	58.6	38.9	11.7	64.2	43.0	13.7
1955-1958[a]	62.2	40.3	12.4	68.2	44.9	15.0
1960-1961	64.8	41.1	12.6	70.5	45.5	14.8
1965-1966	66.85	41.68	12.77	72.83	46.46	15.35
1970-1972	66.83	40.65	12.24	73.76	46.49	15.34
1975	67.02	40.58	...	74.26	46.73	...
Romania						
1956	61.48	40.54	12.08	64.99	43.15	13.45
1961-1963[a]	64.77	42.64	13.42	68.98	44.98	14.62

TABLE IIA.1 (*continued*)

Region, country and period	Males			Females		
	Expectation of life at			Expectation of life at		
	0	30	65	0	30	65
Europe (*continued*)						
Eastern Europe (*continued*)						
Romania (*continued*)						
1964-1967	66.45	42.04	12.77	70.51	45.09	14.25
1970-1972	66.27	41.71	12.70	70.85	45.32	14.42
1974-1976	67.37	...	...	71.97	...	...
Northern Europe						
Denmark						
1946-1950	67.75	43.00	13.60	70.14	44.22	14.19
1951-1955	69.87	43.73	13.87	72.60	45.34	14.62
1956-1960	70.38	43.66	13.81	73.76	46.08	15.07
1961-1965	70.3	43.3	13.5	74.5	46.6	15.4
1966-1970	70.55	43.20	13.53	75.40	47.16	16.10
1971-1975	70.87	43.17	13.68	76.48	47.98	16.98
1975-1976	71.1	43.2	13.7	76.8	48.1	17.1
Finland						
1946-1950	58.59	36.30	11.03	65.87	42.36	13.17
1951-1955	63.4	38.0	11.2	69.8	43.4	13.2
1956-1960	64.90	38.63	11.47	71.57	44.35	13.70
1961-1965	65.4	38.5	11.4	72.6	44.7	13.7
1966-1970	65.88	38.46	11.32	73.57	45.35	14.11
1971-1974[a]	66.45	38.90	11.68	74.82	46.39	14.87
1975	67.38	39.74	12.04	75.93	47.28	15.65
Iceland						
1946-1955	69.4	...	...	73.5	...	...
1961-1965	70.8	44.1	15.0	76.2	48.2	16.8
1966-1970	70.7	43.8	14.4	76.3	47.7	16.5
1971-1975	71.6	44.1	15.0	77.5	48.9	17.8
1975-1976	73.0	45.2	15.9	79.2	50.5	18.6
Ireland						
1950-1952	64.53	40.25	12.12	67.08	42.16	13.32
1960-1962	68.13	41.66	12.56	71.86	44.65	14.37
1965-1967	68.58	41.65	12.44	72.85	45.21	14.65
Norway						
1946-1950	69.25	44.22	14.74	72.65	46.29	15.55
1951-1955	71.11	44.81	14.86	74.70	47.31	15.95
1956-1960	71.32	44.57	14.59	75.57	47.74	16.02
1961-1965	71.03	43.93	14.13	75.97	47.87	16.01
1966-1970	71.09	43.61	13.86	76.83	48.49	16.55
1971-1975	71.41	43.76	...	77.68	49.10	...
1975-1976	71.85	43.98	14.08	78.12	49.53	17.44
Sweden						
1946-1950	69.04	43.02	13.53	71.58	44.57	14.27
1951-1955	70.49	43.74	13.82	73.43	45.72	14.75
1956-1960	71.23	44.04	13.88	74.72	46.63	15.23
1961-1965	71.60	44.12	13.88	75.70	47.45	15.80
1966-1970	71.85	44.10	13.98	76.59	48.10	16.35
1971-1975	72.07	44.06	14.04	77.65	48.99	17.16
1976	72.12	43.90	13.92	77.90	49.16	17.32
United Kingdom						
England and Wales						
1950-1954[a]	67.10	40.64	11.87	72.34	45.20	14.69
1955-1959[a]	67.92	40.97	11.95	73.59	45.94	15.10
1960-1964[a]	68.1	41.1	12.0	74.1	46.2	15.3
1965-1969[a]	68.7	41.4	12.1	74.9	46.9	15.9
1970-1974[a]	69.1	41.6	12.2	75.4	47.2	16.2
1974-1976	69.62	...	...	75.82	...	...
Northern Ireland						
1950-1952	65.5	40.4	12.1	68.8	42.9	13.5
1956-1958	67.55	40.93	12.21	71.79	44.54	14.20
1960-1962	67.64	41.01	12.24	72.40	45.05	14.36
1965-1967	68.09	41.11	12.25	73.34	45.82	15.02
1970-1972	67.63	40.74	11.97	73.67	45.90	15.16
1973-1975	67.24	40.64	11.81	73.55	45.83	15.13
Scotland						
1950-1954[a]	65.01	39.42	11.66	69.48	43.21	13.59
1955-1959[a]	66.04	39.55	11.45	71.29	44.06	13.92
1960-1964[a]	66.23	39.55	11.42	72.12	44.62	14.33
1965-1969[a]	66.93	39.91	11.61	73.05	45.27	14.92

TABLE IIA.1 (*continued*)

Region, country and period	Males			Females		
	Expectation of life at			Expectation of life at		
	0	30	65	0	30	65
Europe (*continued*)						
Northern Europe (*continued*)						
United Kingdom (*continued*)						
Scotland (*continued*)						
1970-1972	67.17	39.79	11.39	73.54	45.45	15.16
1973-1975	67.44	40.07	11.65	73.93	45.06	15.56
Southern Europe						
Albania						
1950-1951	52.6	39.8	13.9	54.4	43.9	16.1
1955-1956	57.20	41.68	13.83	58.58	45.25	16.28
1960-1964[a]	63.7	43.5	14.6	66.0	47.3	16.7
1965-1966	64.9	43.9	15.1	67.0	47.1	16.2
1969-1970	66.5	...	...	70.4	...	...
Cyprus						
1948-1950	63.6	41.8	13.2	68.8	46.4	15.6
1973	70.0	42.6	12.8	72.9	46.0	14.2
Greece						
1950	63.44	41.22	12.97	66.65	43.85	14.35
1955-1959	66.36	42.93	13.31	69.74	45.69	14.90
1960-1962	67.46	43.45	13.49	70.70	46.15	15.06
1970	70.13	44.58	13.87	73.64	47.38	15.29
Israel[b]						
1950-1954[a]	67.2	42.8	13.3	70.1	44.6	14.4
1955-1959[a]	69.0	43.4	13.5	71.8	45.3	14.8
1960	70.67	44.38	14.37	73.47	46.50	15.70
1965-1967[a]	70.61	43.72	13.71	73.50	45.76	14.90
1968-1969[a]	69.26	43.22	13.63	72.86	45.54	14.68
1972-1974[a]	70.17	43.40	13.78	73.11	45.57	14.56
1975	70.3	43.8	14.0	73.9	46.4	15.4
Italy						
1950-1953	63.75	41.18	12.63	67.25	43.97	13.70
1954-1957	65.75	41.74	12.91	70.02	45.14	14.35
1960-1962	67.24	42.32	13.39	72.27	46.43	15.34
1964-1967	67.87	42.14	13.12	73.36	46.77	15.52
1970-1972	68.97	42.55	13.30	74.88	47.63	16.15
Malta						
1948	55.69	39.68	12.84	57.72	40.74	13.54
1955-1959[a]	66.0	40.7	11.9	69.6	43.4	13.3
1960-1962	67.01	40.84	11.95	70.70	43.82	13.50
1965-1969[a]	67.99	41.22	11.95	71.92	44.25	13.42
1970-1973[a]	68.37	41.06	11.78	72.54	44.64	13.60
1975-1976[a]	68.41	40.45	11.28	72.90	44.55	13.08
Portugal						
1949-1952	55.52	38.62	11.90	60.50	43.18	13.96
1955-1958[a]	59.3	39.8	11.9	64.4	44.4	14.0
1959-1962	60.73	40.72	12.42	66.35	45.40	14.64
1965-1967[a]	63.32	40.78	12.54	69.43	45.80	14.85
1970-1971[a]	64.50	41.04	12.35	70.65	46.04	14.85
1974	65.29	40.50	11.97	72.03	45.94	14.74
Spain						
1950	58.76	39.10	11.96	63.50	43.34	13.97
1960	67.32	42.05	12.80	71.90	45.77	14.82
1970	69.69	42.96	13.58	74.96	47.45	16.11
Yugoslavia						
1952-1954	56.92	39.40	11.88	59.33	41.62	13.01
1960-1962[a]	62.30	40.96	12.13	65.43	43.86	13.71
1966-1968[a]	64.53	40.84	11.89	68.92	44.93	14.17
1970-1972	65.42	40.89	12.42	70.22	45.24	14.41
Western Europe						
Austria						
1949-1951	61.91	39.71	12.01	66.97	43.37	13.59
1959-1961	65.60	40.54	12.16	72.03	45.64	15.23
1965-1969[a]	66.64	40.44	11.89	73.37	46.06	15.02
1970-1974[a]	66.97	40.72	12.09	74.15	46.62	15.41
1975-1976[a]	67.87	41.08	12.31	74.98	47.11	15.70
Belgium						
1946-1949	62.04	39.30	12.33	67.26	43.22	13.88
1959-1963	67.73	40.94	12.44	73.51	45.86	14.83
1968-1972	67.79	40.93	12.10	74.21	46.43	15.29

TABLE IIA.1 (*continued*)

Region, country and period	Males			Females		
	Expectation of life at			Expectation of life at		
	0	30	65	0	30	65
Europe (*continued*)						
Western Europe (*continued*)						
France						
1950-1951	63.6	39.3	11.9	69.3	44.1	14.4
1957-1959[a]	66.6	40.4	12.5	73.1	46.1	15.5
1960-1964	67.5	40.7	12.7	74.4	46.8	15.9
1965-1969[a]	67.9	40.8	12.7	75.3	47.4	16.4
1970-1974[a]	68.3	41.4	13.1	76.4	48.2	17.0
1974	69.0	41.5	13.2	76.9	48.6	17.2
Germany, Federal Republic of						
1949-1951	64.56	41.32	12.84	68.48	43.89	13.72
1958-1959	66.75	41.39	12.52	71.88	45.30	14.40
1960-1962	66.86	41.14	12.36	72.39	45.53	14.60
1965-1967	67.62	41.13	12.24	73.57	46.06	15.03
1970-1972	67.41	41.00	12.06	73.83	46.30	15.18
1974-1976	68.30	41.35	12.28	74.81	46.95	15.66
Luxembourg						
1946-1948	61.69	39.03	11.94	65.75	42.56	13.38
1971-1973	67.0	39.9	11.8	73.9	45.9	15.2
Netherlands						
1947-1949	69.4	43.8	13.9	71.5	45.0	14.4
1951-1955	70.9	44.3	14.1	73.5	46.1	14.9
1956-1960	71.4	44.2	14.1	74.8	46.9	15.4
1961-1965	71.7	43.8	14.0	75.9	47.7	16.0
1966-1970	71.0	43.4	13.7	76.4	47.9	16.4
1971-1975	71.2	43.4	13.6	77.2	48.7	16.9
Switzerland						
1948-1953	66.36	41.01	12.40	70.85	44.36	14.04
1958-1963	68.72	42.17	12.94	74.13	46.52	15.24
1968-1973	70.29	43.06	13.32	76.22	48.05	16.33
Oceania						
Australia[c]						
1946-1948	66.07	40.40	12.25	70.63	44.08	14.44
1953-1955	67.14	40.90	12.33	72.75	45.43	15.02
1960-1962	67.92	41.12	12.47	74.18	46.49	15.68
1965-1967	67.63	40.72	12.16	74.15	46.34	15.70
1970-1972	67.81	. . .	12.21	74.49	. . .	15.90
1973-1975[d]	68.36	. . .	. . .	75.35	. . .	. . .
New Zealand						
1950-1952	67.19	41.59	12.84	71.29	44.72	14.80
1955-1957	68.20	42.10	12.87	73.00	45.80	15.30
1960-1962	68.44	41.83	12.78	73.75	46.20	15.47
1965-1967	68.19	. . .	. . .	74.30	. . .	. . .
1970-1972	68.55	41.46	12.56	74.60	46.66	15.95
USSR						
1954-1955	61	. . .	. . .	67	. . .	. . .
1958-1959	64.42	40.71	14.01	71.68	47.07	16.79
1964-1966	66	. . .	. . .	74	. . .	. . .
1968-1971	64.56	39.03	12.97	73.53	46.72	16.13
1971-1972	64	. . .	. . .	74	. . .	. . .

Sources: Compiled from official publications, United Nations, *Demographic Yearbook*, various issues, and files of the United Nations Statistical Office.

NOTE: Unless otherwise noted, data are official life table values.

[a] Data are averages of values from two or more official life tables within the years indicated.

[b] Prior to 1968-1969, for Jewish population only.

[c] Excluding aboriginals.

[d] Data are averages of annual life table values, based on life tables calculated by the Australian Statistician. The life tables for earlier years were calculated by the Australian government actuary.

TABLE IIA.2. TRENDS IN AGE-SPECIFIC DEATH RATES, MALES AND FEMALES, MORE DEVELOPED COUNTRIES, 1950-1954 TO MID 1970s

(Deaths under 1 year per 100,000 live births; deaths at other ages per 100,000 population in appropriate sex-age category)

Region, country and period	Age (in years)																		
	All ages	Under 1	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 and over
Northern America																				
											Males									
Canada																				
1950-1954	987	4 106	197	96	77	133	182	169	197	251	388	619	1 027	1 576	2 446	3 549	5 336	8 341	13 064	22 821
1955-1959	934	3 395	150	74	63	123	166	161	177	229	353	587	973	1 562	2 437	3 657	5 382	8 302	13 232	22 935
1960-1964	896	2 988	122	65	54	116	170	150	163	227	344	577	947	1 528	2 428	3 555	5 426	8 166	12 520	21 180
1965-1969	867	2 423	103	60	52	126	182	153	163	223	348	572	951	1 519	2 379	3 644	5 295	7 988	12 381	21 206
1970-1974	858	1 887	90	54	51	155	192	151	161	223	355	570	925	1 472	2 306	3 534	5 263	7 837	12 122	21 119
1975	852	1 590	85	51	46	164	191	153	158	223	341	552	913	1 442	2 235	3 436	5 138	7 722	12 011	22 173
											Females									
1950-1954	752	3 230	161	62	48	69	88	104	133	192	289	431	639	962	1 550	2 451	4 041	6 787	11 162	20 811
1955-1959	687	2 683	126	48	38	52	62	81	103	150	227	363	556	883	1 404	2 258	3 682	6 374	10 885	20 805
1960-1964	648	2 321	98	42	30	51	59	69	90	136	205	332	519	797	1 299	2 102	3 418	5 798	10 135	19 544
1965-1969	619	1 928	85	41	31	50	57	64	88	131	204	325	503	770	1 199	1 913	3 092	5 210	9 254	18 400
1970-1974	617	1 470	74	36	30	58	58	63	87	130	200	311	480	735	1 122	1 755	2 859	4 775	8 223	16 167
1975	616	1 260	67	35	30	55	58	60	79	123	197	322	451	711	1 083	1 731	2 774	4 551	7 712	14 926
											Males									
United States																				
1950-1954	1 102	3 147	144	67	67	144	202	195	226	317	512	810	1 302	1 947	2 854	4 085	5 871	8 719	13 192	20 072
1955-1959	1 090	2 964	119	57	58	134	193	176	205	288	466	754	1 230	1 857	2 802	4 095	5 797	8 524	13 090	20 362
1960-1964	1 091	2 852	109	53	53	127	181	174	205	292	459	747	1 224	1 851	2 810	4 224	5 894	8 460	12 807	21 501
1965-1969	1 096	2 557	97	50	52	150	206	194	222	312	478	754	1 211	1 895	2 842	4 226	6 214	8 498	12 120	20 474
1970-1974	1 070	2 071	88	48	50	158	219	202	223	304	461	735	1 126	1 786	2 717	3 958	5 909	8 662	12 039	19 318
1975	1 013	1 786	78	42	46	147	210	200	206	277	419	667	1 044	1 615	2 523	3 636	5 556	8 254	11 593	17 573
1976	1 007	...	78	41	44	140	198	187	196	262	406	648	1 018	1 579	2 496	3 586	5 435	8 263	11 521	17 984
											Females									
1950-1954	809	2 447	121	49	41	71	89	111	148	215	330	486	754	1 073	1 637	2 504	4 085	6 671	10 636	18 608
1955-1959	800	2 308	102	41	34	57	74	91	127	184	284	431	658	977	1 487	2 354	3 727	6 240	10 362	18 837
1960-1964	805	2 199	92	39	31	54	70	88	123	184	276	419	636	918	1 449	2 248	3 547	5 824	10 019	19 393
1965-1969	810	1 981	80	36	30	59	73	86	124	186	281	422	622	914	1 360	2 198	3 438	5 454	9 139	19 154
1970-1974	806	1 612	71	34	29	61	72	83	113	172	267	406	590	881	1 297	1 945	3 205	5 255	8 372	16 259
1975	770	1 418	63	29	26	54	67	75	98	146	237	366	544	821	1 227	1 731	2 945	4 879	7 687	14 031
1976	778	...	61	28	25	53	64	72	95	139	225	356	537	807	1 231	1 713	2 856	4 851	7 633	14 312
East Asia																				
											Males									
Japan																				
1950-1954	985	5 586	706	181	93	185	344	386	396	454	583	828	1 224	1 910	2 957	4 817	7 525	11 086	16 221	26 705
1955-1959	838	4 063	361	127	69	134	244	258	268	328	447	689	1 090	1 733	2 726	4 383	7 147	11 129	16 523	25 190
1960-1964	793	2 837	209	87	55	112	182	203	220	278	390	600	956	1 590	2 522	4 095	6 671	10 804	16 848	26 078
1965-1969	758	1 825	135	65	45	96	140	156	186	257	349	529	838	1 394	2 314	3 772	6 195	10 073	16 040	24 309
1970-1974	726	1 333	111	52	36	103	122	128	154	230	342	470	727	1 194	1 967	3 341	5 491	9 043	14 354	23 195
1975	690	1 121	96	45	30	87	107	102	132	194	316	459	650	1 077	1 734	2 937	5 091	8 269	13 374	22 151
1976	684	1 043	87	39	29	82	101	98	125	182	306	457	634	1 039	1 681	2 834	5 010	8 056	13 241	22 235
											Females									
1950-1954	883	4 929	699	160	88	167	294	346	365	410	481	638	901	1 309	1 998	3 312	5 381	8 435	13 020	23 433
1955-1959	721	3 467	333	99	54	96	171	198	227	271	350	494	739	1 095	1 696	2 844	4 939	8 115	12 767	21 120

TABLE IIA.2 (*continued*)

Region, country and period	All ages	Under 1	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 and over
	Age (in years)																			
East Asia (*continued*)																				
Japan (*continued*)																				
										Females (continued)										
1960-1964	661	2 300	172	60	37	62	108	132	156	198	270	409	614	936	1 460	2 492	4 425	7 884	12 992	20 857
1965-1969	615	1 428	106	40	29	44	74	94	116	155	219	335	519	795	1 293	2 195	3 894	7 007	12 271	20 562
1970-1974	590	1 033	86	33	23	40	63	74	92	128	187	282	431	674	1 086	1 883	3 344	6 131	10 819	20 220
1975	574	881	73	27	20	33	55	61	80	112	167	253	392	593	946	1 615	3 076	5 658	10 244	18 910
1976	569	817	68	27	18	31	50	58	75	103	157	243	368	570	902	1 557	2 970	5 460	10 050	19 129
Europe																				
Eastern Europe																				
Bulgaria																				
											Males									
1955-1959	932	7 174	489	90	74	124	158	171	191	238	334	492	806	1 390	2 240	3 628	5 654	8 491	13 316	18 510
1960-1964	854	4 115	221	72	68	109	135	146	174	219	301	466	741	1 224	2 066	3 353	5 354	8 330	12 642	18 691
1965-1969	922	3 421	147	69	56	100	132	142	168	219	309	468	759	1 197	2 084	3 428	5 477	8 624	13 546	20 937
1970-1974	1 026	2 917	121	58	52	97	131	147	171	225	321	498	792	1 302	2 150	3 577	5 849	—	12 945	—
1975	1 114	2 586	118	62	55	96	135	147	173	243	343	553	851	1 332	2 174	3 629	6 072	10 058	14 062	24 805
1976	1 092	2 720	119	54	51	85	120	143	162	218	333	545	861	1 301	2 106	3 543	5 824	9 579	14 671	23 525
											Females									
1955-1959	811	6 023	464	69	53	77	106	129	140	184	248	355	542	873	1 504	2 660	4 635	7 345	11 647	16 699
1960-1964	776	3 432	210	53	41	60	71	92	113	156	215	326	487	806	1 400	2 421	4 491	7 577	11 568	16 346
1965-1969	822	2 741	135	43	33	51	59	72	94	135	195	296	480	756	1 308	2 418	4 351	7 409	12 462	19 149
1970-1974	889	2 264	102	40	31	44	55	66	87	126	186	300	465	761	1 304	2 396	4 371	—	11 556	—
1975	950	2 008	111	39	33	43	50	67	89	113	170	291	456	748	1 314	2 370	4 408	8 262	13 280	23 251
1976	926	1 954	109	35	34	36	59	64	84	116	174	295	484	692	1 299	2 347	4 116	7 686	12 971	20 726
Czechoslovakia																				
											Males									
1955-1959	1 036	3 473	162	68	61	126	174	175	197	240	357	577	1 012	1 721	2 750	4 212	6 461	9 635	15 807	21 566
1960-1964	1 026	2 528	129	57	48	117	175	165	189	245	347	536	908	1 604	2 707	4 197	6 500	9 874	15 359	24 646
1965-1969	1 133	2 653	121	57	49	121	181	170	204	263	396	602	967	1 610	2 807	4 541	6 850	10 271	15 632	24 922
1970-1974	1 251	2 442	95	51	49	120	163	162	201	285	442	707	1 077	1 826	2 857	4 678	7 197	10 772	15 990	26 152
1975	1 243	2 356	83	53	43	104	142	156	183	291	451	685	1 139	1 723	2 768	4 479	7 116	10 931	16 853	26 821
											Females									
1955-1959	898	2 712	146	42	35	54	75	91	118	159	249	365	581	900	1 521	2 709	4 749	8 261	13 746	22 113
1960-1964	878	1 951	98	37	27	45	55	68	95	136	206	333	514	820	1 381	2 429	4 356	7 673	13 134	21 982
1965-1969	948	2 031	91	35	28	48	54	61	83	129	204	322	517	814	1 360	2 406	4 308	7 546	12 625	21 727
1970-1974	1 047	1 820	76	33	25	45	49	59	81	128	204	343	524	875	1 395	2 405	4 328	7 532	12 749	21 944
1975	1 053	1 797	62	35	24	39	42	52	79	117	184	308	519	801	1 328	2 294	4 149	7 449	12 686	22 713
German Democratic Republic																				
											Males									
1950-1954[a]	1 290	7 080	300	100	80	140	210	210	220	300	410	620	1 000	1 530	2 290	3 540	5 630	9 250	15 300	25 040[b]
1955-1959	1 378	5 024	215	77	58	115	164	167	182	233	342	523	886	1 520	2 397	3 723	5 875	9 525	15 358	25 750
1960-1964	1 429	3 688	164	59	46	126	168	150	181	222	319	521	855	1 479	2 489	3 864	6 020	9 591	15 615	26 513
1965-1969	1 429	2 481	119	56	50	105	156	152	167	224	326	507	869	1 446	2 517	4 152	6 471	10 133	16 009	27 481
1970-1974	1 386	2 177	86	50	43	110	145	142	163	223	350	524	848	1 471	2 423	4 130	6 719	10 366	15 932	26 594
1975	1 408	1 798	79	48	45	115	151	127	157	217	368	546	878	1 408	2 410	4 086	6 877	10 905	16 839	28 142
1976	1 367	1 596	69	48	40	114	157	142	169	230	358	556	876	1 344	2 383	3 978	6 627	10 531	16 144	28 383

												Females								
1950-1954[a]	1 070	5 520	240	70	50	90	140	160	190	240	310	440	630	930	1 480	2 600	4 660	8 290	13 960	22 720[b]
1955-1959	1 157	3 974	175	48	39	61	84	105	142	188	277	381	565	858	1 400	2 426	4 430	7 995	13 461	22 622
1960-1964	1 249	2 839	129	40	30	52	69	86	115	167	244	381	538	815	1 329	2 328	4 242	7 806	13 688	23 420
1965-1969	1 321	1 904	96	39	31	46	61	74	102	154	229	357	534	809	1 333	2 333	4 234	7 748	13 510	24 517
1970-1974	1 369	1 471	67	32	25	45	55	67	88	133	211	338	510	816	1 310	2 314	4 198	7 594	13 258	23 944
1975	1 443	1 363	69	33	25	43	53	61	84	125	201	310	505	771	1 301	2 255	4 198	7 738	13 796	24 945
1976	1 414	1 178	58	30	26	51	55	64	81	115	207	325	494	739	1 265	2 238	4 119	7 349	12 958	24 900
												Males								
Hungary																				
1950-1954	1 221	8 104	325	104	94	168	254	256	269	346	474	719	1 141	1 713	2 712	4 156	6 566	10 808	17 437	30 302
1955-1959	1 089	6 509	210	68	67	144	201	200	214	265	385	581	952	1 578	2 505	3 887	6 143	9 813	15 659	25 216
1960-1964	1 069	4 912	155	52	54	114	155	165	194	255	334	536	862	1 484	2 426	3 809	6 094	9 855	15 697	26 284
1965-1969	1 153	4 075	120	47	48	97	145	154	200	262	381	544	883	1 446	2 461	3 986	6 394	10 009	15 897	25 798
1970-1974	1 262	3 834	94	45	45	106	151	161	209	288	447	667	978	1 566	2 522	4 186	6 635	10 272	15 891	26 051
1975	1 334	3 596	83	42	44	105	145	144	224	295	479	749	1 092	1 542	2 667	4 156	6 764	10 588	16 463	25 863
1976	1 330	3 291	80	33	36	101	129	147	208	322	456	745	1 103	1 590	2 658	4 208	6 863	10 544	16 192	26 346
												Females								
1950-1954	1 068	6 599	299	75	66	120	164	188	206	261	337	509	747	1 142	1 894	3 158	5 420	9 316	15 605	25 800
1955-1959	970	5 178	191	48	44	69	94	115	147	196	281	407	623	980	1 649	2 865	5 000	8 648	14 407	23 158
1960-1964	952	3 966	140	36	32	56	70	82	115	170	238	380	559	871	1 465	2 566	4 633	8 135	13 764	23 232
1965-1969	1 011	3 311	106	32	28	48	55	71	95	146	226	348	536	842	1 380	2 487	4 439	7 840	13 393	23 108
1970-1974	1 094	3 033	80	31	28	44	52	69	94	151	238	369	560	884	1 411	2 411	4 285	7 588	12 761	22 444
1975	1 158	2 955	65	27	25	45	54	68	93	139	240	394	596	862	1 399	2 383	4 248	7 612	12 909	22 809
1976	1 170	2 654	65	28	26	46	51	71	98	149	252	404	608	901	1 474	2 386	4 297	7 454	12 804	22 904
												Males								
Poland																				
1950-1954	1 213	10 718	499	145	122	198	315	308	340	430	566	826	1 301	2 031	3 043	4 806	7 405	11 245	16 569	20 082
1955-1959	972	8 221	274	90	76	135	205	234	259	320	457	667	1 075	1 768	2 830	4 325	6 735	9 790	16 236	18 801
1960-1964	823	5 835	166	62	57	109	189	208	244	299	398	602	956	1 554	2 547	4 044	6 296	9 549	14 622	21 554
1965-1969	825	4 196	128	55	45	100	164	184	223	298	418	595	931	1 507	2 467	3 991	6 245	9 322	13 784	21 729
1970-1974	904	3 163	108	52	44	100	166	184	229	311	451	659	980	1 557	2 501	4 015	6 298	9 739	14 706	23 097
1975	949	2 819	99	52	45	103	172	179	240	331	478	728	1 045	1 488	2 593	3 891	6 163	9 450	14 269	20 765
1976	978	2 699	91	45	40	102	169	193	252	354	502	774	1 130	1 592	2 563	4 020	6 290	9 608	14 625	21 302
												Females								
1950-1954	1 016	8 755	467	120	85	140	209	226	251	315	376	520	771	1 197	1 886	3 229	5 513	8 972	13 877	17 558
1955-1959	825	6 660	251	68	49	77	112	135	167	217	299	418	625	998	1 687	2 829	4 793	8 168	13 310	16 665
1960-1964	706	4 615	146	42	34	51	76	97	127	171	247	374	546	831	1 396	2 426	4 352	7 099	11 766	18 447
1965-1969	704	3 233	107	37	28	45	59	71	98	148	216	334	527	784	1 289	2 276	4 069	6 899	10 919	18 298
1970-1974	754	2 400	85	35	27	43	52	62	90	132	206	320	487	768	1 239	2 100	3 778	6 649	11 496	19 405
1975	792	2 129	83	33	27	42	51	58	87	127	196	318	476	730	1 255	2 002	3 659	6 376	11 335	17 788
1976	796	2 038	66	36	24	41	47	58	84	127	202	313	489	752	1 208	2 038	3 629	6 397	11 122	17 982
												Males								
Romania																				
1956-1959[c]	1 020	8 379	...	120	100	140	190	190	230	280	410	610	1 025	1 670	2 713	4 160	6 980	—12 315—		
1960-1964	887	6 756	299	—77—		—139—		—187—		—289—		—732—		—1 844—		—4 569—		—11 649—		
1965-1969	951	5 614	238	—69—		—133—		—181—		—303—		—682—		—1 778—		—4 592—		—12 672—		
1970-1974	982	4 450	220	78	63	109	149	157	204	265	378	563	877	142	2 283	3 682	6 033	9 712	15 031	23 892
1975	973	...	...	79	69	108	137	151	188	275	376	567	863	1 399	2 184	3 538	5 659	9 311	14 664	23 162
1976	995	3 372	208	67	60	99	135	145	190	260	379	588	889	1 374	2 235	3 583	5 753	9 668	15 690	25 651

TABLE IIA.2 (*continued*)

Region, country and period	All ages	Under 1	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 and over
	Age (in years)																			
Europe (*continued*)																				
Eastern Europe (*continued*)																				
Romania (*continued*)																				
											Females									
1956-1959[c]	940	7 168	. . .	100	70	90	130	150	190	240	330	460	710	1 040	1 850	3 080	5 730	—11 260—		
1960-1964	834	5 808	288	—56—		—80—		—126—		—218—		—501—		—1 200—		—3 562—		—10 834—		
1965-1969	882	4 641	218	—47—		—69—		—114—		—201—		—458—		—1 104—		—3 415—		—11 510—		
1970-1974	903	3 741	194	55	41	61	83	95	122	162	228	343	543	853	1 376	2 434	4 475	8 152	13 517	21 957
1975	888	. . .	. . .	53	35	60	71	91	114	150	219	329	524	808	1 341	2 244	4 120	7 734	13 052	21 266
1976	917	2 886	182	50	38	60	77	95	111	149	212	335	510	794	1 348	2 329	4 187	7 945	13 761	23 138
Northern Europe																				
Denmark																				
											Males									
1950-1954	929	3 256	147	57	45	85	130	137	149	193	284	477	751	1 190	1 903	2 952	5 014	—11 780—		
1955-1959	962	2 712	109	45	40	83	113	117	132	171	265	429	755	1 244	1 915	3 070	4 909	7 990	13 258	23 269
1960-1964	1 044	2 295	98	54	39	79	105	110	125	172	263	440	752	1 295	2 059	3 263	5 105	8 349	13 548	23 814
1965-1969	1 088	1 935	86	55	42	89	104	94	125	177	278	446	759	1 313	2 170	3 469	5 387	8 201	13 174	23 132
1970-1974	1 102	1 448	73	51	40	100	106	97	123	190	298	492	803	1 287	2 125	3 441	5 409	7 986	12 199	21 575
1975	1 101	1 179	68	46	41	86	116	106	108	182	289	449	809	1 266	2 032	3 325	5 268	8 002	11 899	21 422
1976	1 159	1 213	71	36	31	101	100	114	102	189	301	486	880	1 308	2 162	3 372	5 312	8 409	12 513	22 702
											Females									
1950-1954	876	2 421	111	35	31	48	62	87	118	167	247	403	582	882	1 472	2 504	4 476	—11 633—		
1955-1959	854	2 007	82	31	24	40	49	74	106	148	219	342	529	812	1 311	2 245	3 979	7 165	12 020	22 085
1960-1964	892	1 730	77	30	21	37	42	60	94	145	215	320	483	760	1 228	2 117	3 810	6 823	11 959	21 724
1965-1969	904	1 369	68	34	27	41	39	54	81	146	226	332	495	748	1 189	2 018	3 549	6 123	10 849	20 324
1970-1974	901	1 023	50	32	25	40	44	49	78	126	223	347	526	740	1 146	1 815	3 091	5 394	9 325	18 411
1975	904	879	43	38	24	29	35	46	68	124	206	351	508	760	1 081	1 720	2 852	5 125	8 673	17 747
1976	962	806	42	24	23	35	35	52	79	104	217	367	534	773	1 135	1 776	3 036	5 157	8 871	18 454
Finland																				
											Males									
1950-1954	1 035	3 913	222	95	79	140	232	284	318	422	586	911	1 443	2 240	3 376	5 111	7 482	11 409	16 909	27 000
1955-1959	976	2 941	182	76	57	112	173	223	279	375	552	819	1 339	2 110	3 265	4 853	7 285	11 064	17 000	25 788
1960-1964	995	2 175	121	64	52	112	156	195	248	356	537	856	1 362	2 131	3 252	4 853	7 224	10 958	16 458	27 237
1965-1969	1 059	1 707	95	69	47	101	141	182	229	361	564	894	1 395	2 173	3 260	4 910	7 428	11 206	17 264	29 000
1970-1974	1 070	1 331	77	59	47	125	161	173	225	344	551	880	1 314	2 037	3 101	4 673	7 016	—13 544—		
1975	1 049	1 103	76	48	41	131	181	183	197	312	501	782	1 244	1 810	2 978	4 498	6 506	9 836	14 591	24 407
1976	1 070	1 140	50	39	33	114	164	187	194	300	453	815	1 252	1 874	2 965	4 516	6 488	10 401	14 632	24 196
											Females									
1950-1954	903	3 110	170	60	52	89	129	163	192	225	293	429	680	1 041	1 784	3 074	5 439	9 353	14 797	26 156
1955-1959	851	2 311	148	46	38	56	77	101	133	197	275	383	594	945	1 544	2 839	4 982	8 963	14 804	25 384
1960-1964	861	1 716	87	38	28	46	59	74	108	156	236	360	555	866	1 506	2 667	4 989	8 714	14 724	25 761
1965-1969	885	1 338	74	42	28	45	51	67	90	131	214	337	510	811	1 397	2 543	4 693	8 541	14 598	25 786
1970-1974	850	1 048	54	37	28	47	49	58	79	116	182	287	449	716	1 231	2 134	3 954	—10 860—		
1975	819	806	57	30	23	41	49	48	72	111	175	271	436	696	1 087	1 918	3 440	6 334	11 069	19 951
1976	833	824	44	25	19	37	43	65	71	111	172	259	444	662	1 032	1 882	3 521	6 196	10 824	19 790

Iceland																			
											Males								
1950-1954	768	2 730	128	99	66	150	191	241	264	362	419	475	743	1 129	1 560	2 722	4 077	7 000	12 600	21 000
1955-1959	724	2 043	114	51	62	113	220	177	211	192	340	548	718	1 091	1 567	2 391	4 312	6 700	11 667	23 333
1960-1964	729	1 974	135	54	52	86	177	170	164	228	365	522	756	1 297	1 613	2 482	3 650	6 917	12 333	20 000
1965-1969	751	1 619	106	68	46	155	163	197	207	217	268	510	796	1 231	1 788	2 857	4 044	6 867	11 857	21 500
1970-1974	783	1 383	95	52	34	130	147	195	207	268	288	556	771	1 357	1 806	2 903	4 348	6 500	10 300	24 250
1975	733	1 556	152	9	8	139	118	136	176	222	224	561	885	1 636	1 405	2 548	3 320	5 944	10 182	20 000
1976	687	632	102	48	52	69	106	78	96	255	268	466	654	1 000	1 974	2 375	4 077	6 333	7 500	16 833
											Females								
1950-1954	724	2 495	139	52	33	51	66	109	118	196	238	487	543	667	1 185	1 952	3 438	5 385	9 000	18 333
1955-1959	687	1 590	113	44	26	33	52	67	109	200	178	317	526	647	1 156	1 680	3 500	5 231	10 899	19 000
1960-1964	649	1 375	88	29	22	39	67	53	102	93	180	333	415	730	969	1 633	3 136	5 733	10 222	17 714
1965-1969	641	1 108	77	18	19	22	53	51	107	121	226	265	523	700	1 029	1 900	3 000	5 000	9 900	19 571
1970-1974	624	952	73	27	18	29	46	56	70	146	175	250	479	744	1 053	1 576	2 788	4 682	8 769	18 857
1975	561	937	186	38	18	37	42	12	76	56	232	236	360	614	975	1 618	2 571	3 652	7 733	14 625
1976	531	930	95	10	—	18	—	36	58	74	182	161	314	600	707	1 676	2 345	3 522	6 812	15 333
Ireland																			
											Males								
1950-1954	1 319	4 710	228	79	56	102	170	200	252	301	432	648	1 080	1 567	2 498	3 786	6 248	10 302	17 102	24 780
1955-1959	1 286	3 906	158	55	44	71	116	139	170	230	345	542	972	1 511	2 470	3 725	5 967	9 725	17 224	25 795
1960-1964	1 266	3 175	118	50	39	70	96	124	150	218	331	523	948	1 494	2 538	3 790	5 856	9 324	15 976	27 385
1965-1969	1 244	2 555	93	47	36	74	113	113	129	198	328	522	924	1 520	2 615	4 082	6 283	9 519	14 949	27 642
1970-1974	1 218	2 053	89	47	37	85	127	118	131	188	350	562	975	1 524	2 593	4 090	6 368	9 719	15 218	26 617
1975	1 153	1 932	97	37	45	80	137	127	119	191	305	542	972	1 449	2 525	4 028	6 346	9 287	15 218	25 833
											Females								
1950-1954	1 188	3 674	202	69	59	105	161	199	239	302	389	526	849	1 169	1 959	3 002	5 268	8 710	14 588	22 161
1955-1959	1 122	2 989	124	48	33	44	82	105	159	220	309	448	756	1 003	1 795	2 627	4 792	8 188	14 600	23 500
1960-1964	1 095	2 491	105	41	30	35	64	81	124	183	264	409	694	933	1 606	2 513	4 379	7 445	13 378	23 468
1965-1969	1 053	2 078	80	33	26	39	47	65	100	135	244	403	651	925	1 586	2 430	4 330	7 106	12 600	23 089
1970-1974	1 024	1 593	73	29	23	43	53	63	78	125	221	387	622	913	1 574	2 380	4 163	6 969	12 375	23 078
1975	968	1 559	68	27	21	21	47	57	75	123	190	361	587	881	1 396	2 302	4 000	6 498	12 205	23 093
Norway																			
											Males								
1950-1954	878	2 722	152	84	61	97	150	143	166	203	280	429	677	1 038	1 602	2 634	4 240	7 077	11 796	22 471
1955-1959	911	2 260	128	66	51	99	130	129	144	171	268	402	684	1 111	1 764	2 719	4 412	7 162	11 615	21 516
1960-1964	1 006	1 970	119	63	42	95	123	121	140	196	269	410	695	1 169	1 907	2 996	4 726	7 558	12 472	22 288
1965-1969	1 062	1 637	103	56	44	94	110	112	143	182	290	458	725	1 189	1 971	3 200	4 975	7 695	12 230	21 433
1970-1974	1 099	1 399	93	53	37	106	116	106	136	185	284	459	746	1 216	1 938	3 129	5 129	7 900	12 349	21 778
1975	1 100	1 262	78	46	43	108	110	115	100	170	278	454	729	1 194	1 941	3 056	5 029	7 778	12 468	20 955
1976	1 097	1 113	80	31	34	95	111	103	120	182	222	439	746	1 178	1 965	3 041	5 002	7 646	11 941	21 669
											Females								
1950-1954	846	2 094	122	49	35	49	64	85	102	132	192	299	455	718	1 151	1 944	3 529	6 292	10 926	21 814
1955-1959	842	1 764	99	36	28	35	42	57	78	115	171	267	406	632	1 069	1 886	3 385	6 110	10 816	21 926
1960-1964	888	1 525	84	33	23	32	39	44	67	104	158	244	373	623	1 054	1 861	3 454	6 215	11 089	21 600
1965-1969	885	1 293	74	31	23	38	36	41	55	97	153	245	366	592	1 008	1 740	3 198	5 791	10 198	19 562
1970-1974	900	978	59	31	21	33	33	42	60	91	144	236	356	554	893	1 574	2 994	5 336	9 613	19 175
1975	901	949	50	19	30	40	35	40	46	76	143	216	373	552	893	1 510	2 653	5 181	9 143	18 583
1976	902	982	54	26	23	32	37	41	63	70	121	200	379	566	900	1 463	2 606	4 910	8 935	18 608

TABLE IIA.2. (*continued*)

Region, country and period	All ages	Under 1	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 and over
	Age (in years)																			
Europe (*continued*)																				
Northern Europe (*continued*)																				
Sweden											*Males*									
1950-1954	994	2 265	129	69	52	101	141	137	158	200	278	449	705	1 162	1 868	3 017	4 935	8 260	13 829	25 475
1955-1959	1 004	1 914	109	61	44	99	117	119	144	180	253	404	665	1 109	1 821	2 940	4 832	8 021	13 299	24 302
1960-1964	1 066	1 745	84	50	39	92	112	111	130	174	244	392	636	1 102	1 844	3 003	4 938	8 138	13 382	23 524
1965-1969	1 104	1 439	69	45	34	89	110	116	144	192	264	411	661	1 060	1 814	3 003	4 958	8 094	12 899	22 826
1970-1974	1 136	1 181	52	38	33	93	112	109	141	182	286	436	678	1 077	1 773	2 958	4 862	7 890	12 474	21 821
1975	1 186	975	49	38	28	89	128	113	133	195	294	453	686	1 080	1 788	2 995	4 831	8 003	12 682	22 319
1976	1 214	906	44	34	34	80	112	117	131	192	282	432	703	1 134	1 815	3 000	5 001	8 078	12 831	23 066
											Females									
1950-1954	955	1 723	100	40	36	48	70	83	114	150	223	348	554	865	1 411	2 420	4 331	7 507	13 023	23 685
1955-1959	919	1 478	78	37	28	43	49	63	83	128	197	301	470	743	1 239	2 183	3 927	6 930	11 943	22 233
1960-1964	936	1 329	66	34	26	40	44	62	76	111	168	286	434	667	1 110	1 956	3 620	6 569	11 526	21 332
1965-1969	943	1 089	47	31	23	40	48	53	78	111	174	267	399	621	1 015	1 756	3 286	6 084	10 554	20 103
1970-1975	930	900	39	28	23	41	43	50	70	109	162	254	393	580	930	1 589	2 883	5 307	9 236	18 167
1975	968	738	39	25	26	44	35	52	72	98	167	262	388	568	893	1 538	2 727	5 196	9 044	17 891
1976	992	749	31	24	20	45	51	55	74	108	169	230	374	557	921	1 480	2 720	5 058	9 172	18 706
United Kingdom																				
England and Wales											*Males*									
1950-1954	1 247	3 136	131	60	50	89	128	136	159	219	334	591	1 053	1 756	2 852	4 439	6 768	10 709	16 531	26 504
1955-1959	1 240	2 603	101	48	42	87	112	109	129	190	307	532	972	1 736	2 799	4 376	6 780	10 490	16 380	24 392
1960-1964	1 241	2 374	96	48	40	92	112	100	121	185	300	529	933	1 677	2 812	4 415	6 780	10 431	15 858	25 134
1965-1969	1 225	2 084	87	44	41	97	98	93	110	170	302	523	923	1 599	2 731	4 412	6 773	10 175	15 264	25 196
1970-1974	1 236	1 947	77	40	35	89	98	90	108	159	290	532	910	1 557	2 557	4 219	6 674	10 038	14 833	24 323
1975	1 228	1 747	68	34	33	87	99	86	105	149	268	509	906	1 455	2 441	4 015	6 464	9 920	14 844	24 032
1976	1 254	1 625	64	34	31	87	96	87	102	155	266	487	900	1 474	2 488	4 030	6 510	10 052	15 311	24 854
											Females									
1950-1954	1 089	2 426	110	42	36	57	82	106	131	178	257	399	611	936	1 517	2 542	4 364	7 616	12 708	22 083
1955-1959	1 090	2 027	85	34	28	38	54	71	99	146	228	359	550	853	1 399	2 348	4 088	7 017	11 952	21 490
1960-1964	1 116	1 845	78	32	25	37	47	60	87	135	218	349	530	812	1 354	2 249	3 899	6 763	11 544	20 859
1965-1969	1 107	1 612	72	29	26	39	43	55	76	125	214	341	528	800	1 282	2 145	3 647	6 220	10 550	20 181
1970-1974	1 138	1 495	64	27	22	38	43	48	69	114	201	347	527	804	1 245	2 039	3 494	5 989	10 158	19 545
1975	1 144	1 386	52	24	18	36	43	50	66	110	191	326	521	784	1 224	1 962	3 315	5 704	10 056	19 293
1976	1 184	1 217	46	24	21	35	41	48	67	106	189	325	528	778	1 257	1 979	3 373	5 815	10 400	20 207
Northern Ireland											*Males*									
1950-1954	1 192	4 276	166	73	60	85	134	155	195	282	404	696	1 125	1 677	2 641	4 000	6 811	10 025	15 828	26 087
1955-1959	1 153	3 133	110	44	43	75	93	119	137	223	358	569	1 045	1 725	2 655	4 293	6 645	9 849	14 127	30 583
1960-1964	1 159	2 985	104	54	40	77	97	111	141	191	332	560	1 018	1 725	2 788	4 223	6 462	9 877	14 833	26 323
1965-1969	1 140	2 664	94	48	41	77	102	99	130	195	340	574	944	1 670	2 753	4 312	6 588	9 672	15 081	25 152
1970-1974	1 182	2 348	94	50	47	141	173	155	162	224	352	631	1 053	1 735	2 848	4 524	6 815	10 252	15 661	28 839
1975	1 139	2 174	74	51	58	131	179	190	209	215	358	645	1 018	1 619	2 740	4 282	6 480	10 016	16 228	30 630
1976	1 165	1 913	89	49	41	157	194	174	162	229	357	574	952	1 702	2 811	4 533	7 011	9 834	17 018	33 561

											Females								
1950-1954	1 082	3 342	143	44	37	59	96	142	174	226	322	485	795	1 106	1 920	2 954	5 444	8 213	14 568	23 611
1955-1959	1 022	2 713	96	35	28	42	46	70	110	184	267	402	647	950	1 730	2 798	4 911	7 506	12 137	27 054
1960-1964	1 012	2 372	92	32	25	31	44	64	91	157	235	400	614	888	1 552	2 525	4 648	7 416	12 421	23 320
1965-1969	982	2 220	79	28	23	32	43	58	90	141	240	359	578	870	1 464	2 390	4 247	7 012	11 059	21 525
1970-1974	1 022	1 966	78	29	22	44	42	61	82	134	228	372	584	909	1 451	2 315	4 117	6 833	11 288	22 908
1975	1 010	1 904	74	28	24	53	47	40	90	119	212	396	491	939	1 446	2 225	3 801	6 420	11 564	22 343
1976	1 051	1 747	108	23	24	48	50	75	111	125	189	357	592	1 000	1 475	2 320	3 641	6 624	12 144	23 994
Scotland											*Males*								
1950-1954	1 299	3 884	169	79	52	112	145	170	205	274	416	726	1 269	2 073	3 175	4 643	7 012	11 149	17 626	27 485
1955-1959	1 295	3 225	123	55	50	88	113	130	170	243	393	674	1 196	2 019	3 195	4 882	7 183	10 817	16 634	27 740
1960-1964	1 308	2 909	112	56	45	80	112	121	150	247	389	666	1 174	2 011	3 300	4 944	7 349	10 874	16 687	26 516
1965-1969	1 283	2 440	102	54	47	94	115	122	144	219	388	658	1 121	1 896	3 104	4 861	7 237	10 638	15 444	25 800
1970-1974	1 301	2 164	93	48	38	90	118	109	141	222	374	672	1 128	1 867	2 993	4 761	7 397	10 741	15 418	25 105
1975	1 285	1 911	71	49	44	90	117	98	151	215	364	682	1 075	1 795	2 856	4 660	7 124	10 361	16 035	24 171
1976	1 317	1 696	74	38	41	93	112	115	147	203	362	648	1 123	1 807	2 961	4 604	7 337	11 032	16 542	25 452
											Females								
1950-1954	1 149	3 010	142	52	42	83	128	158	181	231	330	498	755	1 146	1 860	3 081	5 158	8 663	14 495	23 937
1955-1959	1 127	2 498	96	38	33	43	63	94	123	186	286	430	665	1 058	1 751	2 884	4 857	8 181	13 481	24 350
1960-1964	1 128	2 203	93	34	29	38	50	72	101	167	270	424	650	1 013	1 655	2 748	4 590	7 692	12 889	22 026
1965-1969	1 130	1 918	77	31	28	44	47	59	87	156	258	414	661	978	1 533	2 518	4 316	7 081	11 299	21 364
1970-1974	1 156	1 674	67	31	22	39	42	58	86	144	247	430	664	1 017	1 520	2 399	3 928	6 674	10 825	20 094
1975	1 146	1 516	70	26	15	41	42	60	77	138	247	383	626	986	1 502	2 291	3 693	6 200	10 366	19 403
1976	1 195	1 246	61	23	22	33	47	55	85	138	242	398	681	964	1 619	2 321	3 792	6 224	10 847	20 707
Southern Europe																				
Greece											*Males*								
1952-1954	733	4 811	353	111	81	106	150	164	182	228	306	444	698	1 084	1 678	2 680	3 951	6 605	10 402	20 567
1955-1959	756	4 182	253	81	66	90	116	132	156	184	273	431	692	1 126	1 712	2 684	4 301	6 664	11 184	22 268
1960-1964	814	4 093	181	68	52	85	105	112	135	177	250	411	674	1 090	1 824	2 780	4 401	6 891	11 402	22 840
1965-1969	853	3 595	120	53	48	76	108	111	126	158	241	394	655	1 083	1 748	2 913	4 437	6 997	10 951	26 765
1970-1974	899	2 857	91	44	43	82	104	116	115	147	215	366	639	1 024	1 681	2 708	4 348	6 989	10 891	18 861
1975	933	2 650	73	45	43	83	106	112	119	148	217	361	591	1 073	1 652	2 723	4 263	7 080	10 698	19 791
											Females								
1952-1954	677	4 727	330	88	53	71	112	133	139	179	222	306	454	702	1 085	1 915	3 143	5 892	9 618	21 372
1955-1959	701	4 088	244	62	41	60	79	99	122	146	204	289	433	690	1 104	1 851	3 212	5 559	9 981	26 370
1960-1964	741	3 712	164	47	34	47	59	70	98	126	181	272	404	625	1 121	1 847	3 452	5 877	10 367	22 073
1965-1969	768	3 145	109	38	29	40	49	64	76	111	158	250	383	622	1 039	1 920	3 268	5 975	9 920	24 100
1970-1974	811	2 408	82	33	28	37	44	56	66	94	141	220	358	566	955	1 670	3 176	5 866	9 663	17 022
1975	839	2 126	70	28	29	36	47	55	60	87	126	221	332	535	961	1 648	2 969	5 793	9 826	17 487
Israel[4]											*Males*								
1950-1954	683	4 085	307	93	68	174	218	174	155	199	254	446	847	1 252	2 260	3 661	6 068	——11 000——		
1955-1959	628	3 403	158	53	52	152	183	128	136	156	232	383	691	1 256	2 089	3 397	5 433	——10 775——		
1960-1964	623	2 805	110	53	43	98	118	101	116	152	222	367	662	1 162	2 036	3 285	5 052	——10 357——		
1965-1969	728	2 329	92	44	45	124	170	131	138	180	262	418	704	1 163	2 095	3 488	5 490	8 408	11 891	19 207
1970-1974	794	2 089	73	50	43	111	146	97	126	165	296	477	741	1 226	2 044	3 371	5 497	——11 269——		
1975	806	1 982	68	34	45	141	177	130	120	189	241	428	686	1 153	1 963	3 176	5 284	8 223	12 356	18 625

TABLE IIA.2 (*continued*)

Region, country and period	Age (in years)																		
	All ages	Under 1	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 and over
Europe (*continued*)																				
Southern Europe (*continued*)																				
Israel (*continued*)											*Females*									
1950-1954	608	3 624	288	58	52	77	104	106	140	193	274	392	628	917	1 746	2 839	5 202	—10 103—		
1955-1959	557	2 995	154	37	35	51	64	84	108	152	247	356	587	971	1 552	2 742	4 458	—9 818—		
1960-1964	555	2 237	111	38	28	52	61	69	99	134	204	334	564	900	1 584	2 684	4 252	—9 747—		
1965-1969	611	1 801	82	29	31	49	50	53	86	118	192	339	523	913	1 558	2 668	4 462	7 391	11 891	18 744
1970-1974	677	1 634	63	35	31	47	45	61	73	120	179	320	538	901	1 532	2 710	4 562	—10 980—		
1975	668	1 575	69	32	25	46	48	49	79	103	162	295	519	884	1 381	2 380	4 061	6 676	10 845	18 328
Italy											*Males*									
1950-1953	1 067	6 732	419	100	79	126	167	189	226	267	409	658	1 014	1 526	2 221	3 432	5 726	9 479	15 929	25 838
1955-1959	1 023	5 258	260	78	68	114	140	154	185	234	351	562	953	1 514	2 316	3 483	5 462	9 083	14 832	24 695
1960-1964	1 055	4 410	186	65	58	117	137	144	174	238	347	557	912	1 530	2 427	3 650	5 522	—12 413—		
1965-1969	1 074	3 702	129	54	52	106	115	119	147	219	348	542	897	1 476	2 471	3 913	5 967	—12 462—		
1970-1974	1 057	2 962	88	48	48	105	111	109	130	193	322	547	872	1 386	2 261	3 674	5 742	—12 607—		
											Females									
1950-1953	944	5 858	411	82	61	88	119	144	177	207	287	413	616	942	1 530	2 697	4 868	8 341	13 996	22 796
1955-1959	883	4 451	242	64	46	58	77	97	126	170	238	347	538	827	1 379	2 400	4 277	7 596	12 790	21 991
1960-1964	887	3 657	173	48	39	48	64	81	106	149	216	330	497	773	1 265	2 190	3 902	—10 497—		
1965-1969	902	2 986	111	39	31	43	54	64	89	130	199	308	482	736	1 218	2 094	3 774	—10 198—		
1970-1974	891	2 361	77	31	28	41	48	56	75	113	172	283	441	676	1 110	1 864	3 338	—9 876—		
Malta											*Males*									
1955-1959	966	4 945	139	57	52	81	108	122	144	214	360	568	987	1 714	2 963	—7 480—				
1960-1964	955	3 724	108	36	34	69	117	116	161	174	291	571	880	1 716	2 982	4 311	6 500	11 000	16 556	26 250
1965-1969	994	3 204	93	28	33	68	77	50	106	188	286	526	892	1 696	2 698	4 265	6 571	11 095	16 700	22 400
1970-1974	1 001	2 395	31	33	27	69	80	91	116	179	247	471	936	1 528	2 684	4 073	6 722	9 895	15 527	19 689
1976	1 084	1 936	112	34	14	44	115	101	125	200	400	589	1 067	1 459	3 255	5 000	7 114	11 810	18 000	63 000
											Females									
1955-1959	804	3 610	143	40	27	46	45	110	128	185	250	400	688	1 171	2 206	—6 273—				
1960-1964	802	3 210	87	33	26	29	34	73	97	136	211	359	568	1 151	2 097	3 036	5 205	8 955	15 364	24 333
1965-1969	856	2 542	91	24	18	28	33	38	89	118	206	298	521	987	1 900	3 000	5 068	9 111	15 539	24 857
1970-1974	850	2 056	53	35	30	31	32	37	57	97	180	250	502	858	1 847	2 501	5 032	7 535	13 794	22 161
1976	936	1 163	162	36	23	32	14	41	26	113	128	311	439	942	1 667	3 661	5 213	8 767	15 867	50 250
Portugal											*Males*									
1950-1954	1 236	9 818	1 274	187	115	175	286	317	350	448	596	821	1 160	1 695	2 564	3 927	6 667	—14 146—		
1955-1959	1 177	9 404	996	139	90	121	171	216	269	374	510	738	1 104	1 658	2 566	3 926	6 574	—15 683—		
1960-1964	1 149	8 318	745	129	78	120	153	198	256	337	453	679	979	1 534	2 375	3 799	6 237	—13 672—		
1965-1969	1 156	6 668	423	100	72	121	135	180	252	354	501	693	1 095	1 606	2 526	3 953	6 656	—14 806—		
1970-1974	1 185	5 098	313	96	77	142	170	188	239	322	461	678	976	1 532	2 394	3 858	6 427	—15 202—		
1975	1 155	4 286	204	86	67	156	230	210	258	353	509	741	1 044	1 511	2 453	3 760	5 849	10 118	17 835	33 841

											Females								
1950-1954	1 114	8 489	1 203	167	96	150	207	231	250	306	361	465	647	947	1 586	2 516	4 696	—12 475—	
1955-1959	1 062	8 103	969	125	69	85	117	144	173	227	289	397	591	892	1 432	2 435	4 344	—13 718—	
1960-1964	1 011	7 124	705	106	56	65	88	115	143	189	246	352	539	790	1 296	2 278	4 209	—11 933—	
1965-1969	999	5 545	392	74	48	56	67	89	121	171	239	346	529	790	1 314	2 249	4 288	—12 833—	
1970-1974	1 024	4 162	274	68	45	52	68	88	113	159	226	329	491	757	1 259	2 168	4 082	—13 076—	
1975	932	3 467	175	59	36	50	64	74	101	143	213	322	472	706	1 122	1 962	3 519	7 220	13 824	25 907
Spain											*Males*								
1965-1969	907	3 799	114	54	46	87	128	139	176	238	335	499	790	1 295	2 129	3 308	5 431	—12 160—	
1970-1974	897	2 637	100	51	43	86	119	132	155	213	318	496	799	1 246	2 055	3 290	5 524	8 838	13 451	20 321
											Females								
1965-1969	796	2 999	96	37	33	41	56	70	103	140	195	293	455	695	1 167	1 987	3 538	—10 539—	
1970-1974	800	2 064	83	35	29	38	51	65	84	122	177	272	432	645	1 064	1 803	3 423	6 278	10 734	19 693
Yugoslavia											*Males*								
1950-1954	1 295	12 164	1 098	199	132	208	323	338	359	426	559	803	1 236	1 796	2 803	4 071	6 360	9 848	15 331	24 449
1955-1959	1 072	10 236	740	124	84	128	168	207	238	288	420	615	1 025	1 660	2 639	4 187	6 336	9 380	14 023	20 457
1960-1964	968	8 477	475	79	66	105	137	163	203	265	374	579	932	1 551	2 564	4 039	6 489	9 581	13 884	17 593
1965-1969	911	6 471	278	70	52	91	126	157	197	269	385	562	904	1 465	2 412	3 853	6 417	9 742	14 721	19 213
1970-1974	932	4 851	193	62	52	91	147	169	205	280	427	638	947	1 560	2 414	3 893	6 113	10 344	15 069	21 085
1975	915	4 174	173	57	45	84	133	151	189	257	393	611	927	1 433	2 315	3 675	5 887	9 847	15 741	21 106
											Females								
1950-1954	1 186	10 290	1 159	188	121	213	308	323	354	386	446	565	866	1 242	2 117	3 201	5 353	8 545	13 631	21 846
1955-1959	1 026	9 430	838	114	72	115	169	195	218	269	341	478	707	1 168	1 883	3 231	5 158	8 156	12 241	17 561
1960-1964	918	7 813	526	68	48	79	112	143	173	205	283	408	629	1 000	1 706	2 876	5 057	7 899	12 288	15 252
1965-1969	834	6 014	296	54	34	56	78	96	126	170	238	363	569	897	1 503	2 619	4 837	7 898	12 770	17 660
1970-1974	824	4 517	195	44	34	53	64	80	103	150	219	344	529	885	1 422	2 464	4 394	8 268	12 920	19 308
1975	818	3 761	169	46	30	46	57	71	95	138	216	330	504	821	1 360	2 379	4 112	7 856	13 115	20 119
Western Europe																				
Austria											*Males*								
1950-1954	1 346	6 269	238	86	68	145	211	205	219	298	412	682	1 171	1 795	2 741	4 251	6 512	10 258	16 300	26 379
1955-1959	1 373	4 760	188	74	60	149	249	231	231	269	383	625	1 058	1 793	2 780	4 222	6 461	10 117	15 779	26 286
1960-1964	1 370	3 661	146	59	50	131	183	189	210	268	367	579	986	1 700	2 825	4 309	6 552	9 978	15 497	25 971
1965-1969	1 390	3 026	119	62	47	141	174	167	220	294	406	612	956	1 613	2 808	4 564	6 859	10 297	15 755	25 374
1970-1974	1 345	2 841	101	55	48	167	198	178	199	297	442	627	972	1 544	2 555	4 287	6 768	10 192	15 323	25 103
1975	1 321	2 334	91	49	47	165	188	152	210	259	441	646	960	1 493	2 406	4 011	6 521	10 392	15 775	25 414
1976	1 293	2 017	83	39	40	154	175	165	206	229	445	630	973	1 444	2 339	3 947	6 477	10 198	14 893	25 153
											Females								
1950-1954	1 124	4 813	212	62	48	80	113	129	163	220	308	456	672	987	1 606	2 756	4 852	8 414	14 050	24 174
1955-1959	1 139	3 736	151	53	41	63	85	104	134	179	263	391	590	887	1 456	2 496	4 449	7 852	13 028	23 188
1960-1964	1 152	2 850	119	41	31	50	59	77	109	161	228	359	538	820	1 347	2 287	4 097	7 236	12 569	21 940
1965-1969	1 222	2 312	97	39	32	50	56	63	95	145	221	342	534	808	1 327	2 296	4 119	7 188	12 432	22 437
1970-1974	1 226	2 126	78	33	29	62	55	63	86	128	206	334	498	757	1 234	2 133	3 839	6 838	11 907	21 816
1975	1 238	1 759	76	32	27	53	55	65	87	126	199	304	467	737	1 200	2 018	3 596	6 581	11 616	22 203
1976	1 242	1 614	62	27	22	48	56	57	90	113	187	302	487	718	1 127	1 955	3 536	6 516	11 798	22 429

TABLE IIA.2 (*continued*)

Region, country and period	All ages	Under 1	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 and over
									Age (in years)											
Europe (*continued*)																				
Western Europe (*continued*)																				
Belgium											*Males*									
1950-1954	1 318	5 157	190	70	58	100	153	176	195	278	417	708	1 152	1 770	2 625	3 923	6 076	9 786	15 693	26 329
1955-1959	1 291	4 007	147	62	51	91	141	155	165	216	362	611	1 036	1 686	2 567	3 892	5 949	9 472	15 380	25 925
1960-1964	1 328	3 122	110	54	48	97	159	146	171	230	350	610	1 031	1 740	2 752	4 103	6 063	9 507	14 910	25 670
1965-1969	1 342	2 584	103	52	50	102	143	140	156	216	342	584	1 019	1 719	2 809	4 352	6 488	9 821	15 079	25 340
1970-1974	1 316	2 179	93	48	45	118	151	130	155	207	337	564	945	1 622	2 674	4 308	6 564	9 686	14 714	25 909
1975	1 305	1 825	84	44	40	111	149	119	147	193	314	526	902	1 535	2 518	4 180	6 617	9 951	15 212	24 928
											Females									
1950-1954	1 128	4 067	153	50	41	57	92	115	145	197	275	417	631	978	1 578	2 682	4 607	7 920	13 073	22 677
1955-1959	1 095	3 055	121	47	35	49	62	80	108	161	232	354	551	875	1 402	2 384	4 275	7 381	12 496	21 961
1960-1964	1 106	2 426	89	40	30	40	59	69	94	143	210	344	514	808	1 347	2 328	4 089	7 269	12 095	22 060
1965-1969	1 127	1 985	82	37	32	45	57	67	87	129	207	335	527	798	1 305	2 247	3 974	6 988	12 040	22 065
1970-1974	1 120	1 668	73	33	26	48	56	62	82	125	197	316	504	773	1 238	2 093	3 693	6 601	11 386	21 331
1975	1 136	1 403	58	23	23	46	51	60	81	118	196	311	486	758	1 153	2 000	3 571	6 497	11 413	20 780
France											*Males*									
1950-1954	1 319	4 774	228	59	58	109	166	204	250	328	496	790	1 235	1 825	2 619	3 990	6 300	10 210	17 513	30 691
1955-1959	1 235	3 309	168	46	45	102	143	186	223	305	431	703	1 146	1 787	2 636	3 850	6 076	9 788	16 245	29 791
1960-1964	1 177	2 427	121	43	41	97	137	166	207	282	430	628	1 058	1 689	2 617	3 864	5 789	9 361	15 272	27 845
1965-1969	1 168	1 953	96	43	42	107	161	160	194	283	428	689	998	1 631	2 571	3 981	5 881	9 003	14 514	26 044
1970-1974	1 119	1 520	86	46	42	125	170	151	180	263	427	654	976	1 526	2 322	3 586	5 494	8 247	12 904	22 656
											Females									
1950-1954	1 185	3 693	198	45	42	69	107	136	174	229	310	452	668	960	1 459	2 387	4 129	7 275	12 814	24 431
1955-1959	1 111	2 559	143	35	31	48	70	93	124	186	251	384	577	838	1 304	2 132	3 712	6 703	11 991	23 867
1960-1964	1 059	1 852	102	30	26	46	65	77	106	152	235	332	508	742	1 173	1 930	3 337	6 103	11 038	22 459
1965-1969	1 037	1 504	78	30	27	48	68	72	94	144	213	342	473	702	1 090	1 783	3 147	5 578	10 054	20 732
1970-1974	1 004	1 175	67	33	26	54	63	65	89	130	202	446	654		971	1 588	2 755	5 007	8 873	17 983
Germany, Federal Republic of											*Males*									
1950-1954	1 160	5 530	216	82	64	128	199	199	212	275	381	601	994	1 557	2 353	3 692	5 957	9 818	15 853	26 333
1955-1959	1 215	4 128	163	69	53	129	199	182	194	244	352	561	962	1 633	2 540	3 914	6 177	10 026	16 043	26 909
1960-1964	1 239	3 266	136	63	49	125	178	163	181	237	343	556	935	1 626	2 687	4 135	6 234	9 780	15 431	25 662
1965-1969	1 264	2 623	115	63	49	131	159	152	175	241	354	560	941	1 585	2 700	4 391	6 667	9 989	15 415	25 712
1970-1974	1 246	2 600	98	58	45	144	172	152	178	242	375	572	914	1 523	2 524	4 227	6 688	10 116	15 185	24 753
1975	1 258	2 233	86	47	39	145	160	135	175	236	386	592	943	1 454	2 446	4 143	6 640	10 298	15 463	24 920
1976	1 233	1 969	80	46	38	138	158	135	172	238	368	592	900	1 406	2 373	3 986	6 451	9 913	15 053	24 217
											Females									
1950-1954	979	4 379	174	56	41	70	103	124	152	206	276	412	620	950	1 566	2 791	5 007	8 751	14 484	24 289
1955-1959	996	3 276	130	46	33	53	72	97	126	171	252	366	557	858	1 435	2 533	4 647	8 352	14 108	24 499
1960-1964	1 029	2 569	109	42	29	51	61	79	107	159	232	359	524	809	1 348	2 337	4 177	7 537	12 963	22 803
1965-1969	1 101	2 025	92	40	29	52	59	69	96	146	225	348	532	789	1 322	2 286	4 057	7 189	12 466	22 268
1970-1974	1 136	1 977	77	39	28	57	60	66	89	134	214	342	514	762	1 213	2 120	3 797	6 799	11 872	21 745
1975	1 170	1 717	71	34	25	58	58	60	88	127	202	320	504	724	1 157	2 012	3 650	6 669	11 666	21 401
1976	1 154	1 504	64	31	25	57	58	61	84	122	198	316	485	715	1 130	1 933	3 495	6 319	11 170	21 028

Luxembourg											*Males*								
1970-1974	1 349	2 050	106	68	45	142	173	168	200	272	403	589	1 090	2 011	2 913	4 618	7 111	9 677	16 000	23 875
											Females								
1970-1974	1 081	1 409	90	32	23	55	49	60	130	113	258	350	563	875	1 359	2 361	3 947	6 980	11 423	20 357
Netherlands											*Males*								
1950-1954	781	2 594	169	78	54	79	106	118	131	168	259	414	704	1 118	1 730	2 814	4 650	7 886	13 160	23 232
1955-1959	812	2 032	139	65	47	75	98	98	115	148	244	405	698	1 164	1 855	2 844	4 681	7 849	13 047	23 487
1960-1964	857	1 759	122	61	42	75	102	104	109	154	244	424	731	1 257	2 006	3 135	4 691	7 676	12 662	22 257
1965-1969	904	1 567	105	58	43	90	104	98	111	159	261	442	771	1 306	2 138	3 342	5 140	7 857	12 299	21 844
1970-1974	926	1 344	91	51	40	103	106	91	105	153	255	443	767	1 314	2 177	3 482	5 321	8 168	12 295	21 844
1975	934	1 204	78	38	37	82	94	79	100	135	231	442	762	1 297	2 122	3 546	5 398	8 257	12 595	22 162
1976	933	1 163	69	38	33	82	99	82	97	140	236	448	738	1 239	2 155	3 512	5 458	8 247	12 647	21 490
											Females								
1950-1954	717	2 031	142	51	36	45	60	77	108	149	212	330	521	805	1 340	2 367	4 171	7 400	12 341	21 682
1955-1959	705	1 559	111	42	31	38	45	60	83	125	188	291	437	698	1 180	2 100	3 846	6 907	11 887	21 860
1960-1964	696	1 341	88	37	27	32	39	51	71	106	169	267	414	642	1 062	1 893	3 469	6 281	11 058	20 467
1965-1969	719	1 197	78	35	28	38	41	50	68	106	175	269	415	625	1 038	1 801	3 232	5 874	10 272	19 807
1970-1974	737	1 035	65	30	27	43	41	47	67	101	164	277	411	607	962	1 675	3 023	5 465	9 857	19 173
1975	732	918	59	27	22	35	33	43	66	95	160	255	387	567	930	1 546	2 816	5 094	9 220	18 554
1976	730	970	51	31	22	37	40	44	63	87	147	250	382	563	874	1 547	2 722	5 017	8 816	18 055
Switzerland											*Males*								
1950-1954	1 074	3 310	191	74	66	120	177	180	201	258	370	589	979	1 543	2 399	3 816	6 064	9 583	15 412	25 800
1955-1959	1 050	2 679	160	70	55	116	181	164	175	222	336	546	909	1 475	2 325	3 675	5 760	9 450	14 734	25 480
1960-1964	1 044	2 322	132	61	46	112	164	143	166	212	331	526	865	1 463	2 365	3 672	5 725	9 166	14 406	24 917
1965-1969	1 010	1 882	107	61	48	100	141	133	143	193	295	486	819	1 370	2 213	3 649	5 693	8 946	14 092	23 914
1970-1974	975	1 576	92	55	46	119	167	121	124	173	282	456	757	1 238	2 065	3 357	5 303	8 282	13 200	22 667
1975	958	1 237	77	41	37	112	164	123	118	158	269	456	722	1 205	1 866	3 226	4 933	7 844	12 403	22 096
1976	981	1 201	65	46	30	104	158	124	118	155	254	448	724	1 148	1 943	3 125	4 984	7 947	12 490	22 960
											Females								
1950-1954	954	2 567	153	55	40	55	75	103	135	174	252	389	611	948	1 512	2 600	4 511	7 791	13 136	22 719
1955-1959	921	2 079	120	42	33	46	54	73	101	141	212	345	526	824	1 376	2 339	4 119	7 396	12 578	22 489
1960-1964	893	1 767	99	40	27	39	52	64	83	122	194	298	464	743	1 221	2 101	3 743	6 789	11 949	21 927
1965-1969	875	1 467	84	38	26	41	49	57	68	109	165	272	442	676	1 130	1 952	3 453	6 337	11 235	21 161
1970-1974	843	1 158	67	37	25	47	47	49	68	96	156	259	401	615	972	1 650	3 032	5 586	10 023	19 970
1975	806	901	53	32	25	47	48	47	64	96	149	225	363	564	844	1 517	2 616	4 991	8 898	18 048
1976	831	939	52	25	20	41	40	47	65	88	122	228	371	528	865	1 488	2 584	4 826	8 901	18 896
Oceania																				
Australia											*Males*								
1950-1954	1 039	2 650	178	76	69	152	200	173	185	253	383	633	1 086	1 757	2 761	4 221	6 478	10 051	14 804	25 519
1955-1959	982	2 375	144	58	53	141	180	158	184	234	352	596	1 004	1 689	2 657	4 201	6 378	9 790	14 585	25 241
1960-1964	969	2 202	110	52	50	120	165	145	172	229	372	611	1 011	1 673	2 721	4 210	6 400	9 651	14 524	24 389
1965-1969	983	2 028	101	46	47	136	170	147	163	241	378	618	1 045	1 707	2 774	4 369	6 670	10 105	14 727	24 610
1970-1974	956	1 915	99	45	41	154	180	137	151	224	350	618	1 003	1 666	2 692	4 232	6 522	10 216	15 090	24 391
1975	879	1 629	84	36	38	155	169	131	145	207	333	586	964	1 536	2 414	3 751	5 909	8 678	13 382	22 234

TABLE IIA.2 (*continued*)

Region, country and period	All ages	Under 1	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85 and over
	Age (in years)																			
Oceania (*continued*)																				
Australia (*continued*)																				
											Females									
1950-1954	834	2 103	144	55	44	63	78	98	128	190	280	447	684	977	1 533	2 488	4 180	7 282	11 902	22 302
1955-1959	784	1 898	116	40	35	51	62	73	104	158	242	391	575	875	1 395	2 319	3 941	6 671	11 473	21 584
1960-1964	771	1 733	96	38	29	51	61	71	96	151	231	372	559	829	1 363	2 183	3 731	6 356	10 739	20 727
1965-1969	788	1 581	84	35	26	55	59	69	93	149	229	374	584	861	1 349	2 197	3 699	6 302	10 597	20 143
1970-1974	774	1 459	77	33	27	58	57	63	86	138	218	364	551	845	1 304	2 068	3 570	6 109	10 429	19 707
1975	704	1 213	66	27	23	53	49	52	77	131	202	327	495	769	1 183	1 892	3 135	5 193	8 988	17 377
New Zealand																				
											Males									
1950-1954	1 022	2 965	189	72	68	148	199	174	185	248	330	559	919	1 538	2 450	3 798	5 760	8 974	14 014	23 967
1955-1959	998	2 664	159	65	57	129	179	158	171	213	302	529	865	1 492	2 404	3 836	5 966	9 299	13 736	23 145
1960-1964	972	2 367	134	51	49	112	148	140	150	209	318	574	902	1 501	2 468	3 848	5 973	9 583	14 452	25 167
1965-1969	960	2 085	118	53	46	133	163	137	168	224	331	581	952	1 619	2 572	4 026	6 227	9 703	14 495	25 400
1970-1974	927	1 823	102	48	47	156	165	135	149	215	334	567	921	1 602	2 516	3 975	6 013	9 495	14 150	25 467
1975	893	1 863	104	61	40	151	158	128	134	206	313	597	934	1 473	2 542	3 773	5 940	8 723	13 590	27 038
											Females									
1950-1954	837	2 341	167	60	51	73	99	113	127	184	266	444	666	1 027	1 563	2 434	4 115	6 960	11 409	22 167
1955-1959	812	2 088	144	43	42	52	72	81	101	170	233	395	589	890	1 443	2 341	3 799	6 718	11 237	20 475
1960-1964	797	1 798	105	40	31	48	62	65	102	159	218	367	551	876	1 347	2 186	3 711	6 612	11 014	21 080
1965-1969	781	1 530	96	31	30	50	53	72	97	140	241	389	578	878	1 366	2 208	3 563	6 093	10 535	21 128
1970-1974	771	1 396	85	34	29	63	56	62	92	152	235	377	554	832	1 316	2 067	3 432	5 931	10 007	21 039
1975	734	1 329	89	32	28	49	62	74	99	147	211	325	537	782	1 344	1 908	3 349	5 278	9 425	20 576
USSR[e]																				
											Both sexes									
1973-1974	870	——770——		70	50	100	160	200	280	360	490	640	880	1 230	1 820	2 700	——7 350——			
1975-1976	950	——870——		70	50	100	170	210	300	380	530	690	930	1 340	1 890	2 800	——7 500——			
											Males									
1960-1961	780	——. . .——		. . .	80	160	230	290	380	430	540	790	1 110	1 640	2 400	3 290	——. . .——			
1964-1965	760	——770——		100	70	130	210	280	370	460	570	750	1 190	1 650	2 620	3 600	——7 890——			
1969-1970	880	——760——		80	70	150	230	340	430	560	710	940	1 370	1 880	2 810	4 120	——9 160——			
1973-1974	930	——850——		80	60	140	250	310	440	540	740	970	1 390	1 950	2 870	4 090	——9 050——			
											Females									
1960-1961	660	——. . .——		. . .	60	90	110	130	160	200	260	380	510	750	1 210	1 830	——. . .——			
1964-1965	670	——650——		70	50	60	110	110	140	190	250	350	540	740	1 260	1 890	——6 300——			
1969-1970	760	——610——		60	40	60	80	110	140	190	260	380	570	770	1 250	2 110	——6 890——			
1973-1974	820	——680——		50	40	60	80	90	140	180	260	370	580	820	1 260	2 020	——6 670——			

Sources: Unless otherwise indicated, World Health Organization data bank and official publications.

[a] Data are averages of rates for individual years given in United Nations, *Demographic Yearbook*, various issues.

[b] For 1950-1953.

[c] Data are averages of rates for individual years given in George Retegan and others, eds., *La Population de la Roumanie*, CICRED Monograph Series, World Population Year 1974 (Bucarest, Editions Meridiane, 1974), pp. 118-119.

[d] For Jewish population.

[e] Rates are from official Soviet publications as cited in John Dutton, Jr., "Changes in Soviet mortality patterns, 1959-77", *Population and Development Review*, vol. 5, No. 2 (June 1979), pp. 270, 276-277.

TABLE IIA.3. AGE-SPECIFIC DEATH RATES FOR SELECTED MORTALITY LEVELS IN "WEST" FAMILY OF REGIONAL MODEL LIFE TABLES

(Deaths per 100,000 population)

Age (years)	Males				Females			
	Level 20 (e_0 = 63.6 years)	Level 21 (e_0 = 66.0 years)	Level 22 (e_0 = 68.6 years)	Level 23 (e_0 = 71.2 years)	Level 21 (e_0 = 70.0 years)	Level 22 (e_0 = 72.5 years)	Level 23 (e_0 = 75.0 years)	Level 24 (e_0 = 77.5 years)
Under 1	5 421	4 237	3 159	2 186	3 177	2 308	1 537	901
1 - 4	371	241	153	86	194	116	60	25
5 - 9	127	96	69	45	68	44	25	12
10 - 14	99	77	56	38	54	36	21	10
15 - 19	170	137	105	74	87	59	35	18
20 - 24	240	192	146	103	125	82	51	27
25 - 29	248	197	147	102	152	102	64	35
30 - 34	280	223	166	114	182	128	83	47
35 - 39	352	284	215	151	233	172	117	70
40 - 44	486	406	319	233	318	246	178	116
45 - 49	720	626	516	402	464	380	294	210
50 - 54	1 089	976	832	678	690	578	461	343
55 - 59	1 674	1 538	1 359	1 162	1 035	889	733	569
60 - 64	2 572	2 395	2 155	1 884	1 641	1 430	1 200	953
65 - 69	3 955	3 733	3 426	3 072	2 721	2 438	2 122	1 770
70 - 74	6 183	5 901	5 500	5 033	4 626	4 229	3 780	3 266
75 - 79	9 687	9 324	8 796	8 174	7 789	7 273	6 680	5 980

Source: Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966), pp. 21-25.

TABLE IIA.4. PERCENTAGE OF TOTAL DEATHS FROM SENILITY, SYMPTOMS AND OTHER ILL-DEFINED CONDITIONS (ITEMS A136 AND A137 OF THE INTERNATIONAL CLASSIFICATION OF DISEASES), AROUND 1960 AND MID 1970s MORE DEVELOPED COUNTRIES

Major area, region, country and years	Males		Females	
	Around 1960	Mid 1970s	Around 1960	Mid 1970s
Northern America				
Canada, 1960, 1974	0.8	0.9	1.2	1.1
United States, 1960, 1975	1.2	1.8	1.1	1.6
East Asia				
Japan, 1960, 1976	7.6	3.9	12.2	6.9
Europe				
Eastern Europe				
Bulgaria, 1961, 1976	6.6	5.0	7.8	7.5
Czechoslovakia, 1960, 1974	2.3	0.8	3.8	1.6
Hungary, 1960, 1976	3.8	0.0	5.3	0.1
Poland, 1961, 1975	14.6	6.8	22.3	10.6
Romania, 1976	. . .	0.2	. . .	0.2
Northern Europe				
Denmark, 1960, 1976	1.4	2.7	1.6	2.5
Finland, 1960, 1974	1.8	0.3	2.9	0.3
Norway, 1960, 1976	6.8	5.3	7.0	4.4
Sweden, 1960, 1976	1.5	0.4	2.3	0.4
United Kingdom				
England and Wales, 1960, 1976	0.9	0.4	1.9	0.7
Scotland, 1960, 1976	1.1	0.4	1.4	0.5
Southern Europe				
Greece, 1960, 1975	19.7	8.4	25.2	12.4
Israel, 1960, 1975	3.2	4.5	3.3	4.1
Italy, 1960, 1974	4.2	2.5	5.9	4.0
Portugal, 1960, 1975	12.7	12.2	18.6	19.1
Spain, 1960, 1974	12.7[a]	4.9[b]	. . .	6.5[b]
Yugoslavia, 1962, 1975	23.2	15.2	28.2	18.9
Western Europe				
Austria, 1960, 1976	2.7	1.6	3.2	2.2
Belgium, 1960, 1975	10.2	7.8	13.9	9.9
France, 1960, 1974	12.9	6.9	16.3	9.2
Germany, Federal Republic of				
1960, 1975	5.9	3.6	7.7	3.8
Netherlands, 1960, 1976	4.6	4.8	4.0	4.8
Switzerland, 1960, 1976	1.3	1.1	1.7	1.3

Major area, region, country and years	Males		Females	
	Around 1960	Mid 1970s	Around 1960	Mid 1970s
Oceania				
Australia, 1960, 1975	0.8	0.7	1.3	0.7
New Zealand, 1960, 1975	0.6	0.2	1.1	0.4

Sources: For around 1960, World Health Organization, *Epidemiological and Vital Statistics, 1960, part I, Vital Statistics and Causes of Death* (Geneva, 1963), pp. 494-495; *ibid., 1961* (Geneva, 1964), pp. 478-479; and World Health Organization, *World Health Statistics Annual, 1965, vol. I, Vital Statistics and Causes of Death* (Geneva, 1968), p. 611. For mid 1970s, *ibid., 1977* (Geneva, 1977), table 6, and *ibid., 1978* (Geneva, 1978), table 6.

[a] Both sexes.

[b] The percentage for both sexes is 5.6.

Chapter III

AFRICA

Mortality conditions in Africa are of special interest because levels of mortality are clearly higher there than on any other large continent. Unfortunately, the quality and volume of the data on African mortality fall well below those of the data available elsewhere. Many types of investigations have revealed quite high levels of mortality in African countries, particularly in the sub-Saharan region; but these have in general been based on data and approaches too crude to have provided much information on other aspects of mortality. As a result, relatively little is known about the dimensions of trends and variations in African mortality; this is particularly disappointing in view of the need for such information in formulating programmes to reduce the prevailing levels. Generally speaking, the information available for Northern Africa is more complete and reliable than that for the remainder of the continent. For this reason, it is convenient to treat the two areas separately.

A. Northern Africa

1. *General levels and trends*

Northern Africa, for the purposes of this study, consists of six countries: Algeria, Egypt, the Libyan Arab Jamahiriya, Morocco, the Sudan and Tunisia.

Knowledge of mortality levels in Northern Africa depends primarily on survey information. Civil registration is probably more complete in Egypt than elsewhere in the region, but even in Egypt a recent intensive investigation suggests that death registration is 13 per cent incomplete.[1] Estimates of death registration completeness in Algeria, the Libyan Arab Jamahiriya and Morocco suggest a level closer to 50 per cent than 100 per cent. Fortunately, there have been several good multiround surveys in the region as well as some single-round retrospective inquiries that help to establish levels of mortality. Life expectancy in the Sudan appears to be at least several years lower than in the other countries of Northern Africa. An estimate for the period 1968-1973 based on a variety of information—census questions on child mortality and orphanhood as well as intercensal survival analysis—places life expectancy in the Sudan at 43 years (see table III.1). Average national life expectancies at birth for the other five Northern African countries at the most recent dates available were in the range of 50 to 55 years. Little credence should be attached to the implied ordering of these remaining countries.

[1] Egypt, Central Agency for Public Mobilization and Statistics, preliminary data from the Under-registration Survey, 1974-1975.

Table III.1 contains relatively little information about mortality trends. Only Algeria and Egypt have estimates dating back to years around 1950. Algeria shows a gain in life expectancy at birth (average, males and females) of some seven years between 1948-1951 and 1969-1970, while Egypt appears to have gained nine years in a period six years shorter. Neither country's decline has been particularly rapid by comparative standards. There is some evidence in the table that the Algerian decline accelerated towards the end of the period, a phenomenon perhaps related to the cessation of warfare, but that Egypt's decline has decelerated. Males and females gained years of life at about the same pace in Egypt, while male gains in Algeria have been almost double those of females. Again, the unusual sex pattern of change in Algeria may be related to its history of warfare. Tunisia and the Libyan Arab Jamahiriya are the only other Northern African countries for which there are at least two presumably good sets of estimates. Each pair is, however, too closely spaced to yield useful information on trends, particularly in light of the errors to which the estimates are undoubtedly subject.

Estimated infant mortality rates for the most recent dates available range from about 130 deaths per 1,000 live births in Egypt and the Libyan Arab Jamahiriya to 160 in the Sudan (see table III.2). The earlier estimates for Algeria and Egypt indicate that infant mortality rates in the region could not have been lower than 150 deaths per 1,000 live births around 1950. Egyptian infant mortality rates declined by about 20-25 points between 1950 and 1960, but then seem to have levelled off despite continued declines at other ages (which can be observed in table III.1). Algeria's recent trend depends on whether one accepts as a base period the estimate for 1960-1962 or the much lower figure for 1963-1965. But in neither case is a rapid decline implied.

2. *Age and sex patterns of mortality*

Age patterns of mortality in high-mortality human populations are invariably U-shaped, with high death rates through at least the first two years of life and high and rising rates from at least age 40 to the end of the life span. Although similar in general conformation, age patterns can and do differ substantially from one population to another even if those populations have the same average level of mortality. These differences are undoubtedly closely related to differences in the disease environments to which the populations are subject, which are in turn produced by a combination of natural forces (e.g., malaria prevalence) and behavioural factors (e.g., truncated breast-feeding, cigarette smoking). The differences may also have a genetic basis.

TABLE III.1. ESTIMATED LIFE EXPECTANCY AT SELECTED AGES, NORTHERN AFRICA, 1950-1975

(Years)

Country and source code	Period	Sex	Age 0 (birth)	1	5	10	15	30	45	60	65
Algeria	(1) 1948-1951	M	44	...	...	...	...	...	...	...	...
		F	49	...	...	...	...	...	...	...	...
	(2) 1954-1966	M	39	...	...	...	...	...	...	...	...
		F	45	...	...	...	...	...	...	...	...
	(3) 1969-1970	M	50	...	58	55	...	...	...	15	...
		F	54	...	62	58	...	...	...	17	...
	(4) 1970	M	53	61	62	58	...	...	...	...	13
		F	54	61	63	60	...	...	...	...	14
Egypt	(5) 1948-1952	M	40	46	53	52	47	35	24	15	12
		F	41	48	55	53	49	36	25	16	13
	(5) 1958-1962	M	48	54	58	55	51	38	26	16	13
		F	49	56	60	57	52	39	27	17	14
	(5) 1963-1967	M	49	55	60	57	52	39	27	17	14
		F	50	57	62	59	55	41	29	19	16
Libyan Arab Jamahiriya	(6) 1964-1974	M	51	57	56	52	48	35	23	13	10
		F	54	59	58	54	50	38	25	14	11
	(7) 1972	M	50	...	58	54	...	...	...	14	...
		F	51	...	59	55	...	...	...	16	...
	(8) 1968-1973	M	52	...	...	...	...	...	...	...	...
		F	55	...	...	...	...	...	...	...	...
Morocco	(9) 1970	M	48	...	57	53	...	...	...	14	...
		F	49	...	57	53	...	...	...	14	...
Sudan	(10) 1968-1973	M	43	...	...	...	...	...	...	...	...
		F	44	...	...	...	...	...	...	...	...
Tunisia	(11) 1968	M	52	...	60	55	...	...	...	14	...
		F	50	...	58	54	...	...	...	13	...
	(12) 1968-1969	M	54	60	61	56	52	38	25	14	11
		F	55	60	61	57	53	39	26	15	11

Sources:

(1) France, Haut Comité consultatif de la population et de la famille, *La population française, tome II, La population en Algérie: étude de démographie quantitative,* par Jacques Breil (Paris, La Documentation française, 1957), p. 128.

(2) A. Nizard, T. Locoh and J. Vallin, "Essai d'estimation de la mortalité maghrébine à travers les derniers recensements", *Conférence régionale de population, Accra, décembre 1971.*

(3) Hussein Al-Baradei and K. E. Vaidyanathan, "Trends and differentials of mortality in Algeria" (Cairo Demographic Centre, Doc. CDC/S75/15, 1975).

(4) Algeria, Secrétariat d'Etat au plan, Direction des statistiques, *Etude statistique nationale de la population; résultats de l'enquête démographique; données essentielles sur le mouvement de la population algérienne,* Series 2, No. 5 (Algiers, 1974), p. 130.

(5) V. G. Valaoras and others, "Population analysis of Egypt, 1935-1970 (with special reference to mortality)" (Cairo Demographic Centre, Occasional Paper No. 1, 1972.)

(6) G. B. Saxena, *Life Table: 1964-74, Socialist People's Libyan Arab Jamahiriya.* Draft of Monograph No. 3 of 1973 Census of Libya. Libyan Arab Jamahiriya, Department of Census and Statistics (Tripoli, 1978).

(7) Mahmoud Issa, "Estimation of mortality level in Libya, 1972" (Cairo Demographic Centre, Doc. CDC/S75/5, 1975).

(8) K. V. Ramachandran, "Evaluation of the 1973 Census of Libya". Workshop on methods of demographic data evaluation, adjustment and analysis. Regional Institute for Population Studies (Legon, Ghana, 1977).

(9) L. Nawar and K. E. Vaidyanathan, "Trends and differentials in mortality in Morocco" (Cairo Demographic Centre, Doc. CDC/S75/10, 1975).

(10) K. V. Ramachandran, "Population count, and age, sex, and other characteristics; an evaluation of 1973 Census of Sudan". Regional Institute for Population Studies (Legon, Ghana, 1978).

(11) Ali B. Taher Ouni and S. Zaghloul Amin, "Analysis of mortality in Tunisia, 1968" (Cairo Demographic Centre, Doc. CDC/S75/13, 1975).

(12) Tunisia, Institut national de la statistique, Enquête nationale démographique 1968-1969, fascicule 1, Synthèse: méthode, résultats généraux, Etudes et enquêtes de l'INS, Série démographie, n° 6 (Tunis, 1974), p. 57.

NOTE: M refers to males, F to females.

Probably the best information on age patterns of mortality in the region is drawn from Algerian and Tunisian multiround surveys (corrected for under-registration) and from Egyptian civil death registration statistics, believed to be approximately 90 per cent complete. These age patterns are displayed in table III.3. The age patterns of mortality that emerge from these sources are not, of course, free of error. They are subject to omission and age misreporting both with respect to deaths and in population counts.

While there have been many attempts to develop a "law" of human mortality that would express age-specific death rates as a mathematical function of age, a more useful standard against which to compare age patterns of mor-

TABLE III.2. ESTIMATED INFANT MORTALITY RATES, NORTHERN AFRICA, 1950-1975

Country and source code	Period	Infant mortality rate ($1{,}000\ {}_1q_0$) Both sexes	Males	Females
Algeria	(1) 1960-1962	153	...	...
	(1) 1963-1965	128	...	...
	(3) 1966-1968	...	133	121
	(1) 1966-1968	127	...	...
	(2) 1969-1971	142	142	141
Egypt	(4) 1948-1952	...	151	150
	(4) 1958-1962	...	126	130
	(4) 1963-1967	...	128	131

TABLE III.2 (*continued*)

Country and source code		Period	Infant mortality rate ($_1q_0$) (1,000) Both sexes	Males	Females
Libyan Arab Jamahiriya	(5)	1964-1974	...	113	105
	(6)	1972	...	148	129
	(7)	1973	128	...	...
Morocco	(8)	1970	...	152	121
Sudan	(9)	1973	160	...	...
Tunisia	(10)	1968	...	124	124
	(11)	1968-1969	135	136	134

Sources:

(1) Dominique Tabutin, "Mortalité infantile et juvénile en Algérie du nord", *Population*, vol. 29, nº 1 (janvier-février 1974), p. 45.

(2) Algeria, Secrétariat d'Etat au plan, Direction des statistiques, *Etude statistique nationale de la population; résultats de l'enquête démographique; données essentielles sur le mouvement de la population algérienne*, Series 2, No. 5 (Algiers, 1974), p. 130.

(3) Hussein Al-Baradei and K. E. Vaidyanathan, "Trends and differentials of mortality in Algeria" (Cairo Demographic Centre, Doc. CDC/S75/15, 1975).

(4) V. G. Valaoras and others, "Population analysis of Egypt, 1935-1970 (with special reference to mortality)" (Cairo Demographic Centre, Occasional Paper No. 1, 1972).

(5) G. B. Saxena, *Life Table: 1964-74, Socialist People's Libyan Arab Jamahiriya*. Draft of Monograph No. 3 of 1973 Census of Libya. Libyan Arab Jamahiriya, Department of Census and Statistics (Tripoli, 1978).

(6) Mahmoud Issa, "Estimation of mortality level in Libya, 1972" (Cairo Demographic Centre, Doc. CDC/S75/5, 1975).

(7) K. V. Ramachandran, "Evaluation of the 1973 Census of Libya". Workshop on methods of demographic data evaluation, adjustment, and analysis. Regional Institute for Population Studies (Legon, Ghana, 1977).

(8) L. Nawar and K. E. Vaidyanathan, "Trends and differentials in mortality in Morocco" (Cairo Demographic Centre, Doc. CDC/S75/10, 1975).

(9) K. V. Ramachandran, "Population count, and age, sex, and other characteristics; an evaluation of 1973 Census of Sudan". Regional Institute for Population Studies (Legon, Ghana, 1978).

(10) Ali B. Taher Ouni and S. Zaghloul Amin, "Analysis of mortality in Tunisia, 1968" (Cairo Demographic Centre, Doc. CDC/S75/13, 1975).

(11) Tunisia, Institut national de la statistique, *Enquête nationale démographique 1968-1969, fascicule 3, mouvement de la population*, Etudes et enquêtes de l'INS, Série démographie, nº 6 (Tunis, 1974), p. 40.

tality in Northern Africa is provided by observed age patterns themselves. Coale and Demeny have summarized four different types of age patterns of mortality, each of which varies systematically with mortality level.[2] These types have been designated "North", "East", "South" and "West". The "West" pattern is an average one about which the other three patterns deviate systematically. Therefore, it is useful to compare the Northern African age-specific death rate function to this "average" standard.

Such a comparison is shown in figure III.1. On this figure is plotted the level of life expectancy at birth that is "typically" associated in the "West" and "South" mortality models with each of the age-specific death rates in a particular country. Thus, a completely horizontal age profile in figure III.1 would indicate a perfect correspondence between the observed age-specific death rates and some set of age-specific death rates contained in the Coale-Demeny "West" or "South" models. A non-horizontal profile indicates that the observed rates are out of phase with the model, since the observed rates are located at several levels rather than a single level of mortality in the model. The comparison which follows relates to the data for males, although the same general features are also displayed by the female data.

It is evident from figure III.1 that the "West" model does not provide a particularly good representation of the age-specific death rate sequence in the three countries of Northern Africa shown. Relative to this model, their death rates at ages 1-4 years are unusually high (associated in the "West" model with a lower life expectancy than are death rates at other ages); and mortality at ages 10-25 years is relatively low. Infant mortality seems somewhat on the high side, but not to the same extent as mortality at ages 1-4. Mortality at ages over 60 years seems unusually low in

[2] Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966).

TABLE III.3. AGE PATTERNS OF MORTALITY IN NORTHERN AFRICA

Age interval (years)	Probabilities of dying in interval for person who survives to beginning of interval ($_nq_x$ × 1,000) Algeria, 1969-1970[a] Males	Females	Egypt, 1963-1967[b] Males	Females	Tunisia, 1968-1969[c] Males	Females
0-1	146.5	145.8	127.50	131.20	136.40	133.90
1-5	81.6	90.2	64.46	65.25	72.84	85.34
1-2	36.8	42.3	28.25	40.15	...	...
2-3	23.8	25.9	25.53	26.18	...	...
3-4	13.5	14.9	19.00	19.05	...	...
4-5	10.0	9.9	8.30	7.91	...	...
5-10	14.4	27.6	3.25	3.08	14.36	12.60
10-15	11.3	15.3	9.50	9.11	8.83	7.76
15-20	11.8	18.4	13.18	12.50	11.93	12.00
20-25	19.6	12.9	17.41	15.85	13.64	14.76
25-30	18.8	21.0	23.59	19.83	15.70	16.96
30-35	14.6	20.2	31.22	25.40	16.96	19.78
35-40	25.2	20.8	41.31	34.00	19.53	27.49
40-45	36.6	27.8	54.68	45.50	29.57	28.82
45-50	38.6	30.8	72.36	60.90	39.90	34.72
50-55	71.4	33.9	95.76	81.40	59.31	47.20
55-60	121.4	94.1	126.80	108.90	92.52	83.23
60-65	164.3	141.9	167.70	145.60	145.19	125.95

TABLE III.3 (*continued*)

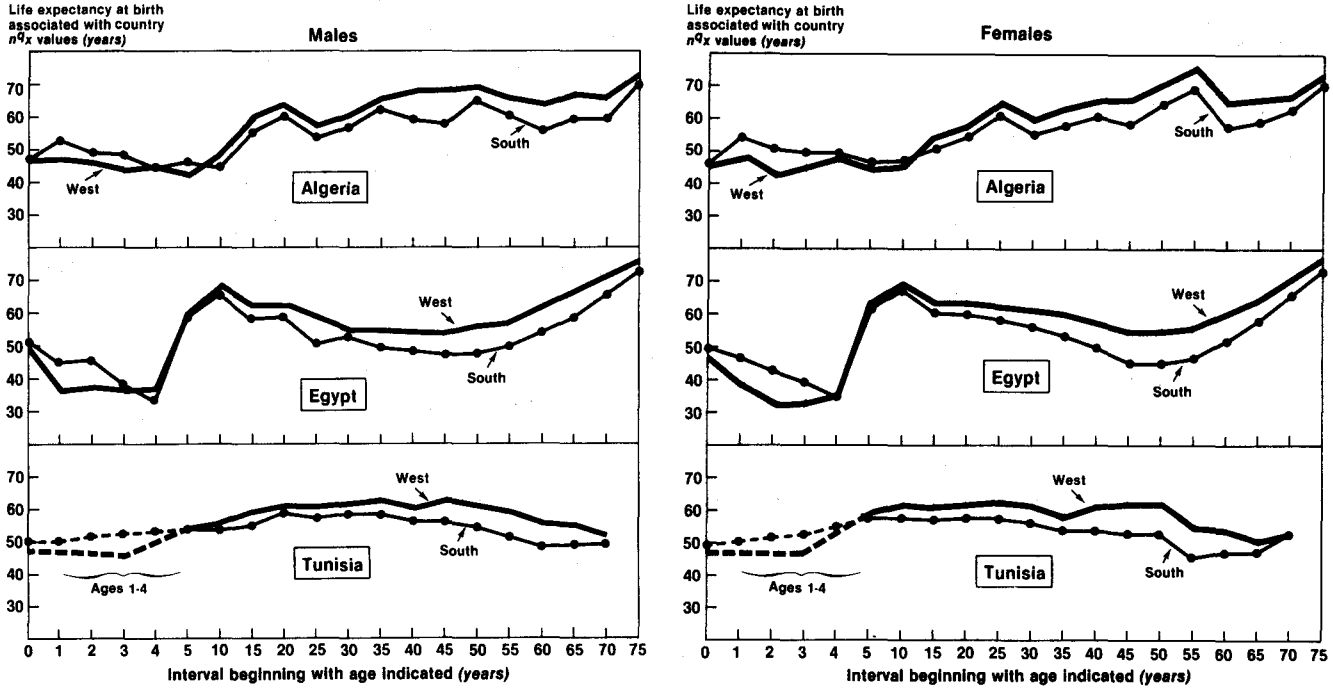
Age interval (years)	Probabilities of dying in interval for person who survives to beginning of interval ($_nq_x \times 1{,}000$)					
	Algeria, 1969-1970[a]		Egypt, 1963-1967[b]		Tunisia, 1968-1969[c]	
	Males	Females	Males	Females	Males	Females
65-70	260.4	219.2	222.00	194.80	209.15	193.94
70-75	323.2	289.4	294.40	260.50	316.74	274.51

[a] Jacques Vallin, "La mortalité en Algérie", *Population*, vol. 30, n66 (novembre-décembre 1975), p. 1036. Values of $_1q_0$ for x = 0-4 years have been taken from the official national life table and adjusted to agree with $_4q_1$ given by J. Vallin. It was assumed that the rate of omission was the same at each age 1 to 4 years.

[b] V. G. Valaoras and others, "Population analysis of Egypt, 1935-1970 (with special reference to mortality)" (Cairo Demographic Centre, Occasional Paper No. 1, 1972), table 18. Age-specific death rates were adjusted on the basis of (*a*) rectified population (on the assumption that the enumeration of the male population was more complete than that of the female, the number of females in total population was increased to 50.3 per cent of total population), and (*b*) adjusted deaths (to account for the missing neonatal deaths and cumulative percentage of deaths for each sex).

[c] Deaths by age and sex have been taken from Tunisia, Institut national de la statistique, *Enquête nationale démographique 1968-1969, fascicule 3, mouvement de la population*, Etudes et enquêtes de l'INS, Série démographie, n° 6 (Tunis, 1974), p. 46. Deaths over age 1 year have been inflated by the factor of 1.09 as suggested by J. Vallin. See Jacques Vallin, "Mortalité et fécondité en Tunisie; résultats commentés de l'enquête nationale démographique (END)", *Population*, vol. 30, n° 6 (novembre-décembre 1975), pp. 1160-1166. The death rates have been smoothed based on the registered deaths for 1968-1969.

Figure III.1. Life expectancy at birth associated with age-specific probabilities of dying ($_nq_x$) in "South" and "West" model life tables of Coale and Demeny, Algeria (1969-1970), Egypt (1963-1967) and Tunisia (1968-1969)



Sources: Table III.3 and Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966).

Algeria and Egypt but not in Tunisia. Egyptian data show enormous variation in the level of life expectancy associated with their age-specific death rates. The Egyptian death rate at ages 1-4 is typically associated with a life expectancy of about 36 years, while at ages 5 and over, the level typically ranges from 55 to 65 years. A somewhat narrower range of implied levels is observed in Tunisia and Algeria.

The "South" model of Coale and Demeny contains a somewhat similar pattern of deviations from the "West" model. Therefore, it is not surprising that the "South" model fits the Northern African data better than does the "West". This improved fit is evident for all three countries in figure III.1. The "South" model provides a more nearly horizontal profile of implied life expectancies: higher at ages under 5 years and lower at ages over 10 years. The fit is quite good in Tunisia but Egypt still shows a very erratic profile, though it is somewhat improved over that implied by the "West" model.

It is surely possible that data errors rather than true mor-

tality conditions have been principally responsible for creating the profiles shown in figure III.1. This seems a particularly strong possibility at ages over 50 in Egypt, where measured rates "improve" markedly from age to age. Elsewhere, data errors seem a somewhat less likely source of the emergent patterns, simply because they would have to be implausibly large. Taking Algeria, the intermediate case in figure III.1, as an example, it would be necessary to divide the male death rate at age 1-4 years by approximately 10 or to raise the death rate at ages 35-39 years by approximately 26 per cent, in order that the rates at these ages imply the same level of life expectancy as the "West" model pattern of Coale and Demeny. It would be difficult to develop a plausible explanation of how such errors could have occurred in the competently conducted Algerian survey, particularly since it is typically the case that death registration in childhood is less complete than in adulthood.

A reasonable conclusion is that the "South" model life table system provides an adequate representation of Northern African conditions, certainly better than the "West" model. An extreme "South"-type pattern is implied for Egypt, but this may be spurious; one would have a bit more confidence in the validity of an extreme "South" pattern if it had also shown up in Algeria and Tunisia.

Sex patterns of mortality in Northern Africa are somewhat unusual. For the most part, the age-specific death rates for Northern African countries seem to conform to the standard pattern in which male rates are higher than female. However, in most life tables for the region, there are age spans in which female mortality exceeds that of males. In the Egyptian life tables centred on 1960 and 1965, female death rates are higher than those of males during each of the first five years of life, although the differences are small. Female death rates are also higher than the male ones in the Tunisian life table for 1968-1969 in the age-group from 1 to 4 years and in half a dozen five-year age-groups scattered throughout adulthood (see table III.3). Female mortality exceeds male mortality in the life tables for both the urban and rural areas only in the age-groups from 20 through 24, 55 through 59 and 70 through 79 years. Such an erratic age pattern of differentials may be more indicative of sex differences in age misreporting or in omission from statistical systems than of true mortality differences.

In Morocco, the urban life table for 1972 has higher female than male death rates only for the first year of life while the rural one has excess female mortality occurring only in the age group of 70 or more years. However, in the 1970 national life table for Morocco, excess female mortality is far more pervasive. It occurs in the ages from 1 through 19 years and in the five-year age-groups from 25 to 29 and 65 to 79 years. Male and female mortality are given as the same in age-groups 30-34 years and 80 or more years, and between the ages of 35 and 44 years male death rates are only marginally higher than those of females. In both the Algerian life tables for 1948 and 1969-1971, on the other hand, female mortality is consistently higher than male mortality from 1 to 40 years of age. At least in the period 1969-1971, female mortality seems to have begun to exceed male mortality around the fourth month of life.[3]

Two sets of figures for the Libyan Arab Jamahiriya provide conflicting patterns. In both life tables female mortality is higher than male mortality in the age-group from 1 through 4 years. In the period life table for 1964-1974, however, female mortality also exceeds that of males between ages 6 and 12 years, whereas in the life table for 1972 female mortality exceeds male mortality in the age-group from 30 through 39 years. Moreover, in the 1972 life table, the ratios of male to female mortality rates, while variable, do not stray far from unity except in the age-group 70 to 79 years, where male mortality is about 36 per cent higher than female. By contrast, in the period life table for 1964-1974, after the age of 12 years male death rates are not only higher than female but the absolute difference between them increases in size with age. As a result, until 30 years of age or so, male mortality exceeds that of females by about 10 per cent. Thereafter the relative differential increases to somewhat more than 40 per cent, around age 50, and then it drops off, reaching about 10 per cent again by 80 years of age.

As noted at the beginning of this section, the age-specific death rates for males are, for the most part, higher than those for females in the Northern African countries. However, at one or more points during the reproductive years in data for Algeria, the Libyan Arab Jamahiriya in 1972, Tunisia and Morocco the death rates for women exceeded those for men. The difference between rates is small enough in most instances to be attributed to the marginal quality of the data, but the fact that the estimated rates of all four countries in the ages from 20 through 49 years of age are so similar for each sex suggests that, although female mortality as a whole may not exceed male mortality, female death rates in the reproductive ages have been uncommonly high for reasons related primarily to childbearing.

In the two countries for which the data are perhaps best —Egypt and Tunisia—sharply contrasting patterns are found for all ages over 5 years. In Egypt the excess male mortality at all ages over 5 years is very similar to that found in the more developed countries and in Latin America, although the changes in rates from 1960 to 1965 indicate a relatively more rapid decrease in male than in female mortality. The 1968 data for Tunisia, on the other hand, show a higher female than male mortality at nearly all ages, while those for 1968-1969 exhibit a pronounced excess of female mortality only through the childbearing years. During the reproductive ages, the ratios of male to female death rates for Tunisia are close to the reciprocals of the ratios for Egypt. In the consolidated age-group from 20 to 49 years, for example, the average Egyptian male

[3] For Tunisia, see Tunisia, Institut national de la statistique, *Enquête nationale démographique 1968-1969, fascicule 3, Mouvement de la population*. Etudes et enquêtes de l'INS, Série démographie, No. 6 (Tunis, 1974), pp. 39, 44-46. For Algeria, see Dominique Taburtin, "La Mortalité en Algérie selon le sexe, le secteur d'habitat et quelques caractéristiques socio-économiques (résultats de l'enquête démographique de 1969-1971)", *Population et famille*, vol. 39 (1976), p. 120. The appropriate citations for Egypt, the Libyan Arab Jamahiriya and Morocco may be found in tables III.1 and III.4.

TABLE III.4. URBAN AND RURAL MORTALITY ESTIMATES FOR NORTHERN AFRICA: INFANT MORTALITY RATES AND LIFE EXPECTANCY AT BIRTH

Country and source code		Period	Estimated infant mortality rate ($1{,}000\ {}_1q_0$)[a] Urban	Rural	Estimated life expectancy at birth (years (e_0))[a] Urban	Rural
Algeria	(1)	1950-1954	152	143	...	...
	(1)	1955-1959	153	160	...	...
	(1)	1960-1962	142	155	...	...
	(1)	1963-1965	119	131	...	...
	(1)	1966-1968	113	133	...	...
	(1)	1969-1971	118	152	59	51
Morocco	(2)	1972	119 (M)	183 (M)	50 (M)	46 (M)
			122 (F)	158 (F)	51 (F)	48 (F)
Sudan	(4)	1968-1973	146	162	47	42
Tunisia	(3)	1968-1969	111	126	...	...
			122 (M)	127 (M)	...	...
			101 (F)	125 (F)	...	...

Sources:

(1) Dominique Tabutin, *Mortalité infantile et juvénile en Algérie*, Institut national d'études démographiques, Travaux et documents, Cahier n° 177 (Paris, 1976), pp. 227-229; and Jacques Vallin, "La mortalité en Algérie", *Population*, vol. 30, n° 6 (novembre-décembre 1975), pp. 1041-1042. See also A. M. Bhari and others, *La population de l'Algérie*, CICRED Series, World Population Year 1974 (Paris, 1974), p. 50.

(2) Morocco, Direction de la statistique, "Table de mortalité marocaine", in *As-Soukan, Etudes du Centre de recherches et d'études démographiques*, n° 3 (Rabat, 1975), pp. 1-16.

(3) Tunisia, Institut national de la statistique, *Enquête nationale démographique 1968-1969, fascicule 3, mouvement de la population*, Etudes et enquêtes de l'INS, Série démographie, n° 6 (Tunis, 1974), pp. 39, 44-46.

(4) K. V. Ramachandran, "Population count, and age, sex, and other characteristics; an evaluation of 1973 Census of Sudan". Regional Institute of Population Studies (Legon, Ghana, 1978).

[a] For both sexes unless noted (M) for males or (F) for females.

death rate in 1965 was about 35 per cent higher than the female, whereas the average female death rate for Tunisia in 1968 was about 25 per cent higher than the male. Female mortality was high enough in Tunisia to produce female life expectancies that were lower than the ones for males at all ages in 1968, though caution is required since a slight reversal occurs in the life tables for 1968-1969. In Egypt, female life expectancy at birth remained slightly higher than that of males.

National differences notwithstanding, the weight of evidence would seem to justify the conclusion that throughout Northern Africa female mortality has usually exceeded that of the males during part of the post-neonatal period and in early childhood. The shift from excess male to excess female mortality may occur at different times during infancy in such a way as to make infant mortality rates for males alternate between slightly higher and slightly lower than female infant mortality rates. In addition, with the exception of Egypt, there would seem to be a similar tendency for female excess among the age-specific death rates during part of the reproductive ages from 15 through 49 years. In general, males have higher death rates at other ages in this region; the net result is unusually small sex differences in life expectancy at birth.

3. *Urban/rural differentials in mortality*

The available measurements of urban/rural differentials in mortality show, with a single exception, that urban mortality has been lower than rural (see table III.4). A careful study of mortality in Algeria during the period 1969-1971 revealed that rural/urban mortality differences are part of a more general pattern related to density of settlement and size of place. Infant mortality rates for sparsely settled rural areas were estimated to have been 152 per 1,000 live births. The rate decreased as the population density increased and reached its lowest point, 100, in the metropolitan areas of the country. One curious aspect of the analysis, however, is that by age 5, life expectancy for females was the same for all urban areas regardless of size, and that of males was the same for all urban and rural zones outside the metropolitan areas. Nevertheless, the estimated life expectancies at birth and age 5 years for both sexes combined followed the pattern indicated by the infant mortality estimates. Life expectancies were highest in the most urbanized and lowest in the most rural areas.[4]

A similar oddity occurs in the 1972 life tables for Morocco. For males and females alike the infant mortality rates are higher in rural than in urban areas and life expectancy at birth is higher in urban than in rural areas, as one would expect. However, the life expectancies at age 1 year, for each sex, are almost the same in the urban and rural life tables. Moreover, at age 5 years for males, and at a slightly higher age for females, the life expectancies for rural areas are consistently higher than those for urban areas.[5] This phenomenon suggests that, in some instances, infants and children under 5 years of age may be the principal beneficiaries of urban residence. Such a possibility must be borne in mind in interpreting data, including that presented elsewhere in this volume, that demonstrate ur-

[4] See Dominique Tabutin, *Mortalité infantile et juvénile en Algérie*, Institut national d'études démographiques, Travaux et documents, Cahier No. 177 (Paris, 1976), pp. 227-229; and Jacques Vallin, "La Mortalité en Algérie", *Population*, vol. 30, No. 6 (novembre-décembre 1975), pp. 1041-1042.

[5] Morocco, Direction de la statistique, "Table de mortalité marocaine", *As-Soukan, Etudes du Centre de recherches et d'études démographiques*, No. 3 (Rabat, 1975), pp. 1-16.

TABLE III.5. MORTALITY IN NORTHERN ALGERIA BY SOCIO-ECONOMIC CLASSIFICATION OF FAMILIES, 1969-1971

Economic classification of head of household	Life expectancy at birth (e_0) (years)	Early childhood mortality ($_1q_0$)	Infant mortality: Estimated rates ($_1q_0$) Total	Urban	Rural	Ratio of rates (rural ÷ urban)
Branch of economic activity						
All northern Algeria	54	...	141	118	152	1.29
Industry	61	...	110	93	136	1.46
Transport, service / Commerce, banking	60	...	114 / 121	100 / 111	139 / 134	1.39 / 1.21
Public works etc.	53	...	154	149	158	1.06
Agriculture	52	...	158	169	157	0.93
None	47	...	143	...	...	...
Ratio of infant mortality rates (highest ÷ lowest)			1.44	1.82	1.18	
Occupation						
Professional, technical	60	52	125	93	165	1.77
Vendors, office workers			106	97	122	1.26
Service, transport			112	107	119	1.11
Artisans, labourers	57	65	134	112	160	1.43
Farmers	51	112	160	177	157	0.89
None	47	83	143	...	...	...
Ratio of infant mortality rates (highest ÷ lowest)			1.51	1.90	1.39	

Sources: Dominique Tabutin, *Mortalité infantile et juvénile en Algérie*, Institut national d'études démographiques, Travaux et documents, Cahier n° 177 (Paris, 1976), pp. 215-216; Dominique Tabutin, "La mortalité en Algérie selon le sexe, le secteur d'habitat et quelques caractéristiques socio-économiques (résultats de l'enquête démographique de 1969-1971)", *Population et famille*, vol. 39 (1976), pp. 133-139; and Jacques Vallin, "La mortalité en Algérie", *Population*, vol. 30, n° 6 (novembre-décembre 1975), pp. 1043-1044.

ban/rural differences in infant and child mortality with no information on higher ages.

Another interesting feature of urban/rural differentials that arises from the recent Algerian studies relates to the pattern of mortality during the first three years of life. In data for three intervals between 1960 and 1968, the urban/rural differential in each instance was found to increase with age. On average, the rural probability of dying for the first year of life was about 13 per cent higher than the urban rate. For the second year of life it was almost 60 per cent higher, and for the third year of life it was over twice as high (2.18). It is rather odd that the urban/rural differential increases so much from the second to the third year, although the increase doubtless reflects, at least in part, the increased risks and losses due to infectious, parasitic and respiratory diseases in the rural areas after infancy. There is obviously room for a great deal of fruitful research to identify the dimensions and clarify the sources of rural/urban differences in mortality.

4. *Socio-economic differentials in mortality*

Among the countries of Northern Africa it is in Algeria that socio-economic differentials in mortality have been most intensively studied. The data grouped by economic activity and occupation of the head of the household (see table III.5) show the predictable relationships: the probabilities of dying are highest among the unskilled and the unemployed. In the non-agricultural sector the estimated rural infant mortality rates are consistently higher than the urban ones, and in both the urban and rural areas those rates vary inversely with presumed socio-economic status. That is, the activities requiring the most skills have the lowest mortality rates and infant mortality is highest among the least skilled. The difference, based on a simple division between skilled and unskilled workers, is quite striking. Estimated infant mortality rates are 107 for the former and 152 for the latter. The associated life expectancies at birth are 61 years for skilled and 54 years for unskilled workers.[6] As can be seen in table III.5, the range of estimated life expectancies is greater for the more refined subdivision of economic activities and occupations, varying from a high of 60 to 61 years in the higher status occupations and economic sectors to a low of 47 years for those without occupation and belonging to none of the economic sectors.

It will be noted that infant mortality rates are at their highest in the agricultural population in both urban and rural areas. That they are higher among urban than rural agricultural populations may reflect the small number of cases on which the former estimate is based. However, it may also be the case that the urban agricultural group is particularly disadvantaged and may contain a large number of under-employed or unemployed workers and/or recent rural-urban migrants who are in fact reporting on their last job. Whatever the case, it will also be noted that, although infant mortality estimates are lower for people without occupations than for farmers, the estimated life expectancy for the farm population is higher than it is for people in

[6] See Jacques Vallin, "La Mortalité en Algérie", *Population*, vol. 30, No. 6 (novembre-décembre 1975), p. 1044; and Algeria, Commissariat national aux recensements et enquêtes statistiques, *Résultats de l'enquête démographique, 4: Mortalité*, Étude statistique nationale de la population, Series 2, No. 7 (Oran, 1975).

families without occupations. Age-specific death rates at all ages except infancy are higher for families that gave no occupation for the head of the household than for any of the five occupational categories in table III.5. As a consequence, the curve showing the number of survivors drops off much more rapidly for the "no occupation" household population than it does for any of the others, and it does not have the same characteristic plateau from early childhood through the young adult ages.[7]

Algerian data grouped by education show a similar differential between estimates of infant mortality for the literate and the illiterate populations. Except for the sparse rural areas, mortality estimates are consistently higher for the illiterate population than for the literate (see table III.6). For northern Algeria as a whole, the associated life expectancies at birth for the literate and illiterate groups differed by 10 years. The estimated life expectancy at birth for the literate population was 62 years while that for the illiterate was only 52. At age 5, the expectation of life was 66 and 58 years for each group, respectively.[8] The estimate of infant mortality for the literate population in the sparse rural areas is substantially higher than any of the others for the literate population and it is also significantly higher than the estimate for the illiterate population in the sparse rural areas. These facts cast suspicion on the estimates for the sparse rural areas. Generally, table III.6 suggests that differences in mortality associated with literacy or residence do not attenuate substantially when the other factor is controlled. Unfortunately, it is not possible with Northern Africa data to examine simultaneously the effects of female and male literacy, a distinction that has been shown to be useful in other regions.

The probabilities of dying between the first and fifth birthdays ($_4q_1$) for household populations grouped by the occupation of the household head showed a greater variation than did the estimated infant mortality rates in table III.5. Similarly, Algerian data for the probability of dying during the second year of life, calculated for the literate and illiterate population subgroups, exhibited a much wider differential than for infant mortality. Although the absolute difference, between the two literacy categories, in mortality at ages 1 to 2 years was about the same in both rural and urban areas—some 27 per 1,000—the relative difference was much greater in urban areas.[9] Since the numbers upon which these probabilities are based were much smaller than those on which infant mortality estimates were based, it is unwise to make much of urban/rural differences; instead it should be emphasized that large socio-economic differences have been found in infant and early childhood mortality in all subgroups of the Algerian population.

[7] See Dominique Tabutin, "La mortalité en Algérie selon le sexe, le secteur d'habitat et quelques caractéristiques socio-économiques (résultats de l'enquête démographique de 1969-1971)", *Population et famille*, vol. 39 (1976), pp. 133-136.

[8] Dominique Tabutin, "La Mortalité en Algérie selon le sexe, le secteur d'habitat et quelques caractéristiques socio-économiques (resultats de l'enquête démographique de 1969-1971)", *Population et famille*, vol. 39 (1976), p. 133.

[9] A. M. Bahri and others, *La Population de l'Algérie*, CICRED Series, World Population Year 1974 (Paris, 1974), p. 51.

TABLE III.6. INFANT MORTALITY AND LITERACY OF HOUSEHOLD HEAD IN NORTHERN ALGERIA, 1969-1971

Geographical area	*Estimated infant mortality rate ($_1,000_1q_0$)*			*Ratio of rates (illiterate ÷ literate)*
	All	*Literate*	*Illiterate*	
Northern Algeria	142	123	148	1.20
Metropolitan	100	82	119	1.45
Other cities	141	120	151	1.26
Dense rural	146	127	153	1.20
Sparse rural	152	166	150	0.90
Ratio of rates (highest ÷ lowest)	1.52	2.02	1.29	

Source: Dominique Tabutin, *Mortalité infantile et juvénile en Algérie*, Institut national d'études démographiques, Travaux et documents, Cahier nº 177 (Paris, 1976), p. 213.

Most of the tendencies suggested for Algeria can also be found in the Sudan. Unpublished results of the 1973 census, which asked retrospective questions on the mortality of children, are shown in table III.7. These data are tabulated according to the occupation and educational attainment of the mother. In urban areas, children of mothers in white-collar occupations clearly enjoy the lowest mortality, with children of inactive mothers in second place. The inactive group also had the lower mortality of the two rural categories, and it has been suggested that inactive women may enjoy a better economic position. Children of urban agricultural workers have the highest mortality levels, followed rather closely by children of urban blue-collar workers and active workers in rural areas. The probabilities of dying before age 2 for offspring of white-collar workers are less than half of those for these latter three groups. Educational attainment also discriminates quite decisively among childhood mortality levels, particu-

TABLE III.7. MORTALITY DIFFERENTIALS IN THE SUDAN ACCORDING TO SOCIO-ECONOMIC CHARACTERISTICS OF THE MOTHER, ESTIMATED FROM 1973 CENSUS DATA

Socio-economic characteristics and rural/urban residence of mother	*Proportion dying by age 2 [q(2)], both sexes*	*Expectation of life at birth implied by q(2) in "North" model life tables (years)*	
		Males	*Females*
Economic activity or occupational group			
Rural			
Active	0.260	32	35
Inactive	0.199	39	42
Urban			
White-collar	0.119	51	55
Blue-collar	0.260	32	35
Agricultural	0.303	28	31
Inactive	0.170	43	47
Educational attainment			
Rural			
No education	0.212	38	41
With education	0.151	46	46
Urban			
No education	0.195	39	43
Elementary	0.134	51	55
Higher education	0.077	59	63

Source: M. K. Rizgalla, "Mortality levels, patterns and differentials in the Sudan" (unpublished Master's thesis, University of Ghana, 1977), pp. 252, 256, 268-269.

NOTE: Mortality estimates are based on data from four provinces comprising about two fifths of the total population of the Sudan.

larly in urban areas. Children of urban mothers with some education beyond elementary school have only a 7.7 per cent chance of dying before age 2, compared to a risk of 19.5 per cent if the mother is uneducated. The mortality of children of mothers schooled only at the elementary level is about half-way between these figures.

B. Sub-Saharan Africa

The direct measurement of mortality for all but a few, unrepresentative areas in sub-Saharan Africa (namely, Mauritius, Réunion and Cape Verde) is not yet possible. Consequently, levels, trends and patterns have so far been estimated by indirect or inferential means. None of the techniques used is fully satisfactory, and levels of mortality can only be estimated within relatively broad confidence intervals. In these circumstances, the measurement of trends is particularly difficult. Ideally, a measure of over-all mortality level for a population for use in inter-country comparisons should take into account death rates at all ages, and the measure should be expressible in a form that eliminates the effects of the population's age structure. The expectation of life at birth meets these requirements. However, for very few countries in sub-Saharan Africa are data available on age patterns of mortality over the entire life span. Because of this limitation, estimates of expectation of life at birth are based, for the most part, on retrospective data collected in sample surveys, and pertaining to only a narrow range of ages. The mortality rates for these age-groups are compared with sets of model life tables from which expectation of life at birth and other mortality parameters are estimated.

1. *Mortality during early childhood*

The best current estimates of mortality in sub-Saharan Africa are for the most part based on indirect methods relying on reported survivorship of kin. These methods, often designated the Brass approach (after William Brass), usually estimate the fraction of births who survive to one of several ages.[10] As noted in the introductory chapter, the methods most accurately estimate the numbers of survivors to ages 2, 3 and 5 years. The estimate of the number of survivors at age 2 years is based on the number of children reportedly ever born to women who gave their age as between 20 and 24 years, inclusive, and the number of those children who were reported to be still alive at the time of the census or survey interview. Such estimates of the numbers of survivors to the age of 2 years per 1,000 live births, as applied to data for sub-Saharan Africa, are given in table III.8. These data are presented before the more conventional measures of mortality because they are believed to be somewhat more reliable and internationally comparable. Nevertheless, they are subject to many possible sources of error. Aside from sampling errors, imperfect census coverage, etc., the estimates may be faulty because of misreporting of mothers' ages, the number of children ever born, or the number of children still living. Flawed estimations may also result from having used inappropriate

Table III.8. Mortality before the age of 2 years in sub-Saharan Africa, 1950-1975

Region and country	*Period*	*Estimated survivors to exact age of 2 years per 1,000 live births* (l_2)	*Probability of dying during first two years of life* ($1{,}000\ {}_2q_0$)
Eastern Africa			
Burundi	1952-1957	796	204
Kenya	1962	829	171
	1969	849	151
Madagascar	1966	864	136
Malawi	1970	653	347
Mozambique	1950	729	271
Rwanda	1952-1957	796	204
	1970	848	152
Uganda	1959	780	220
	1969	838	162
United Republic of Tanzania	1967	803	197
	1973	885	115
Zambia	1969	829	171
Middle Africa			
Central African Republic	1959-1960	727	273
Chad	1964	748	252
Congo	1960-1961	775	225
Gabon	1960-1961	794	206
Zaire	1955-1957	792	208
Southern Africa			
Botswana	1971	870	130
Lesotho	1966	860	140
Swaziland	1966	798	202
Western Africa			
Benin	1961	719	281
Ghana	1960	806	194
Guinea	1954-1955	688	312
Guinea-Bissau	1950	728	272
Liberia	1970	755	245
	1974	851	149
Mali	1956-1958	700	300
	1960-1961	702	298
Mauritania	1964-1965	760	240
Niger	1960	731	269
Sierra Leone	1973	684	316
Togo	1961	738	262
Upper Volta	1960-1961	660	340

Sources: See table III.9.

reference models for the age-specific death rates of the population or for the fertility pattern of reporting women. Of the many sources of error, substantial evidence has accumulated to indicate that by far the most serious is inaccurate reporting of children ever born and children surviving. It is generally believed that dead children tend to be reported less completely than living ones, producing a downward bias in mortality estimates using the Brass approach. However, the reporting of stillbirths or foetal deaths as live births can produce a bias in the opposite direction.

The utility of the data in table III.8 may also be questioned on two other grounds. Within any five-year period, only a small fraction of the sub-Saharan population is represented, and within the whole 25-year period, the data do not embrace even half of the estimated total population in 1970. Southern Africa is especially under-represented in the estimates. Estimates for two points in time are availa-

[10] See William Brass and others, *eds., The Demography of Tropical Africa* (Princeton, N.J., Princeton University Press, 1968), chap. 3.

ble for only six countries, which account for a bare 17 per cent of the sub-Saharan population, and only four of the six pairs of estimates display credible trends.

It is very likely that large measurement errors exist in the Liberian and Tanzanian data for one or both dates, but there is no way of knowing which of the estimates is best. Each pair of estimates is closely spaced and implies implausibly rapid mortality improvement between the observations. When fitted to the Coale and Demeny "North" models, the figures for the United Republic of Tanzania imply an average annual gain in life expectancy at birth of two years during the six-year period from 1967 to 1973. The Liberian estimates imply an annual growth in life expectancy of more than three years during the period from 1970 to 1974. These declines far outpace what could be expected on the basis of events in the country or trends in other countries.

If the Liberian and Tanzanian figures are dismissed, one is left with the estimates for three Eastern African countries (Kenya, Rwanda and Uganda) and one Western African country (Mali) upon which to base an analysis of time trends in sub-Saharan mortality. The four countries contain a bare 11 per cent of the estimated sub-Saharan population. The Mali estimates cover a very short time span, less than five years, and do not indicate any change in mortality. The estimates for the three Eastern African countries span the period from 1954 to 1970. Each of these exhibits a fairly sizable decline in the probability of death between birth and age 2: 20 per 1,000 during a seven-year period in Kenya; 52 per 1,000 in a 15-year period in Rwanda; and 58 per 1,000 in a decade in Uganda. These estimates are of course subject to a good deal of error; it is perhaps only significant that in five of the six cases where trend data are available, non-trivial declines are recorded.

Attempts to relate the probability of dying during the first two years of life to the date of observation for the observations in table III.8 produce very low correlations. In all regions except Middle Africa, the correlations are negative: later observations are associated with lower mortality. But such a procedure mixes actual trends with the changing composition of countries that supply data.

A linear regression relating $q(2)$ to date of observation for all of the data on sub-Saharan Africa in table III.8 suggests that the probabilities of dying during the first two years of life declined moderately during the period. These probabilities of dying imply, in the Coale and Demeny model life tables, an increase in life expectancy at birth from 32 years in 1950 to about 42 years in 1970, and by extrapolation, to about 46 years in 1978. According to this standard, life expectancy increased during the period at an over-all average of about 1.3 per cent annually. In absolute terms, the regression and the "North" models imply that life expectancy increased at about 0.5 years per annum, but at a somewhat higher average annual rate at the beginning of the period (1.53 per cent between 1950 and 1955) than at the end of the period (1.17 per cent between 1970 and 1975). An exponential curve, assuming a constant rate of decline in $q(2)$, gives a slightly better fit to the data in table III.8 than does a linear relationship. According to the exponential curve, life expectancy at birth was about 31 years in 1950, 43 years in 1970 and 47 years in 1978.

2. *Infant mortality rates and life expectancies at birth*

In a few atypical countries, vital registration and census data are sufficiently good that direct estimates of mortality can be made. There is an enormous gap in quality of information between these countries and the remainder. There have been very few multiround surveys in sub-Saharan Africa, and, because more than one census of adequate quality does not at present exist for any but the most atypical sub-Saharan countries, inter-censal survival analyses are not feasible. Consequently, estimates of both infant mortality rates and life expectancy at birth are most commonly derived by fitting the childhood survival functions discussed above to one of the model life table systems. For the most part, the "North" model of Coale and Demeny and the African standard models of Brass, which produce essentially the same results, have been used to perform the transition of childhood mortality into other indices.

The data on infant mortality and life expectancy in table III.9 refer to a number of periods and dates between 1940 and 1975, but the dates given are not always true reference dates, because the indirect methods of estimating early childhood mortality measure mortality experience during varying periods prior to the time when the data were collected. For this reason, as well as because of the uncertain quality of much of the data, it does no injustice to them if they are rearranged in a more convenient manner. In order to illustrate more clearly the apparent levels and trends, the estimates in table III.9 have been grouped in table III.10 into broader periods of 1945 to 1955, 1955 to 1965 and 1965 to 1975. Excluding the atypical countries (Mauritius, Réunion and Cape Verde), where mortality has been relatively low and both infant mortality rates and life expectancies are based on complete vital registration, the range of infant mortality rates and of life expectancies show little change from period to period. Around 1950 the range of estimated infant mortality rates was from 120 to 235 deaths per 1,000 live births. Around 1960 it was 130 to 230, and around 1970 it was 95 to 250. The range of life expectancies was from 28 to 46 years around 1950, from 27 to 43 years around 1960, and from 28 to 52 years around 1970. The means and standard deviations for the various sets of estimated infant mortality rates and life expectancies are the following:

	Mean	*Standard deviation*
Infant mortality rates ($1{,}000_1q_0$)		
Around 1950 (N = 9)	170	42
Around 1960 (N = 24)	185	35
Around 1970 (N = 20)	140	41
Life expectancy at birth *(years)*		
Around 1950 (N = 10)	39	8
Around 1960 (N = 30)	37	8
Around 1970 (N = 23)	45	8

Source: Calculated from figures in table III.10. N refers to number of countries.

Tables III.9 and III.10 provide a substantially expanded set of estimates, compared to table III.8, but, as has already been mentioned, these estimates are of a questionable, often less than fully comparable, quality. The means

TABLE III.9. INFANT MORTALITY RATES AND EXPECTATION OF LIFE AT BIRTH FOR SELECTED COUNTRIES OF SUB-SAHARAN AFRICA, 1950-1975, ESTIMATED FROM NUMBERS OF SURVIVORS TO AGES 2, 3 AND 5 YEARS

Region, country and estimated 1970 population (thousands)	*Period*	*Infant mortality rate* ($_1q_0$)	*Life expectancy at birth (years)*			*Basis of estimation*	*Source code*
			Both sexes	*Male*	*Female*		
Eastern Africa (99,818)							
Burundi (3,350)	1952-1957	155	40	...	...	B	5, 10
	1965	150	41	39	42	B	13, 18, 27
	1970-1971	140	44	43	46	B	13
Ethiopia (24,855)	1966-1968	140	43	...	...	B	8, 10
Kenya (11,247)	1948	185	36	...	...	C	2
	1962	130	43	...	...	B	2, 5, 8, 10, 18
	1969	120	47	...	...	B	1, 2, 8, 19, 22
Madagascar (6,932)	1966	105	50	...	...	B	1
Malawi (4,360)	1970	225	31	...	...	B	8
Mauritius (824)	1951-1953	101.2	51	49.8	52.3	A	24
	1961-1963	61.2	60	58.7	61.9	A	24
	1970-1972	58.9	63	60.9	64.9	A	24
Mozambique (8,234)	1950	200	34	...	...	B	1, 5, 8, 10, 18
Réunion (447)	1951-1955	125.3	51	47.5	53.4	A	24
	1963-1967	79.3	59	55.8	62.4	A	24
Rwanda (3,679)	1952-1957	155	40	...	...	B	5, 10
	1970	120	47	...	...	B	1
Uganda	1959	160	40	...	...	B	2, 5, 10, 19
	1969	120	45	...	...	B	8, 19, 22
United Republic of Tanzania (mainland) (13,273)	1956	190	35	...	...	C	5, 10, 19
	1967	145	41	39	42	B	2, 8, 19, 28
	1973	95	53	...	...	B	23
Zambia (9,806)	1953-1954	120	46	...	...	C	27
	1969	130	46	...	...	B	1, 8, 17
Middle Africa (40,446)							
Angola (5,670)	1940	275	26	...	...	B	5, 10
Central African Republic (1,612)	1959-1960	200	35	35	36	B	1, 6, 8, 18
Chad (3,640)	1963-1964	195	34	34	35	B	4, 6, 22
Congo (1,191)	1960-1961	185	38	36	39	B	1, 6, 8, 11, 18
Gabon (500)	1960-1961	230, 150	30, 41	..., 40	..., 42	B	1, 6, 8, 13, 18
Zaire (21,638)	1950-1955	175	37	...	...	C	26
	1955-1957	160	40	...	...	B	5, 8, 10, 18, 26
	1955-1960	175	37	...	...	C	25
	1960-1965	175	37	...	...	C	25
	1965-1970	160	39	...	...	C	25
	1974	175	37	...	...	C	25
Southern Africa (24,202)							
Botswana (617)	1971	95	52	51	55	B	25
Lesotho (1,043)	1956-1957	180	36	...	...	C	18, 22, 27
	1966	110	49	49	50	B	25
	1971-1972	110	48	...	...	C	27
Swaziland (409)	1966	145	42	...	...	B	1, 8, 14, 18, 25
Western Africa (101,501)							
Benin (2,686)	1961	205, ...	30, 35	..., 34	..., 36	B	1, 5, 6, 8, 10
Cape Verde (268)	1959-1961	100	51	...	...	A	24
	1965	76.7	57	...	...	A	24
	1970	95.0	53	...	...	A	24
Ghana (8,628)	1960	165	40	...	...	B, C	1, 6, 8, 26
	1968-1969	135	47	46	48	B, C	12
	1971	120	46	...	...	B, C	12
	1975		48	47	50	D	12
Guinea (3,921)	1954-1955	235	28	...	...	B	1, 5, 6, 8, 10
Guinea-Bissau (487)	1950	200	31	...	...	B	1, 5, 6, 8, 10
Ivory Coast (4,310)	1963	175	34	...	...	B	18
Liberia (1,523)	1962	190	37	36	39	D	18
	1970	180	37	...	...	B	15, 16
	1971	150	45	...	...	D	16
	1974	130	45	...	...	B	28
Mali (5,047)	1956-1958	235	29	...	...	B	5, 6, 10
	1960-1961	215, ...	29, 32	..., 31	..., 33	B, D	1, 6, 8, 18
Mauritania (1,162)	1964-1965	185	35	...	...	B	6, 8

TABLE III.9 (*continued*)

Region, country and estimated 1970 population (thousands)	Period	Infant mortality rate ($_1q_0$)	Life expectancy at birth (years)			Basis of estimation	Source code
			Both sexes	Male	Female		
Western Africa (*cont.*)							
Niger (4016)	1960	195, . . .	33, 36	. . ., 36	. . ., 37	B	1, 5, 8, 10, 18
Senegal	1960-1961	225	36	. . .	. . .	D	18
Sierra Leone (2,644)	1963	225	30	. . .	. . .	C	27
	1973	250, . . .	28, 33	. . ., 31	. . ., 35	B	3
Togo (1,960)	1957	195	34	. . .	. . .	C	27
	1961	195, . . .	34, 38	. . ., 37	. . ., 39	B	8, 13
Upper Volta (5,384)	1960-1961	260, . . .	27, 34	28, 35/46[a]	27, 34/46[a]	B	5, 6, 7, 8, 10, 13, 18

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NOTE: Infant mortality rates are rounded to the nearest multiple of 5, except those for countries with complete registration (coded "A"). Unless stated otherwise in the text or sources, infant mortality rates and life expectancy at birth were derived by fitting childhood survival estimates to the Coale and Demeny "North" model life tables. The fit was made using estimated numbers of survivors to ages 2, 3 and 5 years (l_2, l_3 and l_5, respectively) when all were available. The figures in this table will not necessarily agree with those implied by data in table III.8.

Figures separated by a comma are averages from irreconcilable sets of estimates.

Values of expectation of life at birth are the rounded averages of estimates obtained by fitting survival functions to model life tables, or the unrounded figures from life tables constructed for the country.

Basis of estimation codes: A = complete vital registration statistics; B = indirect estimation of childhood survival, and in some cases also of adult survival (when not given in source, "North" model was used); C = other methods of estimation; D = basis of estimation unknown and unspecified in source.

TABLE III.10. INFANT MORTALITY RATES AND LIFE EXPECTANCY AT BIRTH ESTIMATED FOR SELECTED COUNTRIES OF SUB-SAHARAN AFRICA, 1950, 1960 AND 1970, BOTH SEXES

Region and country	Estimated infant mortality rate ($_1q_0$)			Estimated life expectancy at birth (years) (e_0)		
	Around 1950 (1945-1955)	Around 1960 (1955-1965)	Around 1970 (1965-1975)	Around 1950 (1945-1955)	Around 1960 (1955-1965)	Around 1970 (1965-1975)
East Africa						
Burundi	155	150	140	40	41	44
Ethiopia	. . .	. . .	140	. . .	. . .	43
Kenya	185	130	120	36	43	47

TABLE III.10 (*continued*)

Region and country	Estimated infant mortality rate (1,000 $_1q_0$)			Estimated life expectancy at birth (years) (e_0)		
	Around 1950 (1945-1955)	*Around 1960 (1955-1965)*	*Around 1970 (1965-1975)*	*Around 1950 (1945-1955)*	*Around 1960 (1955-1965)*	*Around 1970 (1965-1975)*
East Africa (*cont.*)						
Madagascar	...	...	105	...	...	50
Malawi	...	...	225	...	...	31
Mauritius	101	61	59	51	60	63
Mozambique	200	...	...	34	...	...
Réunion	125	79		51	59	
Rwanda	155		120	40		47
Uganda	...	160	120	...	40	45
United Republic of Tanzania	...	190	145, 95	...	35	41, 53
Zambia	120	...	130	46	...	46
Middle Africa						
Central African Republic	...	200	...	...	35	...
Chad	...	195	...	...	34	...
Congo	...	185	...	...	38	...
Gabon	...	230, 150	...	...	30, 41	...
Zaire	175	175	175	37	37	37
Southern Africa						
Botswana	...	...	95	...	...	52
Lesotho	...	180	110	...	36	48
Swaziland	...	...	145	...	...	42
Western Africa						
Benin	...	205, ...	...	...	30, 35	...
Cape Verde	...	100	95	...	51	53
Ghana	...	165	135, 120	...	40	47, 46
Guinea	235	...	...	28	...	...
Guinea-Bissau	200	...	...	31	...	...
Ivory Coast	...	175	...	...	34	...
Liberia	...	190	180, 150	...	37	37, 45
Mali	...	215, ...	...	...	29, 32	...
Mauritania	...	185	...	...	35	...
Niger	...	195, ...	...	...	33, 36	...
Senegal	...	225	...	...	36	...
Sierra Leone	...	225	250, ...	...	30	28, 33
Togo	...	195	...	...	34	...
Upper Volta	...	260, ...	...	...	27, 34	...

Source: Table III.9.

show some increase in mortality between 1950 and 1960 followed by a larger reduction in the most recent interval. However, the changes in means are close to or less than one standard deviation, adding increased uncertainty to average estimates based on a shifting composition of countries. If only estimates for the countries with estimates separated by at least 10 years are considered, the following trends are observed:

Country	Earliest and latest dates of estimate	Estimated life expectancy at earliest date (years)	Estimated gain in life expectancy (years)	Average annual gain in life expectancy (years)
Burundi	1952-1957 to 1970-1971	40	4	0.25
Cape Verde	1959-1961 to 1970	51	2	0.20
Ghana	1960 to 1975	40	8	0.53
Kenya	1948 to 1969	36	11	0.52
Lesotho	1956-1957 to 1971-1972	36	12	0.80
Liberia	1962 to 1974	37	8	0.67
Mauritius	1951-1953 to 1970-1972	51	12	0.63
Réunion	1951-1955 to 1963-1967	51	8	0.67
Rwanda	1952-1957 to 1970	40	7	0.45
Sierra Leone	1963 to 1973	30	3	0.30
Uganda	1959 to 1969	40	5	0.50
United Republic of Tanzania (mainland)	1956 to 1973	35	18	1.06
Zaire	1950-1955 to 1974	37	0	0.00
Zambia	1953-1954 to 1969	46	0	0.00
	MEAN	40.7	7.0	0.47

Source: Table III.9.

While none of these figures can be interpreted literally, except perhaps those for Mauritius, Réunion, and Cape Verde, which are based upon adequate vital registration, in the aggregate they paint a picture of quite modest progress: an average of less than half a year's gain in life expectancy at birth per calendar year. This is a modest rate of improvement for sub-Saharan Africa, the region that began the period with by far the lowest average life expectancy of any region. Furthermore, there is no apparent pattern within these 14 countries for countries with the lowest life expectancy at the earliest period to experience the most rapid subsequent gains. Many analysts have assumed that the high-mortality countries will tend to experience the most rapid improvements because their populations suffer from many diseases that can be easily prevented or cured. Yet what is "easy" in one context may be quite difficult in another. Serious constraints on health progress in sub-Saharan Africa include very low incomes and national

budgets, shortages of administrative skills and experience and lagging international commitments to help solve the serious health problems of the region.

Among the many conditions that have prevented sub-Saharan African populations from emerging into the moderate-mortality zone, perhaps the most important is impoverishment. A distinct lag in food production and economic growth, relative to population growth, coupled with rapid inflation, natural disasters, wars and an apparent increased emphasis on governmental spending in military areas, have certainly taken their toll in health progress. For example, whereas before the oil crisis of 1973-1974 the real growth of the poorest countries was about 2 per cent, by 1975-1976 it had dropped to a negative value of −0.8 per cent per annum.[11] The oil crisis did not affect Nigeria in the same way as it did most other African nations. None the less, as in these other countries, the index of agricultural production in Nigeria has been declining in recent years. Food prices in Lagos apparently increased by more than 50 per cent just in the year ending November 1975, continuing a price inflation of earlier years that had been more gradual. By July 1975, "The price of such things as beef, eggs, poultry and pigs had gone up to such a level that it had become almost impossible for the low-income groups to afford them," and authorities were beginning to predict the development of "a famine situation unknown in Nigeria's living memory". Nevertheless, figures published by the Nigerian Central Bank show that the consumer price index increased from 236 at the beginning of 1975 to 342 by the middle of 1976 (1960 = 100). Food prices alone reportedly climbed from 294 to 457 during the same period. In acknowledging that "the food supply in general is inadequate in terms both of quantity and quality" the Government also stated in 1975 that it did not expect the situation to change substantially between then and 1980.[12]

For years the World Food Conference and the World Food Council have warned that agricultural production in Africa is falling ever farther behind needs and demand.[13] Few countries seem not to have been affected by the combination of declining production and inflation. The consequence is that in many places the standard of living is reportedly declining. One report suggests that in Zaire it has dropped precipitously since 1963, and in 1977 the World Bank reported that "the average *per capita* consumption has declined since 1971. Even in 1980 the *per capita* consumption level will not recover to the peak in 1971".[14] According to one authority, "the real-value return of agricultural produce [in 1977 was] 25 per cent of what it was in 1960. Formerly an agricultural exporter, Zaire is now forced to import much of its food supply".[15] The stagnation or decline in agricultural production, particularly on plantations, has induced emigration and a return to subsistence farming among the dispossessed. The emigration to cities has produced a higher rate of growth in the supply than in the demand for manpower, largely because new investments in industry have been highly capital-intensive. As a result, the real wages of unskilled workers are now likely to be lower than they were before independence. The index of real minimum wages, based on 1966 as 100, dropped from a high of about 240 in 1961 to about 60 in 1974. The composite real wage index (1970 = 100), however, rose from 83 to 84 in 1968 to 104 in 1971 before dropping back to 85 in 1973.[16]

The United Republic of Tanzania was among the three or so African countries most adversely affected by inflation during the early 1970s. Inadequate food supplies, relative to increasing demands, were apparently the major cause. It was reported that between 1969 and 1974 the proportion of a worker's income spent on food increased by 80 per cent. At the latter date food expenditures consumed an estimated 70 per cent of workers' incomes. According to the Central Statistical Bureau of the United Republic of Tanzania, the ratio of all prices for wage earners increased from 100 in 1964 to 169 by 1974. The prices of basic food-stuffs skyrocketed between 1972 and 1975. The overall increase was fifteen-fold. Maize, rice and wheat were, respectively, 30, 27 and 12 times higher in 1975 than in 1972. With the villagization programme, however, it was hoped that national self-sufficiency in the food supply would be achieved and that prices of food-stuffs would decline.[17]

Uganda has also suffered severe inflation in the price of staples. Whereas food shortages were initially acute mainly among townspeople, they eventually affected the farmers as well, who have had difficulty selling their coffee crops in a glutted market. In 1975 and 1976 inflation rates for Zambia, Kenya, the Ivory Coast and Ghana ranged from 30 to 50 per cent per annum, and the outlook for 1977 was little or no better. These rates are about the same as those estimated for Nigeria, Zaire and the United Republic of Tanzania.[18] Such price inflation has been accompanied or aggravated by a number of other problems. For one thing, during recent years the national debt of the non-oil-producing countries in the less developed regions increased rapidly, from about $75 billion in 1972 to $120 billion in 1976. About 40 per cent of the total is owned by the poorest countries, those designated by the United Nations as the most seriously affected.[19] In addition, at least

[11] Reports of the United Nations Conference on Trade and Development (UNCTAD) and the General Agreement on Tariffs and Trade (GATT) cited in *African Development*, vol. 10, No. 5 (May 1976), p. 477.

[12] *Ibid.*, vol. 10, No. 3 (March 1976), pp. 236-237, and vol. 10, No. 12 (December 1976), p. 1329.

[13] In addition to the reports of the World Food Conference and the World Food Council, see the report in *African Development*, vol. 9, No. 2 (February 1975), pp. 17, 18 and 51. The index of *per capita* food production in Sierra Leone, for example, fell from 100 in 1961 to 89 in 1973 (*ibid.*, vol. 9, No. 4 (April 1975), p. S.L.19).

[14] World Bank report No. 1407-ZR, Eastern Africa Regional Office, 13 April 1977.

[15] Professor Herbert Weiss in *The New York Times*, 29 August 1977, p. A31.

[16] See *Annual Report* of the Bank of Zaire, various issues; *Conjoncture économique*, No. 13, November 1973; *Africa News*, 11 April 1977; and Herbert Michel, *Wirtschaftsstruktur und Industrialisierungsprobleme Zaires* (Munich, Weltforum Verlag, [1976]).

[17] See *African Development*, vol. 9, No. 12 (December 1975), pp. 81, 83 and 97.

[18] See *ibid.*, vol 10, No. 1 (January 1976), p. 15; and Jacques Vignes in *Jeune Afrique*, 29 October 1976.

[19] Conclusions of GATT and UNCTAD reports, cited in *African Development*, vol. 10, No. 5 (May 1976), p. 477.

TABLE III.11. AGE-SPECIFIC DEATH RATES FOR SELECTED COUNTRIES OF SUB-SAHARAN AFRICA

(Deaths per 1,000 population)[a]

Age (years)	Kenya, 1969	Madagascar, 1966	Mauritius, 1972	Réunion, 1967	South Africa (Coloured population), 1970	United Republic of Cameroon, 1976	Upper Volta, 1960
				Males			
Under 1	136.4	220.2[b]	68.2	102.2	165.4	185.6	215.7
1-4	22.0	27.6	5.7	6.0	15.7	22.1	58.3
5-9	4.4	5.7	0.9	1.1	1.6	8.5	14.3
10-14	2.7	3.4	0.9	0.7	1.2	5.1	5.3
15-19	3.4	5.0	1.2	1.6	2.4	5.5	7.6
20-24	4.5	6.2	1.3	3.1	5.5	6.7	9.2
25-29	6.2	8.5	1.7	3.7	6.3	7.2	10.5
30-34	9.0	9.2	2.3	5.7	7.7	8.5	15.8
35-39	10.3	11.7	3.4	7.1	9.1	8.9	13.6
40-44	14.3	14.5	5.5	8.2	13.6	13.5	17.1
45-49	16.4	19.9	8.5	13.9	18.3	15.7	21.6
50-54	22.5	25.0	14.5	19.3	26.0	25.1	28.0
55-59	21.7	36.2	22.5	28.1	34.4	24.3	37.8
60-64	31.5	50.2	38.5	38.9	50.0	46.9	49.2
65-69	34.1	64.4	56.3	57.9	65.4	53.3	51.3
70-74	55.0		86.0	83.4	98.9	93.1	
75-79	44.1	113.4	127.0		116.7	96.7	104.1
80-84	73.2		157.8	130.8	179.9	174.2	
85 and over	85.6		203.3		261.8		
				Females			
Under 1	137.9	157.4[b]	54.1	84.2	147.2	164.8	215.2
1-4	24.5	23.3	6.5	5.9	15.4	21.3	57.3
5-9	4.7	4.8	1.0	0.9	1.2	7.0	15.9
10-14	2.5	2.8	0.6	0.6	0.8	4.4	7.9
15-19	3.2	4.4	1.2	1.0	1.5	5.2	7.4
20-24	4.3	6.0	1.9	1.7	2.1	6.1	11.1
25-29	5.1	7.9	2.1	2.8	3.2	7.3	11.9
30-34	6.4	9.0	2.8	3.4	4.4	9.5	16.9
35-39	7.3	9.9	2.8	4.5	6.1	9.3	11.9
40-44	8.2	11.4	3.8	6.0	8.7	12.1	19.8
45-49	10.4	14.7	5.2	8.2	11.1	13.3	18.3
50-54	14.1	19.7	8.6	10.1	17.7	22.5	35.5
55-59	12.4	21.9	11.9	13.7	21.6	20.5	30.3
60-64	22.7	41.2	19.8	20.3	30.1	39.8	74.1
65-69	24.2	47.3	30.1	30.5	41.0	45.8	83.9
70-74	40.4		53.7	51.1	68.7	73.4	
75-79	36.2	103.7	83.8		92.5	75.9	98.4
80-84	71.4		123.9	101.9	136.0	163.1	
85 and over	89.1		189.9		188.3		

Sources:

Kenya—Calculated from registered deaths by age and sex for 1968-1970 (*Demographic Yearbook, 1974* (United Nations publication, Sales No. E/F.75.XIII.1), pp. 540-541) and the 1969 census age-sex count (*ibid.*, pp. 158-159). Death rates were adjusted at the United Nations Population Division for approximately 75 per cent incompleteness for males and 83 per cent for females;

Madagascar—Y. Courbage and P. Fargues, "A method for deriving mortality estimates from incomplete vital statistics", *Population Studies*, vol. 33 (March 1979), pp. 165-180. Death rates were adjusted by the authors for 35 per cent incompleteness for males and 25 per cent for females;

Mauritius—Calculated from registered deaths by age and sex for 1971-1973 (*Demographic Yearbook, 1974*, pp. 542-543) and the 1972 census age-sex count (Mauritius, Central Statistical Office, *1972 Population Census of Mauritius*, vol. 1 (Rose Hill, 1974), table 4;

Réunion—Calculated from registered deaths by age and sex for 1966-1968 (*Demographic Yearbook, 1974*, pp. 544-545) and the 1967 census age-sex count (*ibid.*, pp. 160-161);

South Africa—*Demographic Yearbook, 1974*, pp. 646-647;

United Republic of Cameroon—Based on deaths during the 12 months preceding the 1976 census as reported in Cameroon, Direction de la statistique et de la comptabilité nationale, *Recensement général de la population et de l'habitat d'avril 1976*, vol. 2, Tome 1 (Yaoundé, 1978), p. 83. Death rates were adjusted by the authors for 45 per cent incompleteness for males and 48 per cent for females;

Upper Volta—Service de la statistique, and INSEE, Service de coopération, *Enquête démographique par sondage en République de Haute Volta, 1960-61* (Paris, 1970), annex tables.

[a] Infant death rates have also been calculated per 1,000 population in age-group.

[b] Calculated by Courbage and Fargues (see sources) by matching estimated death rate at ages 1 to 4 years ($_4M_1$) to Coale and Demeny "West" model life tables.

one third of the urban population of the less developed countries live in slum or squatter settlements. These have been growing at an estimated rate of 15 per cent annually, which far exceeds the capacity of most governments to keep pace with public health and medical needs, much less to improve the living conditions of the people concerned.[20] As a consequence, during recent years conditions either

[20] Report of Habitat: the United Nations Conference on Human Settlements, cited in *African Development*, vol. 9, No. 3 (March 1975), p. 13.

have not improved or have deteriorated. In the case of Kenya, medical services seem to have become less adequate with the passage of time while the demand has increased. It is estimated that in 1976-1977, 90 per cent of all physicians were located in urban areas, leaving only about 100 to care for the more than 10 million people in the rural areas. "In many rural areas, it is not unusual to find a health centre which only three years ago catered for 20,000 people now caring for 66,000 people".[21]

3. *Age and sex patterns of mortality*

(a) *Pattern of mortality over the entire age span*

As already noted, there is little reliable information on age patterns of mortality in the countries of sub-Saharan Africa. The same can be said for sex differentials. This is so in spite of the large number of demographic surveys that have been undertaken in the region since the 1950s. The sparseness of reliable information is due not only to the small sample sizes of these surveys, which can result in large errors when grouping deaths into the conventional sex-age categories, but also to non-sampling errors, namely, the failure to report deaths that occurred in the household, misunderstanding of the reference period and extreme age mis-statement.

However, for seven populations, the age and sex patterns of mortality may have at least some reliability, judged by the criterion that the recorded age patterns are essentially U-shaped (on a semi-logarithmic scale). Nevertheless, the age patterns of mortality presented here are certainly not free of the previously mentioned errors and all of the data should be treated with caution. In fact, for three of the countries (Kenya, Madagascar and United Republic of Cameroon—see table III.11, sources) it was necessary to make very large adjustments to the data to correct for under-reporting of deaths, and the age patterns for these countries should probably be considered with even greater skepticism. The data are presented in table III.11 and figures III.2 and III.3. They have been collected from both retrospective surveys (Madagascar, United Republic of Cameroon and Upper Volta) and civil registration systems (Kenya, Mauritius, Réunion and the Coloured population of South Africa) and represent nearly the full spectrum of the mortality transition from a very low expectation of life at birth (33 years) in Upper Volta to a relatively high one (63 years) in Mauritius.

Figures III.2 and III.3 allow some comparison to be made of the age pattern of mortality in the various populations. For males, although all populations exhibit the basic similarity of a U-shaped mortality pattern, there is clearly wide variation, with the age curves intersecting each other at various points. The female age patterns, however, seem to show greater similarity with much less crossing over. Both sexes show some bunching of the mortality rates at the older ages, presumably reflecting the relatively small declines that take place in death rates at these ages as life expectancy improves.

We may gain greater insight into the age curves of mortality for these sub-Saharan populations by examining their deviations from an "average pattern" of mortality as represented by the Coale and Demeny "West" model life tables. A comparison of the death rates for these populations with the Coale-Demeny model is presented in figures III.4 (males) and III.5 (females). As with the identical comparison performed for the countries of Northern Africa, these figures plot the level of life expectancy at birth in the "West" model mortality pattern associated with each of the age-specific death rates in a particular country. A completely horizontal age profile indicates perfect correspondence between the observed age-specific death rates and the "West" model, whereas a non-horizontal profile indicates that the observed age pattern of mortality deviates from that of the "West" model. Deviations will be discussed here only for the male populations. The female death rates show similar, although by no means identical, characteristics.

Only for Madagascar does the "West" model appear to fit the data well throughout the entire age span. For Upper Volta and the United Republic of Cameroon, the "West" model seems to represent well the age pattern from about ages 20 years and older. At ages under 20 years the age profiles for both Upper Volta and the United Republic of Cameroon present a steep trough: the profiles drop sharply from ages under 1 year or 1-4 years to age-group 5-9 years and then rise equally sharply before levelling off. The "North" model of the Coale-Demeny system exhibits a similar pattern of deviation from the "West" model at the younger ages. Upper Volta and the United Republic of Cameroon, therefore, appear to be best represented by a combination of the Coale-Demeny models: the "North" model under age 20 and the "West" model thereafter.

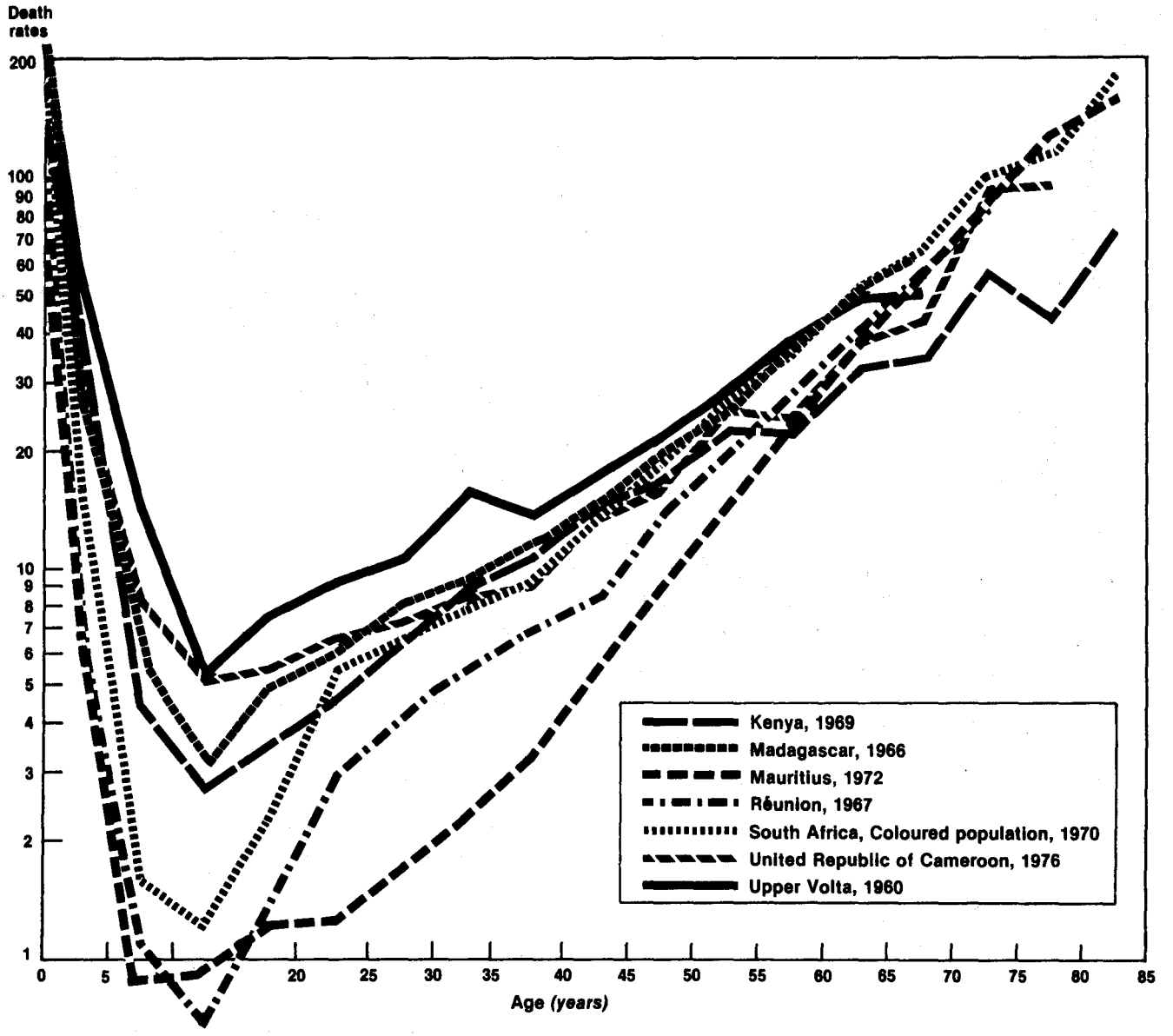
The age-specific death rates for Mauritius, Réunion and the Coloured population of South Africa all exhibit similar patterns of deviations. From infancy to about ages 10-14, the observed death rates show increasingly lower mortality relative to the "West" model. However, from about ages 15 years onward, the observed rates show increasingly higher mortality. Interestingly, this pattern of deviations is not exhibited by any of the other three models described by the Coale-Demeny model life table system. As these three populations are generally thought to have the highest-quality mortality data in the sub-Saharan region, it is quite likely that the deviations are real and not an artifact of similar age patterns of data errors. A closer study of the trends and structure of causes of death as well as the socio-environmental conditions in which the demographic processes are operating in these three countries is clearly called for.

Kenya presents its own special case as the age-specific death rates are based on registration data estimated to be only about 20 per cent complete. The deviations at the older ages are most probably due to increasing omissions of deaths from the registration system and it is likely that at least some of the deviations at other ages are also due to data errors.

[21] *New African Development*, vol. 11 (April 1977), p. 317.

Figure III.2. Age-specific death rates in selected countries of sub-Saharan Africa, males

(Deaths per 1,000 population)



Source: Table III.11.

The results of these comparisons are disappointing with respect to discovering a single age pattern of mortality for sub-Saharan Africa. If the seven countries analysed are representative, African data show a wide variety of mortality patterns. Some of these patterns are similar to the models of Coale and Demeny, others are not. Patterns under age 10 and over age 10 may resemble different Coale-Demeny models. However, given the unreliability of the data at hand, statements about the age patterns of mortality in this region must remain tentative.

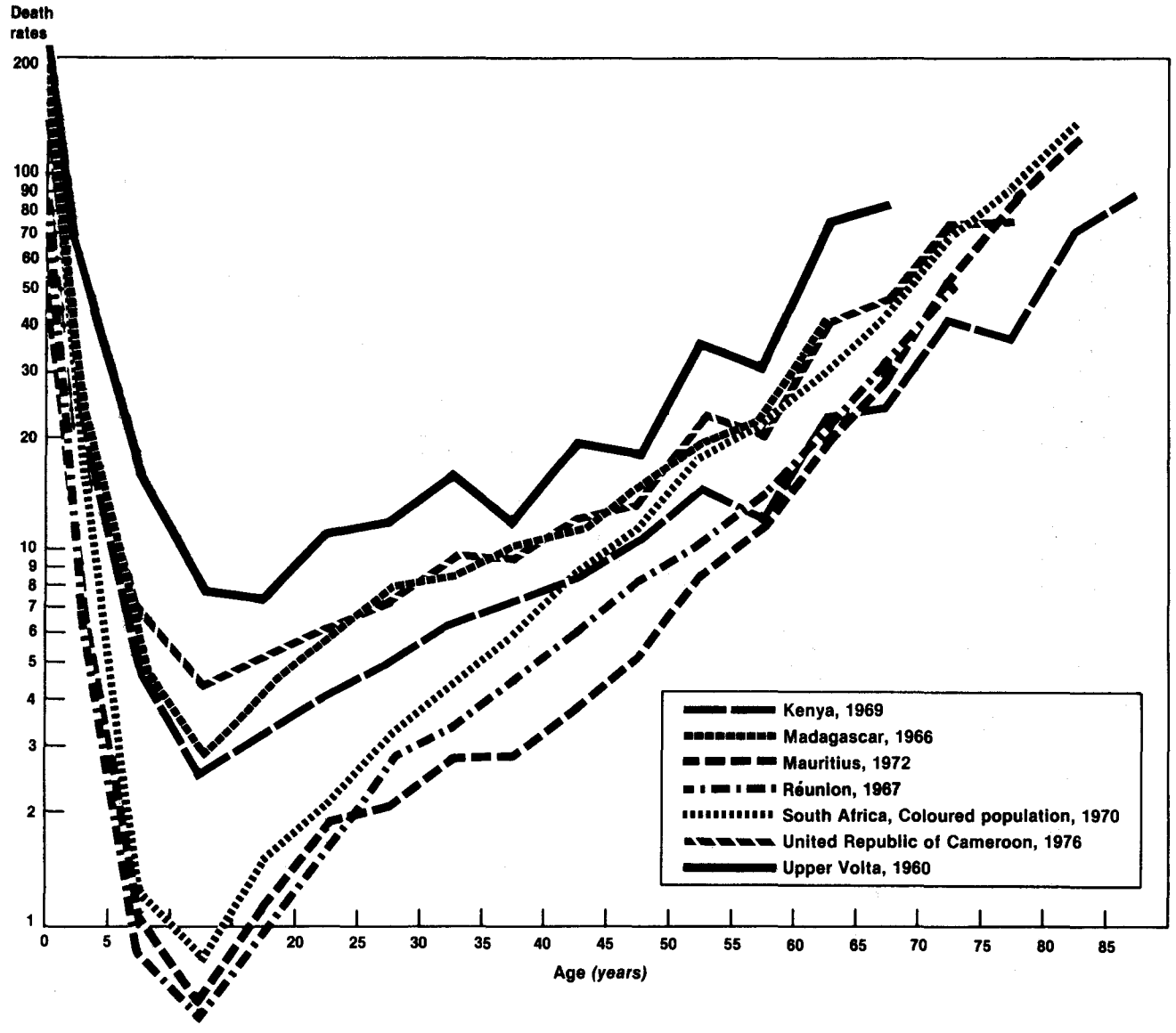
(b) *The age pattern of mortality under the age of 5*

All mortality models currently in use, including the so-called "African standard",[22] exhibit essentially the same pattern of mortality between ages 0 and 5 years, namely, that within this age-group the probability of dying decreases substantially with each successive year of life.

[22] See William Brass and others, *The Demography of Tropical Africa* (Princeton, N.J., Princeton University Press, 1968), pp. 120-135.

Figure III.3. Age-specific death rates in selected countries of sub-Saharan Africa, females

(Deaths per 1,000 population)



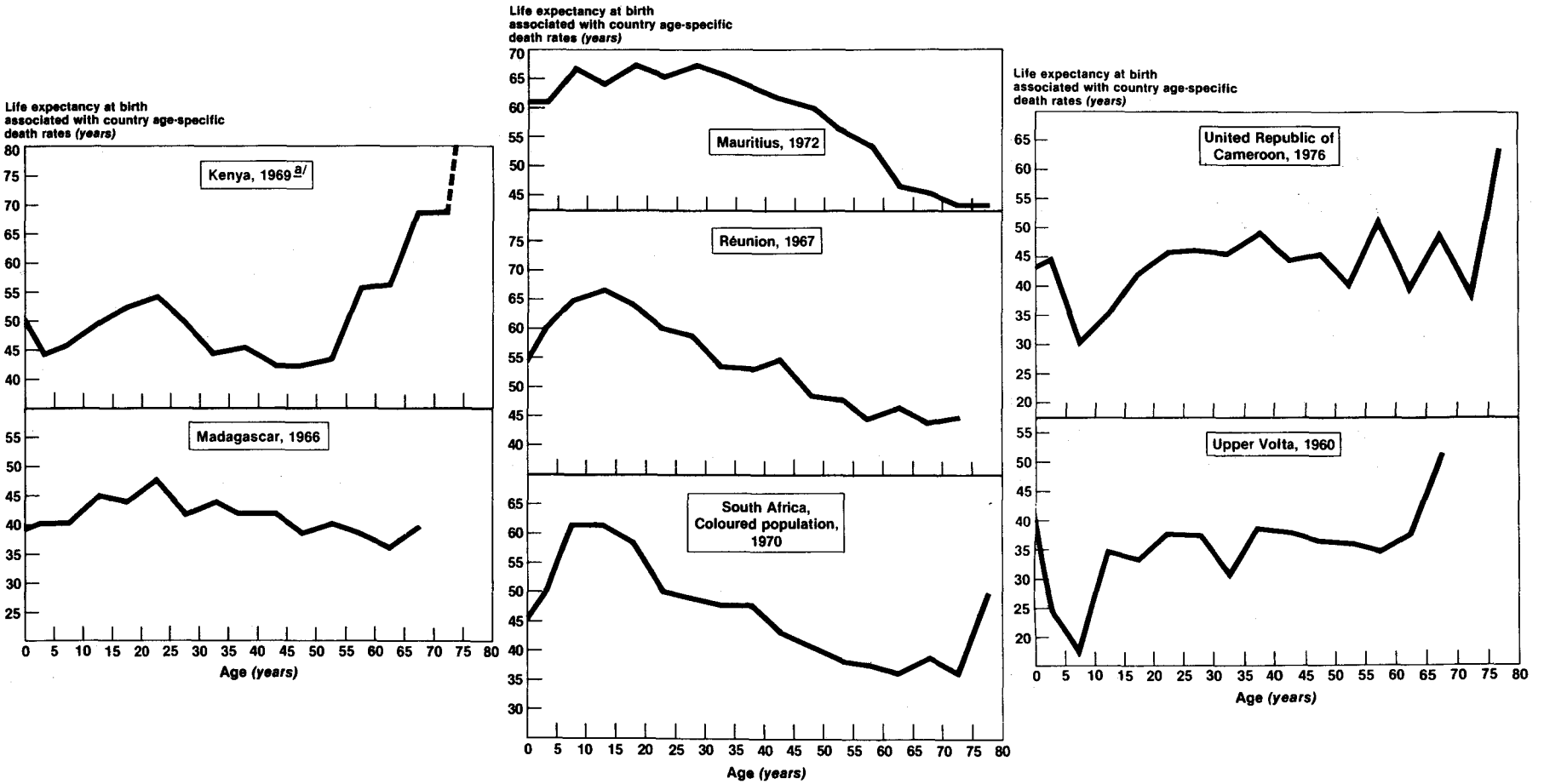
Source: Table III.11.

More precisely, when life expectancy is low, the probability of dying during the second year of life is invariably much less than half the probability of dying during the first year of life, while the probability of dying during the third year of life is approximately half the probability of dying during the second year of life. However, a number of studies have indicated that the pattern of mortality under 5 years of age in sub-Saharan Africa differs fundamentally from the patterns given in the reference models.[23] Of the seven countries discussed above, all but Madagascar have data which permit an examination of the relationship between mortality during infancy and the early childhood age-group of 1-4 years.

Figure III.6 shows graphically, for males, the relationship between mortality in these two age-groups both in the sub-Saharan Africa data and in the four models of the

[23] See, for example, J. E. Gordon and others, "The second year death rate in less developed countries", *American Journal of Medical Science*, vol. 254 (1967), pp. 357-380; R. Clairin, "The assessment of infant mortality from the data available in Africa", in J. C. Caldwell and C. Okonjo, *The Population of Tropical Africa* (London, Longmans, and New York, Columbia University Press, 1968); S. K. Gaisie, "Levels and patterns of infant and child mortality in Ghana", *Demography*, vol. 12 (February 1975), pp. 21-34; Pierre Cantrelle and H. Leridon, "Breast feeding, mortality in childhood and fertility in a rural zone of Senegal", *Population Studies*, vol. 25 (November 1971), pp. 505-533; Pierre Cantrelle, "Is there a standard pattern of tropical mortality?", in Pierre Cantrelle and others, eds., *Population in African Development* (Liège, International Union for the Scientific Study of Population, 1974); I. A. McGregor and others, "Growth and mortality in children in an African village", *British Medical Journal* (December 1961), pp. 1661-1666; I. A. McGregor and others, "Mortality in a rural West African village (Keneba) with special reference to deaths occurring in the first five years of life" (unpublished paper, n.d.). See also I. A. McGregor, "Patterns of mortality in young children in Keneba village", in Centre international de l'enfance (Paris) and Institut de pédiatrie sociale (Dakar), *Conditions de vie de l'enfant en milieu rural en Afrique* (Dakar, 1967), pp. 120-123.

Figure III.4. Life expectancy at birth associated with age-specific death rates in "West" model life tables of Coale and Demeny, selected countries of sub-Saharan Africa, males

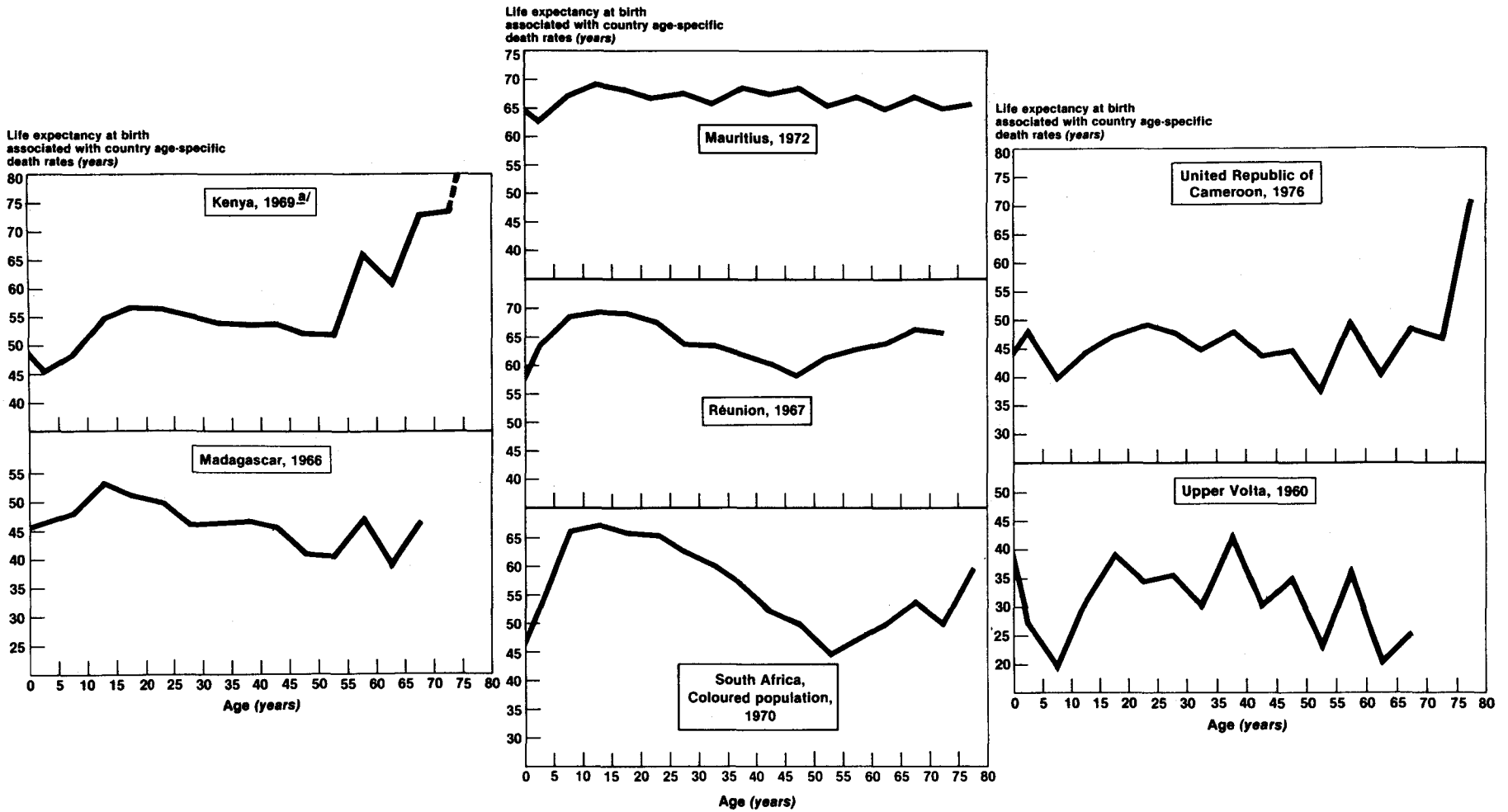


Sources: Table III.11 and Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966).

NOTE: Points are plotted for five-year age-groups in the centre of the age interval except for ages under 1 year and 1 to 4 years.

[a] The implausibly low death rate at ages 75-79 years (44.1 per 1,000 population) falls outside the boundaries of the Coale and Demeny model life table system.

Figure III.5. Life expectancy at birth associated with age-specific death rates in "West" model life tables of Coale and Demeny, selected countries of sub-Saharan Africa, females



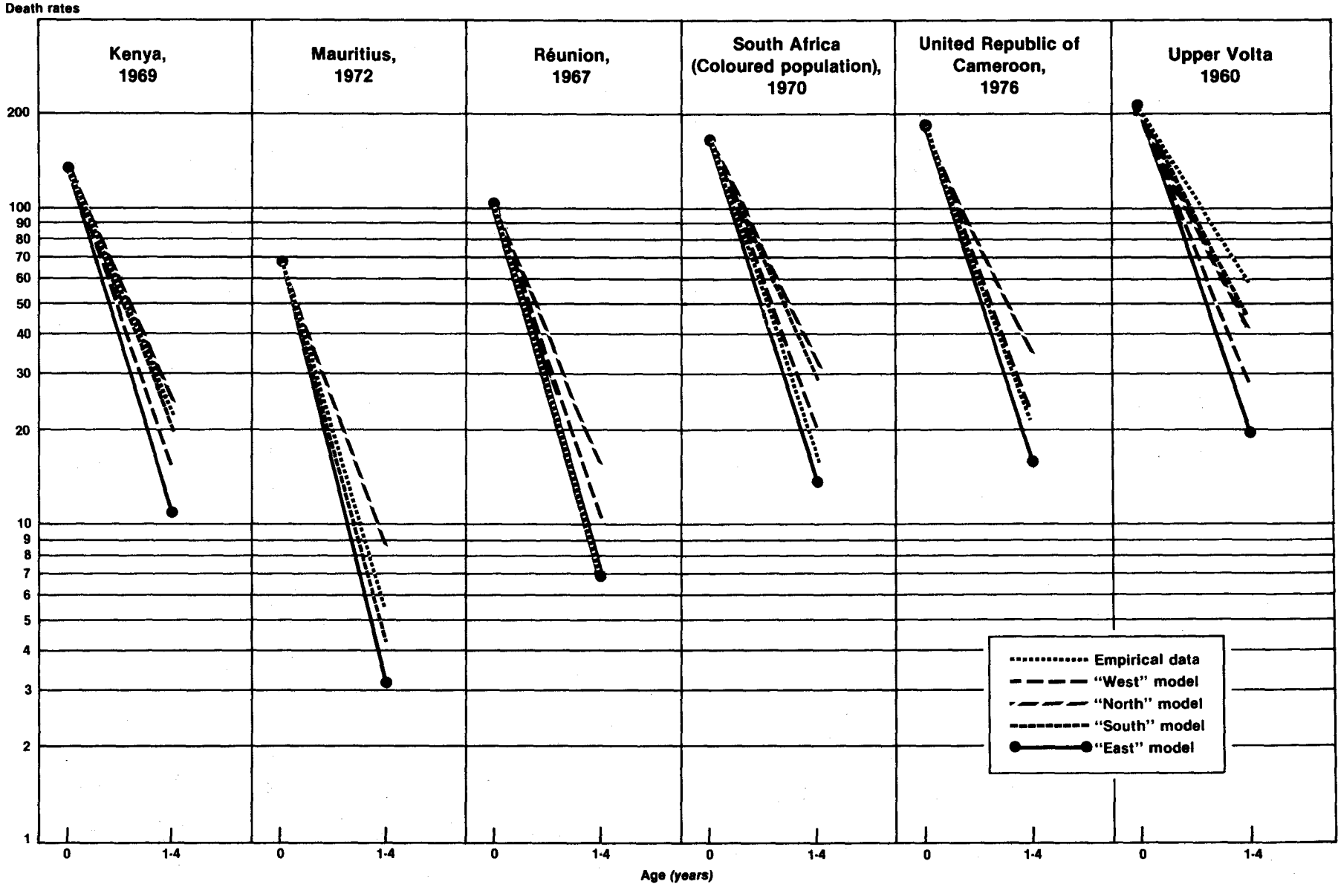
Sources: Table III.11 and Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966).

NOTE: Points are plotted for five-year age-groups in the centre of the age interval except for ages under 1 year and 1 to 4 years.

[a] The implausibly low death rate at ages 75-79 years (36.2 per 1,000 population) falls outside the boundaries of the Coale and Demeny model life table system.

Figure III.6. Comparison of death rates at ages 0 and 1-4 years in selected countries of sub-Saharan Africa with the Coale and Demeny model life tables, males

(Deaths per 1,000 population)



Sources: Table III.11 and Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966).

Coale-Demeny system. For most of the sub-Saharan African populations, a Coale-Demeny model adequately reflects this broad relationship. The patterns in the United Republic of Cameroon, Mauritius and South Africa (Coloured population) are similar to the "West" model. Réunion data are similar to the "East" model and those for Kenya to both the "North" and "South" models and intermediate between them. In both of these models, childhood mortality is high relative to that during infancy. The data for Upper Volta, however, stand apart with even higher relative mortality during the early childhood years than that implied by the "North" or "South" models. The pattern in Upper Volta does not seem to be unusual among sub-Saharan African populations. Similar patterns have been recorded from surveys in Benin (1961), Madagascar (1966), West Cameroon (1964-1965), Togo (1961), rural Gambia (1949-1975) and rural Senegal (1963-1967).[24]

For a few of these populations, mortality rates for single years under age 5 are available. As mis-statement of age in single-year data is even more extreme than in five-year age-groups, considerable caution must be exercised in examining these rates. Patterns and similarities among countries may reflect patterns and similarities in data errors rather than in mortality rates. Figure III.7 presents graphically these mortality rates along with those from the Coale-Demeny models at similar levels of infant mortality. Chad and Mauritius both exhibit a concave age pattern of mortality. The mortality pattern under age 3 in Chad is similar to that of the "South" model, but after that age it diverges with a slope parallel to that of the "North" model. The Mauritian data, however, exhibit a pattern of mortality under age 2 similar to that of the "North" model, then diverge to parallel the "South" pattern.

The data for Upper Volta, Togo, Gambia and Senegal present similar age patterns of mortality entirely unlike any of the reference models. In these populations, mortality during the second year of life is somewhat higher than expected in comparison to that of the first year and, even more noteworthy, mortality during the third and fourth years is higher than expected in comparison to earlier ages. This pattern results in a mortality curve that is convex between ages 2 and 5.

A number of studies[25] have pointed up the intertwined roles of childhood immunity, breast feeding and the seasonality of infectious diseases in determining patterns of mortality under the age of 5 in sub-Saharan Africa. Towards the end of the first year of life, the child generally loses his passive immunity against infectious diseases as the protective antibodies in his bloodstream diminish. It is also about this time that the quantity and quality of mother's milk often become unsatisfactory for the child's nutritional needs. Without the passive immunity, the child is increasingly susceptible to the infectious diseases in the environment. The situation may worsen during the rainy seasons—the time of year when transmission of infectious and parasitic disease is most likely—as the quantity of mother's milk has been shown to decrease at this time. At weaning, which may occur as late as the third year of life, the child is even more dependent on his own natural resources and more likely to suffer the adverse effects of food shortages and other consequences of an inhospitable environment. The result of these processes is high mortality relative to most reference models during the second year of life and even higher relative mortality during the third year.

In sum, it appears that the age pattern of mortality during infancy and early childhood in countries of sub-Saharan Africa may very well be different from that of the standard reference models. Although for some populations the broad relationship between mortality during infancy and ages 1-4 years is within the range of the reference models, a more detailed examination of the data points up important differences.

In a number of other sub-Saharan populations not even the broader relationship between infant mortality and that at 1-4 years is similar to the reference models. In these populations childhood mortality is higher at each age than would be expected from any of the models. The general pattern of mortality during the first five years of life observed in these populations has been either reported or suspected to exist in other tropical countries, not only in Africa but also in India and Latin America. However, at present the data available are insufficient, as regards both quantity and quality, to permit inferences as to its universality in sub-Saharan Africa, much less elsewhere.

(c) *Sex patterns of mortality*

When the quality of data is poor, there are often significant sex differentials in the patterns of age mis-statement and in omissions from death registration systems and population counts. Therefore, statements about sex differentials in mortality for sub-Saharan Africa are not likely to be irrefutable. Nevertheless, the degree of consistency among the seven countries considered here as well as the apparent similarity to sex differentials among North African populations lend credence to the data.

Throughout most of the age span, death rates in sub-Saharan Africa appear to correspond to the standard pattern in which male rates exceed female rates. However, for most of the countries, there are also some age-groups in which female death rates are greater, generally during childhood and the ages of childbearing.

With respect to the childhood years, the Kenya data show higher female than male mortality for all ages under 10 years, as do data for Mauritius for ages 1-9. The data for Upper Volta present higher female rates for children aged 5-14 years and nearly identical rates for boys and girls under 5. For the United Republic of Cameroon, the

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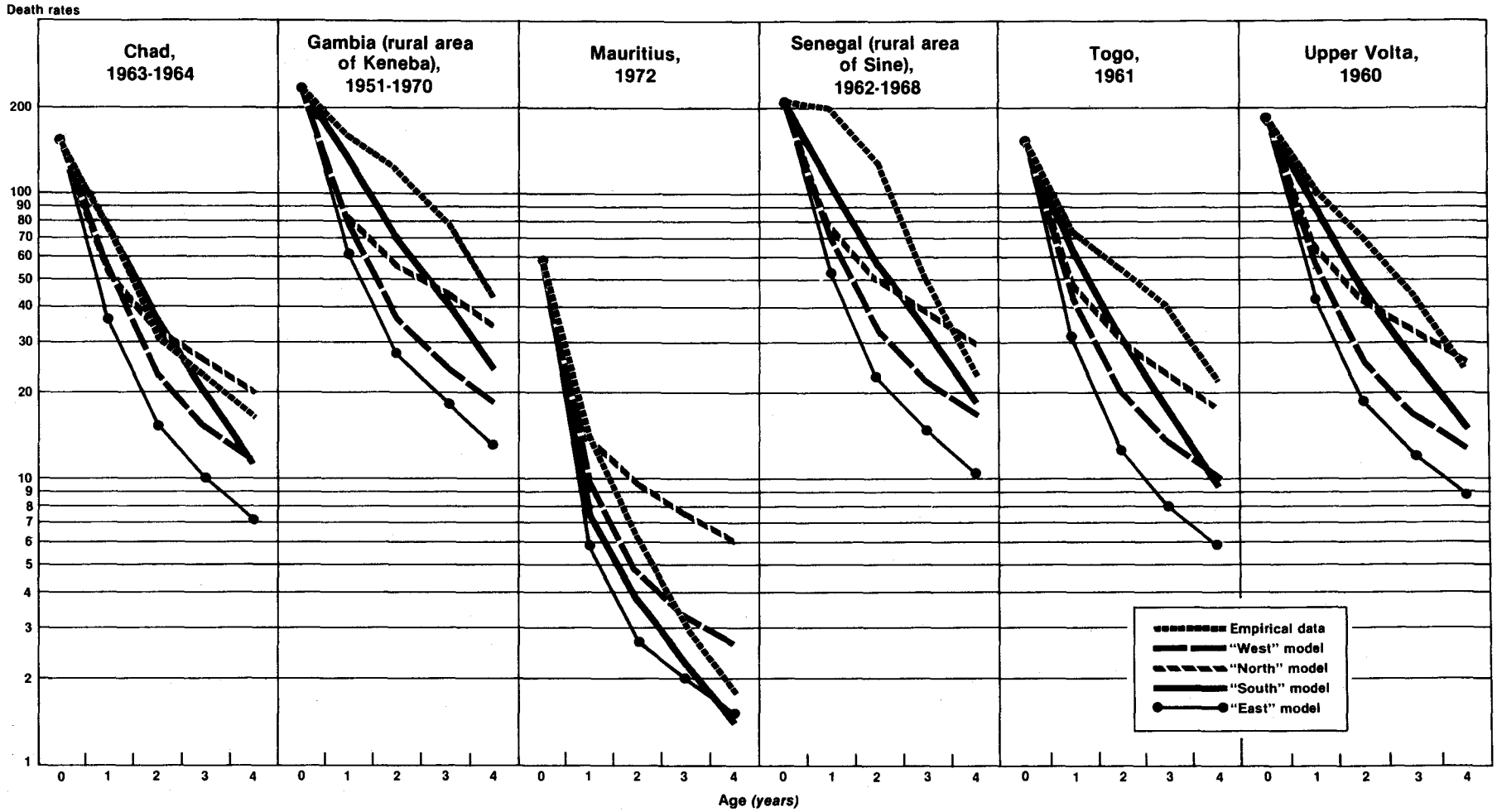
[24] See *Demographic Yearbook, 1977* (United Nations publication, Sales No. E/F.78.XIII.1), pp. 410-411, as well as the sources cited in the preceding footnote.

[25] I. A. McGregor and others, "Mortality in a rural West African village (Keneba) with special reference to deaths occurring in the first five years of life (unpublished paper, n.d.); Pierre Cantrelle, "Is there a standard pattern of tropical mortality?", in Pierre Cantrelle and others, eds., *Population in African Development* (Liège, International Union for the Scientific Study of Population, 1974); and R. G. Whitehead and others, "Factors influencing lactation performance in rural Gambian mothers", *Lancet*, vol. 2, No. 8082 (22 July 1978), pp. 178-181.

Figure III.7. Comparison of death rates under age 5 years in single years of age for selected countries of sub-Saharan Africa with the Coale and Demeny model life tables, both sexes

(Deaths per 1,000 population)



Sources: For Chad and Upper Volta, R. Clairin, "The assessment of infant mortality from the data available in Africa", in J. C. Caldwell and C. Okonjo, *The Population of Tropical Africa* (London, Longmans, and New York, Columbia University Press, 1968); for Gambia, I. A. McGregor and others, "Mortality in a rural West African village (Keneba) with special reference to deaths occurring in the first five years of life" (unpublished paper, n.d.), table 5; for Mauritius, unpublished data provided by the Central Statistical Office of Mauritius to the Organisation for Economic Co-operation and Development; for Senegal, Pierre Cantrelle and H. Leridon, "Breast feeding, mortality in childhood and fertility in a rural zone of Senegal", *Population Studies*, vol. 25 (November 1971), p. 511; for Togo, *Demographic Yearbook, 1974* (United Nations publication, Sales No. E/F.75.XIII.1), pp. 1040-1041.

Coloured population of South Africa and Réunion, the death rates at ages 1-4 are only marginally (2-3 per cent) higher for males.

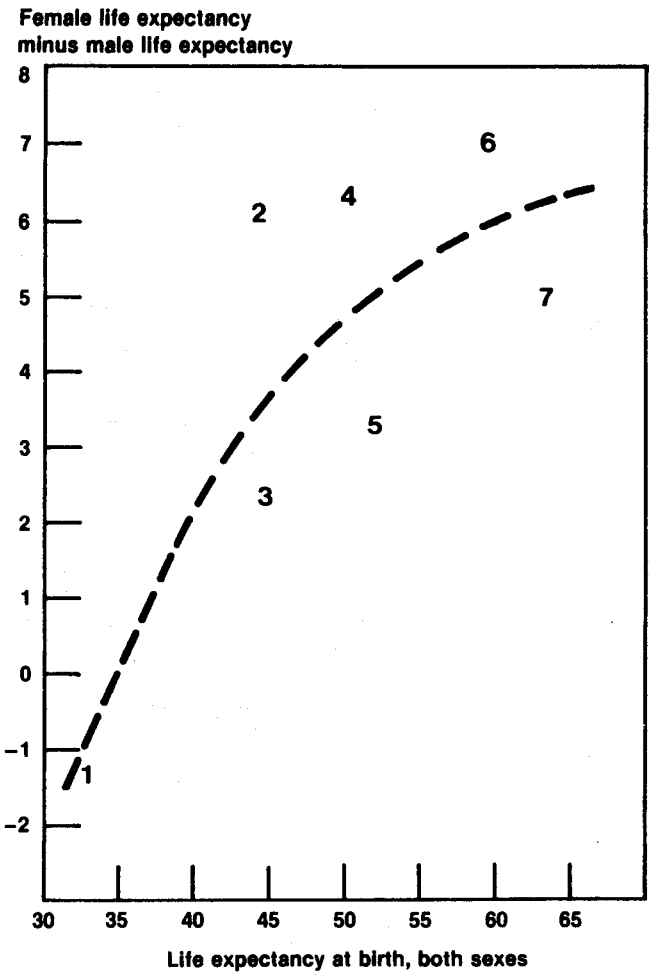
During the childbearing years excess female mortality is estimated in the United Republic of Cameroon for ages 25-39, in Upper Volta for ages 20-34 and 40-44, and in Mauritius for ages 20-34. In addition, the registered death rates in Madagascar, before adjustment for the incompleteness of death registration (see notes to table III.11), display higher female than male death rates for ages 20-34 years. It is possible that faulty adjustment of the death registration data has disguised the true male/female differential in mortality.[26]

During the remainder of the life span, the typical pattern of excess male mortality is generally exhibited, although the rates presented for Kenya do show slightly higher female mortality for age-group 85 and over. Upper Volta remains an exception, however. The 1960-1961 survey recorded higher female mortality for ages 50-54 and 60-69 years. Upper Volta, in fact, appears to be a special case in which the recorded survey data show very similar levels and age patterns of mortality for both males and females. This results in a pattern of alternating direction of excess mortality throughout the life span with females having excess mortality in nine of 16 age-groups.

In summary, then, it appears that, at least for these sub-Saharan countries, it is not uncommon for female mortality to exceed that of males for some or all of the childhood years and it is quite common for females to exhibit higher mortality during all or part of the childbearing ages. During the remaining years, males generally have higher death rates. Resulting sex differentials in life expectancy at birth are nevertheless in favour of females, except for Upper Volta, and follow the usual pattern of the higher the level of life expectancy the greater the differential (see fig. III.8).

Figure III.8. Sex differentials in life expectancy at birth as a function of over-all life expectancy, sub-Saharan Africa

(Life expectancy in years)



Source: Table III.11.

1. Upper Volta
2. Madagascar
3. United Republic of Cameroon
4. South Africa (Coloured population)
5. Kenya
6. Réunion
7. Mauritius

4. *Differential mortality*

There is relatively little evidence available on mortality differentials within the countries of sub-Saharan Africa, but all existing information points to the presence of substantial differentials. The best data at present available may be summarized briefly under two subheadings.

(a) *Mortality differentials associated with location, ethnicity and religion*

Geographical location, ethnicity and religion as indicators of mortality differentials might appear at first glance to form an unlikely combination, but in fact it is often difficult to separate them, either because of the way data have been collected or because of the ways that ethnic and religious groups are arrayed geographically. Data for the simplest components, i.e., for regional or other areal divisions, are given in table III.12. Exceptionally large regional differences are exhibited in the data for Angola, Kenya, Mozambique and the United Republic of Cameroon. Among the estimates of numbers of survivors to the exact age of 2 years in table III.12, the mean range is from about 722 to 814 per 1,000 live births. The average low and high life expectancies at birth associated with these figures, and with the other estimates in the table, are 32 and 47 years, respectively, giving a mean maximum regional differential of 15 years. This is close to half of the average minimum life expectancy and indicates the existence of very significant regional differentials in mortality among sub-Saharan African countries.

There are comparable estimates of regional variations in mortality at more than one date for only three countries: Ghana, Kenya and the United Republic of Tanzania. The figures for Kenya and the United Republic of Tanzania show reductions in mortality at both the upper and lower limits between dates. Equally important, they indicate a

[26] In fact, the surprisingly large sex differential in life expectancy at birth (6 years) based on the adjusted rates lends credence to the view that the death registration data may have been adjusted incorrectly. The sex differential in life expectancy based on unadjusted rates is only 1.2 years.

narrowing of the range between those estimates.[27] The figures for Ghana cover a period of only about two and a half years and exhibit characteristics and trends that are the opposite of those shown in the Kenyan and Tanzanian estimates. Such findings add to the uncertainties allied to any attempt to interpret the figures in table III.12.

The estimates of mortality for Upper Volta, in tables III.12 and III.13, illustrate the extent to which regional and ethnic divisions are sometimes intertwined. The Upper Volta data equate regional and ethnic divisions. Elsewhere, as in Mauritania, the distinction is primarily one between the settled and nomadic populations, which are also concentrated in different regions of the country. In the case of Mauritania, the estimates show no significant difference between settled and nomadic mortality rates (see table III.13). In North Bénoué, in the United Republic of Cameroon, ethnic, religious and geographical zones are closely overlapping and distinct mortality differentials emerge. The hill and plains peoples both have higher mortality rates and lower life expectancies at birth than do the Moslems. The other examples from the United Republic of Cameroon and the Central African Republic show equally impressive ethnic variations in mortality levels.

[27] If the various estimates of mortality for Kenya and the United Republic of Tanzania from tables III.8, III.9, III.12 and III.14 are compared, it will be noted that they are not all mutually compatible. The reasons for this are unknown, but it is striking that the ranges for subgroups of the population do not indicate the national averages given in tables III.8 and III.9.

TABLE III.12. ESTIMATED CHILDHOOD SURVIVAL DURING THE FIRST TWO YEARS OF LIFE, DERIVED INFANT MORTALITY RATES AND EXPECTATION OF LIFE AT BIRTH, REGIONAL SUBDIVISIONS OF SELECTED COUNTRIES OF SUB-SAHARAN AFRICA

Region, country, period, and regional range	*Estimated number of survivors at age 2 (of each 1,000 live births)*	*Associated infant mortality rate* ($_{1,000}\,_1q_0$)	*Life expectancy at birth (years)*			*Basis of estimation*	*Data source codes (see table III.9)*
			Both sexes	*Males*	*Females*		
Eastern Africa							
Ethiopia, 1966-1968, areal range	845-770	110-170	37-49	...	...	B	8, 18
Kenya, provincial range							
1948	...	130-240	30-45	...	...	C	2
1962	890-755	88-193	35-54	...	...	B	2, 5, 8, 10, 18, 19
1969	910-855	75-145	43-57	...	...	B	2
Mozambique, 1950, regional range	785-675	165-255	27-39	...	...	B	5, 8, 10, 18
Uganda, 1959, regional range	795-760	130-200	32-48	...	...	B	2, 5, 10, 19
United Republic of Tanzania, regional range							
1967	...	95-205	34-53	...	...	B	8, 19
1973 (mainland)	930-810	60-150	42-62	...	...	B	23
Middle Africa							
Angola, 1940, regional range	790-590	165-330	20-39	...	...	B	5, 10
Chad, 1964, north-south range	775-730	160-195	32-40	...	...	B	1, 8, 18
United Republic of Cameroon, 1960-61							
Northern Cameroon	725	200	33	...	...	B	8, 18
North Bénoué	715	220	34	33/47[a]	35/49[a]	B	1, 6, 8, 18
South Bénoué	820	130	45	44/54[a]	46/56[a]	B	1, 6, 8
South-east Cameroon	865	100	50	...	...	B	1, 6, 8, 18
West Cameroon	815	145,190	42,36	—,34/—,44[a]	—,37/—,46[a]	B	6, 8, 13, 18, 22
Zaire, 1955-1957, regional range	840-745	110-200	34-50	...	...	B	5, 8, 10
Southern Africa							
Swaziland, 1966, regional range	820-785	130-145	39-46	...	...	B	8, 18
Western Africa							
Benin, 1961, north-south range	755-710	185-220	31-37	...	...	B	5, 6, 8, 10
Ghana, regional range							
1968-1969	...	55-190	36-64	34-63	38-66	B, C	12
1971	...	65-235	29-60	...	...	B, C	12
Guinea, 1954-1955, regional range	710-680	220-270	24-30	...	...	B	1, 5, 6, 8, 10
Niger, 1960, range, strata 1-6	790-690	145-230	28-43	...	...	B	1, 8
Togo, 1961, range for four rural districts	780-660	165-250	26-39	...	...	B	8, 18
Upper Volta, 1960-1961, ethnic-regional range	750-630	195-290	22-35	...	...	B	5, 6, 8, 10

NOTE: Estimated numbers of survivors to age 2 years are averages of all estimates for each country and date. These figures and infant mortality rates are rounded to the nearest multiple of 5. Infant mortality rates and life expectancy at birth were derived by fitting childhood survival estimates to the Coale and Demeny "North" model life tables. See also note to table III.9.

[a] Expectation of life at age 5 years.

TABLE III.13. ESTIMATED CHILDHOOD SURVIVAL DURING THE FIRST TWO YEARS OF LIFE, DERIVED INFANT MORTALITY RATES AND EXPECTATION OF LIFE AT BIRTH, SELECTED ETHNIC OR OTHER POPULATION SUBGROUPS IN SUB-SAHARAN AFRICA

Region, country, period, ethnic or other classification	*Estimated number of survivors at age 2 (per 1,000 live births)*	*Associated infant mortality rate ($1{,}000\ {}_1q_0$)*	*Life expectancy at birth (years)*			*Basis of estimation*	*Data source codes (see table III.9)*
			Both sexes	*Males*	*Females*		
Middle Africa							
Central African Republic							
Central Oubangui, 1959, ethnic range	765-720	185-220	30-37	...	...	B	5, 10
United Republic of Cameroon, 1954-1967							
Foulbé	...	...	48	49	46	B	20
Agricultural labourers	...	...	33	34	32	B	20
1960, North Bénoué, ethno-religious range	755-675	195-260	26-35	...	...	B	5, 10
Western Africa							
Mauritania, 1964-1965							
Nomadic population	760	190	36	...	...	B	6, 8
Settled population	775	180	37	...	...	B	6, 8
Upper Volta, 1960-1961							
Ethnic-regional range	750-630	195-290	22-35	...	...	B	5, 6, 8, 10

NOTE: Estimated numbers of survivors and infant mortality rates rounded to the nearest multiple of 5. Infant mortality rates and life expectancy at birth were derived by fitting childhood survival estimates to the Coale and Demeny "North" model life tables. See also note to table III.9.

With the exception of the Ivory Coast, there are substantial rural/urban differences, with urban mortality being consistently lower than rural mortality (see table III.14). The mean differential for the figures in table III.14 is 12 years for life expectancy at birth, but in several individual cases it is far greater. In Senegal, for example, the indicated life expectancy at birth was twice as high in Dakar as in the rural areas in the 1960s. Unpublished data for Sierra Leone point towards a large rural/urban mortality discrepancy.[28]

There are a number of problems in attempting to interpret the above differentials. First there are the small sample sizes which in most cases are subject to large error. Secondly, there is the possibility that different models should be used for different subgroups of a population when making indirect estimates. A single set was used for all subdivisions in each country presented in table III.14. Finally, the indirect methods used assume that subpopulations are closed to migration, whereas in fact there has been a great deal of internal migration in each of the countries. However, the bias from internal migration would typically be to raise urban mortality estimates relatively to rural. Since the opposite result is consistently shown in table III.14, it cannot be attributable to violations of the closure assumption.

[28] According to a summary of these data, the probability of surviving to age 2 is about 9 per cent higher in Greater Freetown than in the western area. S. K. Gaisie, "Some aspects of socio-economic determinants of mortality in Tropical Africa", paper presented at the United Nations/World Health Organization Meeting on Socio-economic Determinants and Consequences of Mortality, Mexico City, 19-25 June 1979 (World Health Organization doc. DSI/SE/WP/79.13).

(b) *Socio-economic differentials in mortality*

There have been very few investigations of socio-economic differentials in mortality within sub-Saharan Africa. In some cases, socio-economic differentials may be inferred indirectly from ethnic or religious classifications, or even geographical ones, as discussed above. In such cases, socio-economic differentials are inferred on the basis of broad, often subjectively determined, differences in levels of education or the social or economic standing between the people in one group or place as opposed to another. Urban/rural differentials are often taken to indicate, as much as anything else, differences between the socio-economic status of urban dwellers and rural peoples. The usually lower mortality levels in towns and cities than in the hinterland can be at least partially attributed to higher education levels, better jobs and housing, and other elements of higher socio-economic status present in greater profusion in urban than in rural areas. These methods of gauging socio-economic differentials, however, are unreliable because there are many other factors that could be influencing the measured differences.

Perhaps the best example of more conventional measurement of socio-economic variations in mortality in sub-Saharan Africa comes from the United Republic of Tanzania (see table III.15). Data collected in 1967 and 1973 are available for both levels of education and household occupation categories. Unfortunately, the same categories were not used for each date, so the results are not strictly comparable. Table III.15 shows only the 1973 results, but these are quite similar to those for 1967. Quite striking mortality differences are observed for children of mothers

TABLE III.14. ESTIMATED CHILDHOOD SURVIVAL DURING THE FIRST TWO YEARS OF LIFE, DERIVED INFANT MORTALITY RATES AND EXPECTATION OF LIFE AT BIRTH, RURAL AND NON-RURAL AREAS, SELECTED COUNTRIES OF SUB-SAHARAN AFRICA

Region, country, period, area type	*Estimated number of survivors at age 2 (per 1,000 live births)*	*Associated infant mortality rate ($_{1000}q_0$)*	*Expectation of life at birth, both sexes (years)*	*Basis of estimation*	*Data source codes (see table III.9)*
Eastern Africa					
Kenya, 1962					
Nairobi	890	90	54	B	1, 2, 5, 8, 10, 18
Provincial average	825	140	45	B	Table III.12
1969, Nairobi	905	80	57	B	2
Provincial average	880	110	50	B	Table III.12
United Republic of Tanzania, 1973					
Large urban/rural range	920/880	60/100	61/52	B	23
Western Africa					
Ghana, urban/rural range					
1968-1969	...	100/150	51/41	B, C	12
1971	...	95/130	53/45	B, C	12
Ivory Coast, 1957-1958, first agricultural sector	760	180	37	B	1, 5, 6, 8, 10
1963, Abidjan	770	180	37	B	6, 21
Liberia, 1971					
Urban/rural	...	125/170	46/44	D	16
Senegal					
1962-1968, rural	638	220	29	B, C, D	9
1964-1965, 1968, Dakar	...	75	59	C, D	6, 8
Togo, 1961					
Lomé	...	115	48	B	8
Rural average	720	210	33	B	Table III.12
Upper Volta					
1960, rural	...	200	34	D	6
1961-1962, Ouagadougo (urban)	...	130	45	B	8

NOTE: Estimated numbers of survivors and infant mortality rates rounded to the nearest multiple of 5. Infant mortality rates and life expectancy at birth were derived by fitting childhood survival estimates to the Coale and Demeny "North" model life tables. See also note to table III.9.

TABLE III.15. CHILDHOOD MORTALITY ACCORDING TO CHARACTERISTICS OF PARENTS, UNITED REPUBLIC OF TANZANIA, 1973

	Probability of dying (1,000 q(x)) before age: 2[a]	3[a]	5[a]
Years of mother's education			
0	113	126	151
1-4	106	107	131
5-8	83	59	74
9-13	41	29	28
Occupation of household head			
Professional	80	62	75
Clerical/sales	82	85	118
Other non-agricultural	101	100	135
Agricultural self-employed	114	128	150
Agricultural paid	94	118	169

Source: Howard R. Hogan and Shiraz Jiwani, "Differential mortality", in United Republic of Tanzania, Bureau of Statistics, and University of Dar Es Salaam, *The Demography of Tanzania: an Analysis of the 1973 National Demographic Survey of Tanzania*, Roushdi A. Henin, Douglas Ewbank and Howard R. Hogan, eds., *1973 Demographic Survey of Tanzania*, vol. 6 (Dar es Salaam, 1976?), pp. 212-213.

[a] Estimates of $q(2)$, $q(3)$ and $q(5)$ are based on reports of women aged 20-24, 25-29 and 30-34 years, respectively.

with different educational levels, particularly when the mother has achieved nine or more years of schooling. Differences between results for those with no schooling and those with minimal schooling are not large, a finding which has been attributed to the offsetting effect of earlier weaning practices and greater resort to bottle-feeding among mothers with some education.[29] Occupational differentials run in the expected direction but are not as striking. Children of professionals, the lowest occupational mortality group, have double the mortality rates of children of mothers with 9-13 years of schooling. The agricultural sector has the highest child mortality, although there are some anomalous reversals between the self-employed and the paid agriculturists.

Data from the 1960 Census of Ghana show that the proportion of children born alive who were dead at the time of census was almost twice as high for mothers with no education compared to mothers with elementary education, and more than four times as high for mothers with no education as for mothers with secondary education. These ratios were similar in urban and rural areas.[30] A recent review of unpublished studies of mortality differentials in Africa has brought to light several other pertinent findings. In Ethiopia, the reported probability of dying before age 2 ($q(2)$) varied from 0.012 for children born to women with

[29] Howard R. Hogan and Shiraz Jiwani, "Differential mortality", in United Republic of Tanzania, Bureau of Statistics, and University of Dar es Salaam, *The Demography of Tanzania: an Analysis of the 1973 National Demographic Survey of Tanzania*, Roushdi A. Henin, Douglas Ewbank and Howard R. Hogan, eds., *1973 Demographic Survey of Tanzania*, vol. 6 (Dar es Salaam, 1976?), pp. 212-213.

[30] S. K. Gaisie, *Dynamics of Population Growth in Ghana*, Ghana Population Studies No. 1 (Legon, Ghana, University of Ghana Demographic Unit, 1969).

secondary education to 0.179 for those mothers with no formal schooling. In Sierra Leone, children of illiterate mothers had a $q(2)$ of 0.231 (males) and 0.203 (females), whereas for children of mothers who were post-primary graduates the figures were 0.126 and 0.115 for males and females, respectively. The probability of death before age 2 in Ethiopia ranged from 0.039 among children of white-collar workers through 0.135 among agricultural workers to 0.247 among blue-collar workers.[31]

The direction of socio-economic differentials in mortality in Africa is hardly surprising, but their magnitude may well be so. They imply the co-existence of population groups enjoying radically different mortality conditions, differences as large as those between the blocs of more developed and less developed countries. Obviously, many factors contribute to the extremely high mortality of lower socio-economic groups in Africa: poor nutrition, inadequate preventive health measures, inaccessible health facilities, poor personal health practices, illiteracy, low income, poor environmental sanitation and so on. That many factors are involved does not imply that all are equally important. Multivariate studies of mortality help to distinguish the more important from the less important factors. There have been three noteworthy multivariate analyses of mortality in sub-Saharan Africa. These studies pertain only to childhood mortality and the implications for mortality of adults is presumed but not altogether certain.

Surveys carried out in 1973 in Ibadan City and in the Western and Lagos States of Nigeria collected much valuable information on socio-economic status of households and on their immediate environmental conditions.[32] The surveys revealed very large differences in child mortality according to the level of mother's education. In Ibadan, the average proportion dead for mothers with no schooling aged 20-24, 25-29 and 30-34 years was 0.146 whereas it was 0.106 for mothers with only primary schooling and 0.071 for mothers with at least some secondary schooling. Urban/rural differences in mortality were small when mother's education was controlled, which was termed "an astonishing situation in view of undoubted differences in access to health facilities".[33] In fact, differences in mortality by maternal educational levels were by far the largest revealed in the surveys, and were not substantially diminished by controlling such factors as type of marriage, father's occupation, maternal grandfather's occupation, father's education, family planning practice or area of residence. Most of these other variables showed differentials in the expected direction, but these were relatively small. Father's occupation, however, continued to have a distinct and substantial impact. The author of the report attributes much of the effect of maternal education on child mortality to the changes it produces in the dynamics of family relationships: greater power for the wife, reduced reliance on traditional practices of childbearing reinforced by grandparents, and increased child-centredness.

A multivariate analysis of mortality differentials in Kenya was conducted at both the household and areal levels. The household analysis was based on a 1974 survey. The authors note that the level of reported mortality was certainly too low, so the results must be interpreted cautiously. These did not point as unambiguously to a single factor as dominating child mortality variation, although in multiple regression analysis mother's literacy significantly reduced the probability of child death before age 3. Urban residence also significantly reduced child mortality, but this factor appeared to be largely working through other variables such as toilet facilities. But about twice as important as urban residence or literacy of mother in terms of its effect on child mortality was whether or not the household resided in an area where malaria was endemic throughout the year. If it was, child mortality was higher by about 48 per 1,000, in a situation where the mean of child mortality, as measured by the probability of dying by the age of 3 years ($q(3)$), was 60 per 1,000. Mother's ill health, household income and use of a pit toilet also had significant effects on child mortality in the predicted direction (i.e., a positive effect in the first case and a negative effect in the two others). The importance of malarial endemicity was strikingly confirmed in the areal analysis: areas with year-round endemic malaria had a life expectancy at birth, as estimated from the 1969 Census of Kenya, that was about 11 years lower than that of other districts, even after controlling measures of socio-economic status. Adult literacy also had a strong effect in the sense that movement from 0 to 100 per cent literate was associated with a gain of 15-28 years in life expectancy.[34]

A similar analysis of areal differences in child mortality was conducted on the basis of results from the 1973 National Demographic Survey of the United Republic of Tanzania.[35] Malarial prevalence was again identified as the most important variable explaining areal differences in life expectancy. Higher altitudes were associated with lower mortality, a relationship also believed to reflect primarily the prevalence of malaria in low-lying areas. Once again, the proportion of an area's women who had completed five or more years of schooling made a positive and independent contribution to increased life expectancy. The availability of health facilities was not significantly associated with mortality in an area.[36]

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[31] Unpublished studies by Gebretu (Ethiopia) and Tesfay (Sierra Leone) cited in S. K. Gaisie, "Some aspects of socio-economic determinants of mortality in Tropical Africa" (World Health Organization doc. DSI/SE/WP/79.13), p. 6.

[32] The following account is drawn from a report on these surveys by John C. Caldwell, "Education as a factor in mortality decline; an examination of Nigerian data", *Proceedings of the Meeting on Socio-economic Determinants and Consequences of Mortality, El Colégio de México, Mexico City, 19-25 June 1979* (New York and Geneva, United Nations and World Health Organization [1980]), pp. 172-192.

[33] *Ibid.*, p. 5.

[34] Richard Anker and James C. Knowles, "An empirical analysis of mortality differentials in Kenya at the macro and micro levels", International Labour Organisation, World Employment Programme Research, Population and Employment working paper No. 60 (WEP 2-21/WP.60) (Geneva, November 1977), particularly table 5.

[35] Howard R. Hogan and Shiraz Jiwani, "Differential mortality", in United Republic of Tanzania, Bureau of Statistics, and University of Dar es Salaam, *The Demography of Tanzania: an Analysis of the 1973 National Demographic Survey of Tanzania*, Roushdi A. Henin, Douglas Ewbank and Howard R. Hogan, eds., *1973 Demographic Survey of Tanzania*, vol. 6 (Dar es Salaam, 1976?), pp. 212-213.

[36] *Ibid.*, summary of pp. 222-224.

5. *Morbidity and causes of death*

It has been estimated recently that about 35,000 infants and children under 5 years of age die every day. Nearly all of these deaths occur in the less developed countries, and nearly all of them result from the combined effects of nutritional deficiencies and infectious, parasitic and respiratory diseases which can be drastically reduced or eliminated by removing the environmental factors that promote them.[37] Much has been written about morbidity in Africa, particularly as regards tropical diseases and nutrition, and no attempt will be made here to summarize that literature. The discussion that follows will be highly selective, primarily because, despite the massive literature, very little of a statistical nature is available on levels and trends in morbidity and causes of death in sub-Saharan Africa.

The World Health Organization Regional Office for Africa has recently reported morbidity rates for Zaire which indicate that roughly one in 10 people suffer from malaria and that nearly as many suffer from diseases of the digestive tract. The combined morbidity rate for all other infectious, parasitic and respiratory diseases is given as about 35 per 100 population. In certain ages the prevalence of diseases is much greater than the average for the population and the resulting death rates are also well above the national average. The data on such age variations are not very good, but one report on Sierra Leone concluded that, around 1970, only about 10 per cent of rural children were completely free of kwashiorkor, severe malnutrition characterized by protein deficiency, which makes children especially vulnerable to disease. In Dakar, about half of the deaths of children under 3 years of age have been attributed to malnutrition.[38]

At the outset of the Onchoceriasis Control Programme, in 1974, it was estimated that 1 million of the 10 million people in the Volta River Basin were infected by the disease. About 70,000 were blind. It is hoped that the campaign against river blindness will not only reduce the prevalence of the disease but, by controlling the black flies that cause it, will make possible the reoccupation of substantial areas of land in Ghana, Ivory Coast, Mali, the Niger, Benin, Togo and Upper Volta. Resettlement of the rich farmlands would help those countries to achieve self-sufficiency in basic food production or enable them to become food exporters. Outbreaks of the disease before the Control Programme began had led to the abandonment of as many as half of the villages along the White Volta. In some villages infection rates as high as 85 per cent of the population were reported, with 5 to 10 per cent of infected individuals blinded by the parasites.

Malaria is one of the most widespread diseases in the world; according to World Health Organization estimates it affects some 200 million people. In Africa, about a quarter of all adults suffer malarial fever at one time or another but virtually all are infected. The majority develop a relative immunity. After infancy almost every child in tropical Africa has malaria and at least 1 million children die of the disease. The difficulties in reducing levels of mortality from malaria in Africa are in striking contrast to earlier optimism about its eradication. Part of the reason for the poor performance lies in lagging international commitments to anti-malarial programmes.[39] Part lies in the inaccessibility of many areas to conventional anti-malarial campaigns. And part lies in evolution of the parasite as well as of the mosquitoes that carry it in areas where campaigns have been conducted. Meanwhile, evidence accumulates on the enormous effect that anti-malarial campaigns can have on mortality. A project of fenitrothion-spraying in Kenya from 1972 to 1976 in an area of 17,000 people reduced the crude death rate from 23.9 per 1,000 to 13.5 per 1,000 in only two years. The infant mortality rate was reduced from 157 per 1,000 to 93 per 1,000. No change in the crude death rate occurred in a nearby untreated area.[40] The rather spectacular results of this carefully conducted experiment suggest that anti-malarial activities will have a major role to play if African mortality is to move from the high into the moderate range.

Schistosomiasis (bilharziasis) and filariasis also affect very large numbers of people in Africa and, as malaria and onchoceriasis, have a profound debilitating effect. Schistosomiasis is an insidious parasitic disease passed between people through fresh water with snails as the intermediate hosts. Filariasis is transmitted by mosquitoes. An indeterminate number of people are infected by the former. Filariasis is estimated to infect about 300 million people around the world. The numbers and proportions affected in Africa are unknown. All of these diseases are difficult to control, and in recent years there has been a tendency for them to spread. This has occurred in part because of mosquitoes having developed resistance to DDT or other insecticides and because the vectors have moved into areas newly opened to development by irrigation and other water-control schemes.[41]

The actual cause of death structure in sub-Saharan Africa is unknown. Only a few examples exist that are based on relatively good and plentiful data, and these are all arguably unrepresentative, for they are almost exclusively based on hospital deaths. One such study, from Kaduna in northern Nigeria, is for the age-group from 15 to 44 years. It reports on 3,259 deaths out of 92,731 hospital admissions during the calendar years 1971, 1972 and 1973. Almost 32 per cent of all deaths were attributed to infectious and parasitic diseases, and 14 per cent to deaths caused by accidents, poisonings and violence. In the last category, road accidents were the principal cause of death. Diseases of the circulatory and digestive systems each accounted for

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[37] See the recent survey by Erik Eckholm, *The Picture of Health; Environmental Sources of Disease* (New York, W. W. Norton, 1978).

[38] M. T. N'Doye, "Infant mortality and nutritional problems", unpublished paper presented at a conference of the Organisation of Economic Co-operation and Development in Paris. Cited by S. K. Gaisie in "Levels and patterns of infant and childhood mortality in Ghana", *Demography*, vol. 12 (February 1975), pp. 12-34.

[39] T. H. Weller, "World health in a changing world", *Journal of Tropical Medicine*, vol. 77, No. 4, Supplement (1974), pp. 54-61.

[40] D. Payne and others, "Impact of control measures on malaria transmission and general mortality", *Bulletin of the World Health Organization*, vol. 54 (1976), pp. 369-377.

[41] For a concise, vivid description of these diseases and the interaction between disease control and development, see World Health Organization, *Tropical Diseases* (Geneva, [1979]).

11 to 12 per cent of all deaths, and another 7 per cent were attributed to neoplasms. One interesting finding of the study was that infectious and parasitic diseases and accidents accounted for a much higher proportion of all deaths among the two lowest socio-economic groups than among the three other group classifications. The author of the report concluded that the high accident rate among the poorer classes resulted from the fact that the people in question usually travel in crowded and unsafe lorries and buses which, when involved in accidents, give rise to large numbers of casualties.[42]

It is worth emphasizing that the pattern of mortality found in one part of Tropical Africa may differ significantly from that found elsewhere. Northern Nigeria is a good example, in contrast with southern and, particularly, coastal Nigeria. Diseases that are major risks in one area may be little known in another. In this case, malaria is a grave problem in the southern regions whereas the tsetse fly is ubiquitous in much of the north and trypanosomiasis is a major threat to life. The incidence of various diseases in sub-Saharan Africa also can vary significantly, sometimes drastically, over time. As in the example of onchocerciasis mentioned above, or schistosomiasis, the spread of disease from one area to another or its recrudescence can cause newly settled or old settled areas to become effectively uninhabitable. In the case of malaria, the disease does not exist above an altitude of approximately one mile, and during unusually dry periods the incidence may drop almost to zero and death rates from the disease fall below "normal". However, the return of the disease raises morbidity rates again to almost 100 per cent and death rates rise above the longer-term average.[43]

[42] O. O. Hunponu-Wusu, "Current mortality patterns among Nigerians in the age group 15-44 years", *Jimlar Mutane*, vol. 1 (February 1976), pp. 34-40.

[43] A useful summary of some of these elements may be found in Pierre Cantrelle, "Mortality: levels, patterns and trends", in John C. Caldwell and others, eds., *Population Growth and Socio-economic Change in West Africa* (New York and London, Columbia University Press, 1975), pp. 99-118; and G. Melvyn Howe and others, *Environmental Medicine* (London, Heinemann Medical, 1973).

Chapter IV

ASIA

As used in this chapter, Asia excludes Cyprus, Israel, Japan and the Asian portion of the Union of Soviet Socialist Republics, which are discussed in chapter II on the more developed countries. For convenience, the continent is subdivided into several regional groupings of countries and territories, as follows:

Major area	*Region*	*Countries*
East Asia	China	China
	Other East Asia	Democratic People's Republic of Korea, Hong Kong, Mongolia, Republic of Korea
South Asia	Eastern South Asia	Burma, Democratic Kampuchea, East Timor, Indonesia, Lao People's Democratic Republic, Malaysia, Philippines, Singapore, Thailand, Viet Nam
	Middle South Asia	Afghanistan, Bangladesh, Bhutan, India, Iran, Nepal, Pakistan, Sri Lanka
	Western South Asia	Bahrain, Democratic Yemen, Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates, Yemen

The availability of adequate data for mortality analysis in Asia falls somewhere between that of Africa and Latin America. Death registration is incomplete or non-existent in most parts of Asia, and during the past quarter century it has not improved significantly. Around 1950 only three countries and territories claimed to have "complete" vital registration according to the definition that 90 per cent or more of all deaths were recorded. These were Hong Kong, Singapore and Peninsular Malaysia. By 1975 only one additional country, Sri Lanka, had been added to the list. The four areas are all arguably atypical and together they account for less than 2 per cent of Asia's population (see table IV.1). All four are small insular or peninsular areas whose economic, social and health conditions are hardly representative of Asian countries, and it is not coincidental that the mortality levels of the four are the lowest ones in Asia. For most of Asia, including the world's two most populous nations, levels of mortality must be estimated, frequently by means of indirect techniques applied to data derived from sample surveys. Surveys are often not based on nationally representative samples and the indirect methods of estimation reflect the mortality experience of particular age-groups, such as infants and young children, over an indeterminate period of time. For these reasons generalization about levels, trends and age patterns in mortality is necessarily hazardous and tenuous.

A. General levels and trends

The range of mortality levels in Asia around 1975 may be conveniently if arbitrarily represented by placing countries and territories into one of three groupings: (1) low mortality, where life expectancy at birth for both sexes is 60 years or more, (2) medium mortality where it is believed to be between 50 and 60 years and (3) high mortality where life expectancy is estimated to be less than 50 years. Using this classification, table IV.2 shows 12 countries and territories out of 28 for which estimates are available to be low-mortality areas. Another seven fall into the medium category and nine must be characterized as high-mortality areas. The classification of Burma in table IV.2 is based on the mortality level in towns only, where expectation of life at birth was estimated to be some 58 years in 1974. While this places Burma near the upper boundary of the medium-mortality category, United Nations estimates for the whole country place Burma near the low end of this category.[1] The data for Turkey and Pakistan in table IV.2 are rather old, pertaining as they do to the 1960s, but based on the United Nations estimates just mentioned, both countries remained in the same categories in 1970-1975, i.e., medium- and high-mortality, respectively.[2] The United Nations estimates must be viewed cautiously, as discussed below.

China, which has not published country-wide data on vital statistics, has been the major imponderable in any demographic study of Asia, as it contains nearly two fifths of that continent's total population. Unpublished death registration data covering deaths in the years 1972-1974, corrected for under-registration, give an estimate of expectation of life at birth for both sexes of about 63 or 64 years. The death registration data relate to a 10 per cent sample of the population of some 25 provinces including about 93 per cent of the total population of China.[3] Estimated life expectancy in the late 1970s was reported by the Minister of Public Health of China to be 68.2 years for both sexes, 66.9 years for males and 69.5 years for females.[4] These estimates for the two periods in the 1970s may not be completely compatible, as it is not known what adjustments, if any, were made in the data for the late 1970s. Also, being estimates, some degree of uncertainty is attached to them. However, it appears likely that by the late 1970s, life expectancy had reached, and possibly surpassed, 65 years.

[1] *World Population Trends and Prospects by Country, 1950-2000; Summary Report of the 1978 Assessment* (United Nations publication, ST/ESA/SER.R/33, 1979), table 3-B.

[2] *Ibid.*

[3] Judith Banister and Samuel H. Preston, "Estimates of completeness of death recording in the Chinese sample survey of 1972-74", paper presented at the Workshop on Population Research in China, National Academy of Sciences, Committee on Population and Demography, Washington, D.C., 28 October 1980.

[4] *Headliners*, No. 63, June 1980.

TABLE IV.1. COUNTRIES OF ASIA CLASSIFIED ACCORDING TO THE COMPLETENESS OF DEATH REGISTRATION IN 1974

Region	Number of countries	Population in mid 1974 (millions)	Number of countries and population (millions) by completeness of death registration: Complete[a]	Incomplete or of unknown completeness	No data reported from the civil register[b]
East Asia	6	879.8	1[c] (4.2)	2 (33.7)	3 (841.8)
South Asia					
Eastern	12	311.1	2[d] (12.2)	6 (115.2)	4 (183.7)
Middle	8	807.2	1[e] (13.7)	1 (32.0)	6 (761.5)
Western	9	79.3	...	6 (62.5)	3 (16.8)
TOTAL	35	2 077.4	4 (30.1)	15 (243.4)	16 (1 803.8)
Percentage of population		100.0	1.4	11.7	86.8

Source: Tabulated from *Demographic Yearbook, 1974* (United Nations publication, Sales No. E/F.75.XIII.1), tables 3 and 24.

[a] Registration reported to cover at least 90 per cent of all deaths.

[b] For some of these countries, estimated numbers of deaths are available for one or more years based on sample surveys or sample registration schemes.

[c] Hong Kong.

[d] Peninsular Malaysia and Singapore.

[e] Sri Lanka.

The estimates of mortality level for the countries in table IV.2 were based on concrete data, either on registered deaths or information on mortality collected during demographic surveys. To be sure, these data have in many cases been adjusted for gross deficiencies by various techniques for estimating demographic measures from incomplete data. For the remaining countries of Asia, the basis for estimating mortality level is less secure, because the requisite data are either not available or are too defective. The United Nations has made estimates of expectation of life at birth for these countries[5] taking into account all available information having some bearing on mortality levels. The classification of the remaining countries into the above scheme, i.e., of low, medium or high mortality, based on the United Nations estimates, can be done with some degree of certainty, as the three categories are quite broad.

The remaining countries in the low-mortality group would seem to be the Democratic People's Republic of Korea and Mongolia. In the high-mortality category are the remaining countries of Eastern South Asia: Democratic Kampuchea, Lao People's Democratic Republic and Viet Nam. These countries have experienced extraordinary mortality because of the political conflicts of the 1960s and 1970s. Democratic Kampuchea, in particular, has suffered great losses of human life because of the tragic events which have taken place there.[6] Although accurate data on population size and number of deaths are not available, rough estimates of the population in 1980 were about 5 million.[7] When these estimates are compared with a United Nations projection for 1980 of 8.9 million people,[8] which does not take into account the catastrophic mortality that has occurred, one is left with the conclusion that in the 1970s a total of 3 to 4 million Kampucheans died or were never born (because of greatly depressed birth rates). Also estimated as having high mortality are Bhutan and Saudi Arabia.[9] In this way, a total of 35 territories may be accounted for, but it should be noted that three of these are parts of Malaysia.

Broad changes in mortality between the early 1950s and the early 1970s based on expectation of life at birth are shown in table IV.3, which groups countries by five-year categories of life expectancy at both dates. Of the 30 countries included, only two—Afghanistan and Yemen—did not move to a higher category of life expectancy during this period. Of the remaining countries, seven moved to the next higher category, 11 improved their standing by two categories, and 10 countries improved theirs by three or more categories. It thus appears that, although the changes cannot be quantified precisely, there have been modest to very substantial declines in mortality in most countries of Asia since 1950.

Changes in mortality trends during the past quarter of a century, as opposed to the apparent net changes just discussed, can be examined in only the nine countries and territories given in table IV.4, for which data are available for at least three points in time. For a number of these, the data are of rather uncertain quality. The Indian data illustrate well the difficulty of establishing the path of mortality change from fragmentary data which are subject to wide margins of error. Either a deceleration or acceleration in life expectancy gains between the earlier and later periods can be inferred from these data, depending upon which set of estimates is chosen. In this case, the figures showing a more rapid increase in life expectancy during recent years

[5] *World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment* (United Nations publication, ST/ESA/SER.R/33, 1979), annex table 3-B.

[6] "For Cambodians the years 1970-1978 have been filled by external invasions, revolutionary disorganization, epidemics, mass starvation, and seemingly unending purges . . . ", Karl D. Jackson, "Cambodia 1978: war, pillage and purge in Democratic Kampuchea", *Asian Survey*, vol. 19, No. 1 (January 1979), p. 84.

[7] A United States Bureau of the Census estimate of 4.8 million is cited by Peter J. Donaldson, "In Cambodia. A holocaust. Clearly", *The New York Times*, 22 April 1980. An estimate of 5 million to 5.5 million is given in Bernard D. Nossiter, "U.N. statistics hint at the toll of Cambodians", *ibid.*, 6 May 1980.

[8] *World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment* (United Nations publication ST/ESA/SER.R/33, 1979), table 1-C.

[9] *Ibid.*, table 3-B.

TABLE IV.2. CLASSIFICATION OF COUNTRIES IN ASIA ACCORDING TO BROAD CATEGORIES OF EXPECTATION OF LIFE AT BIRTH, LATEST AVAILABLE DATA

Mortality category and country	Date of estimate	Expectation of life at birth (years)		
		Both sexes	Males	Females
Low mortality (life expectancy 60 years and over)				
Bahrain[a]	1971	61	...	...
China[b]	Late 1970s	68	67	69
Hong Kong[c]	1971	71	67	75
Jordan[a]	1976	65	...	...
Kuwait[d]	1974-1976	68	66	70
Lebanon[e]	1970	64	62	66
Malaysia				
Peninsular Malaysia[c]	1972	66	63	68
Philippines[d, f]	1969-1971	61	59	64
Republic of Korea[d, g]	1971-1975	63	59	66
Singapore[a]	1969-1971	69	66	72
Sri Lanka[d, h]	1970-1972	65	64	67
Syrian Arab Republic[a]	1976	64	...	...
United Arab Emirates[a]	1975	67	...	...
Medium mortality (life expectancy 50 to 59 years)				
Burma (178 towns)[i]	1974	58	56	60
Iran[d]	1973-1976	57	57	57
Iraq[a]	1974-1975	58	57	59
Malaysia				
Sarawak[c]	1970	53	52	53
Oman[a]	1975	50	...	...
Thailand[d, j]	1969-1971	59	57	61
Turkey[k]	1966	54	...	...
High mortality (life expectancy under 50 years)				
Afghanistan[l]	1972-1973	35	34	36
Bangladesh[m]	1974	46	46	47
Democratic Yemen[a]	1973	42	41	43
India[d, n]	1970-1972	48	49	46
Indonesia[o]	1971	47	45	48
Malaysia				
Sabah[c]	1970	47	49	45
Nepal[p]	1974-1976	43	45	42
Pakistan[q]	1962-1965	46	47	45
Yemen[a, r]	1975	38	38	39

[a] Estimates of United Nations Economic Commission for Western Asia derived, for most of the countries, by applying the Brass-Sullivan techniques to child survivorship data obtained from censuses or sample surveys.

[b] *Headliners*, No. 63, June 1980.

[c] *Demographic Yearbook, 1974* (United Nations publication, Sales No. E/F.75.XIII.1), table 33.

[d] Estimates, based on death registration statistics (adjusted, as necessary, for incompleteness), prepared for United Nations model life table project. For methodology and qualifications, see forthcoming publication.

[e] Youssef Courbage and Philippe Fargues, *La Situation démographique au Liban, I, Mortalité, fécondité et projections: méthodes et résultats*, Publications de l'Université libanaise (Beirut, Librairie orientale, 1973), p. 28. Mortality estimates based on registered deaths for 1970 adjusted for under-registration by model life table techniques.

[f] See also Zelda C. Zablan, "Trends and differentials in mortality", chap. 5, in *Population of the Philippines*, ESCAP Country Monograph Series, No. 5 (ST/ESCAP/63) (Bangkok, 1978).

[g] See also Economic and Social Commission for Asia and the Pacific, *Population of the Republic of Korea*, ESCAP Country Monograph Series, No. 2 (E/CN.11/1241) (Bangkok, 1975).

[h] See also Sri Lanka, Department of Census and Statistics, *Life Tables 1970-1972, Sri Lanka* (Colombo, 1978).

[i] Burma, Central Statistical Organization, *Statistical Yearbook, 1975* (Rangoon, 1976), p. 55.

[j] See also Economic and Social Commission for Asia and the Pacific, *Population of Thailand*, Country Monograph Series, No. 3 (ST/ESCAP/18) (Bangkok, 1976).

[k] Estimate, based on the Turkish Demographic Survey, given in the source cited in footnote *c*.

[l] United States of America, Department of Commerce, Bureau of the Census, *Afghanistan, a Demographic Uncertainty*, by James F. Spitler, International Research Document, No. 6 (Washington, D.C., 1978), pp. 3-7. These estimates are for the settled population. Expectation of life at birth of the nomadic population would almost certainly be lower.

[m] United Kingdom, Ministry of Overseas Development, Population Bureau, and Bangladesh, Ministry of Planning, Census Commission, *Report on the 1974 Bangladesh Retrospective Survey of Fertility and Mortality*, vol. I (London and Dacca, 1977), pp. 81-93.

[n] See also India, Office of the Registrar General, *Census of India, 1971*, Series 1, India, Paper 1, *All India Life Tables* (New Delhi, 1977).

[o] Indonesia, Biro Pusat Statistik, *Estimates of Fertility and Mortality in Indonesia, Based on the 1971 Population Census*, by Lee-Jay Cho and others (Jakarta, 1976).

[p] United States of America, Department of Commerce, Bureau of the Census, *Nepal*, by Roger G. Kramer, Country Demographic Profiles, No. 21 (Washington, D.C., 1979), p. 7. Data are averages of life table values for 1974-1975 and 1976 based on Demographic Sample Survey of Nepal. See also Nepal, Central Bureau of Statistics, *The Demographic Sample Survey of Nepal, Second Year Survey, 1976*, by A. K. Bourini (Kathmandu, 1977), pp. 33-34.

[q] Mohammad Afzal, *The Population of Pakistan*, CICRED Monograph Series, World Population Year 1974 (Islamabad, 1974).

[r] See also J. Allman and A. G. Hill, "Fertility, mortality, migration and family planning in the Yemen Arab Republic", *Population Studies*, vol. 32, No. 1 (March 1978), pp. 159-172.

are more compatible with the timing of public health and developmental programmes known to have been implemented than are the figures showing a recent deceleration in the increase in life expectancy.[10] As the Indian figures suggest, the data in table IV.4 as a whole are too scanty to afford useful generalizations for either Asia or its major regions. More and better data might easily produce different trends than the ones indicated.

Nevertheless, some tentative groupings of countries may be made on the basis of apparent similarities in mortality trends. The figures for Peninsular Malaysia, Singapore, Sri Lanka and Thailand show a more rapid decline in mortality during the earlier periods, whereas the figures for Nepal, the Philippines and towns in Burma indicate an acceleration of mortality decline during the more recent period.

The data for Sri Lanka, which are considered to be reliable, show a unique pattern of mortality change, the uniqueness lying in the unprecedented gains in life expectancy in the early post-war period. Between 1945-1947 and 1952-1954, increases in expectation of life at birth approximated two years per annum for males and females alike

[10] For further discussion of this point, see A. Adlakha and D. Kirk, "Vital rates in India, 1961-71, estimated from 1971 census data", *Population Studies*, vol. 28, No. 3 (1974), pp. 381-400; P. M. Visaria and Anrudh K. Jain, *India*, Country Profiles (New York, The Population Council, 1976); J. P. Ambannavar, *Second India Studies: Population* (Delhi, Macmillan Co. of India, 1975); and P. M. Visaria, "Mortality and fertility in India, 1951-61", *The Milbank Memorial Fund Quarterly*, vol. XLVII, No. 1 (January 1969), pp. 91-116.

TABLE IV.3. CHANGE IN EXPECTATION OF LIFE AT BIRTH BETWEEN 1950-1955 AND EARLY 1970s, SELECTED COUNTRIES OF ASIA

Expectation of life at birth in 1950-1955 (years)	*Expectation of life at birth in early 1970s (years)*							*Number of countries*
	Under 40	*40-45*	*45-50*	*50-55*	*55-60*	*60-65*	*65 and over*	
Under 40	Afghanistan Yemen	Democratic Kampuchea Democratic Yemen Lao People's Democratic Republic Nepal Viet Nam	Bangladesh India Indonesia Pakistan Saudi Arabia					12
40-45		X		Burma	Iran Iraq Malaysia	Syrian Arab Republic	Jordan	6
45-50			X		Thailand Turkey	China Democratic People's Republic of Korea Mongolia Philippines Republic of Korea		7
50-55				X		Lebanon		1
55-60					X		Kuwait Sri Lanka	2
60-65						X	Hong Kong Singapore	2
Number of countries	2	5	5	1	5	7	5	30

Sources: For 1950-1955, *World Population Trends and Prospects by Country, 1950-2000; Summary Report of the 1978 Assessment* (United Nations publication, ST/ESA/SER.R/33, 1979), annex table 3-B; for 1970s, table IV.2 and discussion in text.

TABLE IV.4. LIFE EXPECTANCY AT BIRTH BY SEX, AND AVERAGE ANNUAL INCREMENT, SELECTED COUNTRIES OF ASIA, 1941-1975

(Years)

Country	*Period*	*Males*		*Females*	
		Life expectancy at birth	*Average annual increment*	*Life expectancy at birth*	*Average annual increment*
Burma (urban)[a]	1954[b]	40.8	...	43.8	...
	1960-1962[b]	45.2	0.63	47.0	0.46
	1974[c]	56.3	0.85	60.2	1.02
Hong Kong	1961[d]	63.6	...	70.5	...
	1968[e]	66.7	0.44	73.3	0.48
	1971[d]	67.4	0.21	75.0	0.57
India					
Data of Registrar General	1941-1950[f]	32.5	...	31.7	...
	1951-1960[f]	41.9	0.94	40.6	0.89
	1961-1970[g]	46.4	0.45	44.7	0.41
Data of Visaria, and of Adlakha and Kirk	1941-1950[h]	33.3	...	32.8	...
	1951-1960[h]	37.8	0.45	37.0	0.42
	1961-1970[h]	46.5	0.87	44.5	0.75
Malaysia					
Peninsular Malaysia	1956-1958[i]	55.8	...	58.2	...
	1969-1971[j]	63.5	0.59	68.2	0.77
	1972[e]	63.4	−0.05	68.0	−0.10
Nepal[k]	1952-1954	31.6	...	29.4	...
	1961	34.7	0.39	32.5	0.39

TABLE IV.4 (*continued*)

Country	Period	Males: Life expectancy at birth	Males: Average annual increment	Females: Life expectancy at birth	Females: Average annual increment
	1974-1976	44.7	0.71	41.8	0.66
Philippines	1948[l]	48.8	...	53.4	...
	1960[l]	51.2	0.20	55.0	0.13
	1969-1971[m]	58.7	0.75	64.0	0.90
Singapore	1956-1958[n]	60.5	...	66.6	...
	1961-1963[n]	63.3	0.56	69.7	0.62
	1969-1971[m]	65.9	0.33	72.2	0.31
Sri Lanka[m, o]	1945-1947	44.8	...	43.1	...
	1952-1954	58.4	1.94	57.3	2.03
	1962-1964	62.1	0.37	62.6	0.53
	1970-1972	63.8	0.21	66.7	0.51
Thailand	1947[p]	48.5	...	51.4	...
	1959-1961[p]	53.6	0.40	58.7	0.53
	1964-1965[p]	55.2	0.35	61.8	0.68
	1974-1975[q]	58.0	0.28	64.0	0.22

[a] Data are for a varying number of towns.

[b] U Khin Maung Lwin and M. Mya-Tu, *Handbook of Biological Data on Burma*, Special Report Series, No. 3 (Rangoon, Medical Research Institute, 1967).

[c] Burma, Central Statistical Organization, *Statistical Yearbook, 1975* (Rangoon, 1976).

[d] Hong Kong, Census and Statistics Department, *Hong Kong Life Tables 1971-1991* (1973).

[e] *Demographic Yearbook, 1974* (United Nations publication, Sales No. E/F.75.XIII.1).

[f] *Demographic Yearbook, 1957; ibid., 1966* (United Nations publications, Sales Nos. 57.XIII.1 and 67.XIII.1).

[g] India, Office of the Registrar General, *Census of India, 1971*, Series 1, India, Paper 1, *All India Life Tables* (New Delhi, 1977).

[h] P. M. Visaria, "Mortality and fertility in India, 1951-61", *The Milbank Memorial Fund Quarterly*, vol. XLVII, No. 1 (January 1969), pp. 110-111; and A. Adlakha and D. Kirk, "Vital rates in India, 1961-71, estimated from 1971 census data", *Population Studies*, vol. 28, No. 3 (1974), pp. 381-400.

[i] West Malaysia, Department of Statistics, *Life Tables for West Malaysia (1966)*, by Lee-Jay Cho, Research Paper No. 2 (Kuala Lumpur, 1969).

[j] R. Chander, ed., *The Population of Malaysia*, CICRED Monograph Series, World Population Year 1974 (Kuala Lumpur, 1974; Paris, 1975).

[k] United States of America, Department of Commerce, Bureau of the Census, *Nepal*, by Roger G. Kramer, Country Demographic Profiles, No. 21 (Washington, D.C., 1979), pp. 22-23. Estimates for 1952-1954 and 1961 based on census age distributions and estimated population growth rates. Estimates for 1974-1976 are averages of life table values for 1974-1975 and 1976 based on Demographic Sample Survey of Nepal.

[l] Economic and Social Commission for Asia and the Pacific, *Population of the Philippines*, Country Monograph Series, No. 5 (ST/ESCAP/63) (Bangkok, 1978).

[m] Estimates, based on death registration statistics (adjusted, as necessary, for incompleteness), prepared for United Nations model life table project. For methodology and qualifications, see forthcoming publication.

[n] Saw Swee-Hock, *Singapore: Population in Transition* (Philadelphia, Pa., University of Pennsylvania Press, 1970).

[o] See also Sri Lanka, Department of Census and Statistics, *Life, Births and Deaths in Ceylon, 1920-1952* by S. J. Somasundram and R. Raja Indra (Colombo, 1954); *Life Tables, Ceylon 1962-1967* (Colombo, 1970); and *Life Tables 1970-1972, Sri Lanka* (Colombo, 1978).

[p] Thailand, Ministry of Public Health, Division of Vital Statistics, *Public Health Statistics, Thailand, 1970* (Bangkok, 1971).

[q] United States of America, Department of Commerce, Bureau of the Census, *Country Demographic Profiles: Thailand* (ISP-DP-15) (Washington, D.C., 1978).

(table IV.4), almost certainly surpassing any others in world history. Gains of this magnitude can only be sustained for short periods, however, and by the 1960s, increases in life expectancy at birth averaged 0.2 years per annum for males and 0.5 years per annum for females. If the data for the more recent years are examined in more detail, as shown in the text table below, it is seen that mortality improvement came to a halt, at least temporarily, by 1971. (The slight differences in life expectancy between 1970-1972 as shown in table IV.4, and 1971 as shown in the text table are due in part to the different time coverage, i.e., 1971 *versus* 1970-1972, and in part to differences in the methodology used in constructing the life tables.)

Year	Males: Life expectancy at birth	Males: Average annual increment	Females: Life expectancy at birth	Females: Average annual increment
1950	56.4	...	54.8	...
1955	58.1	0.34	57.1	0.45
1960	61.9	0.76	61.4	0.86
1965	63.7	0.36	65.0	0.72
1967	64.8	0.55	66.9	0.95
1971	64.2	−0.15	67.0	0.02

Sources: Sri Lanka, Department of Census and Statistics: for 1950, *Life, Births and Deaths in Ceylon, 1920-1952*, by S. J. Somasundram and R. Raja Indra, (Colombo, 1954); for 1955 through 1967, *Life Tables, Ceylon 1962-1967* (Colombo, 1970); for 1971, *Life Tables 1970-1972* (Colombo, 1978).

In Peninsular Malaysia also, stagnation seems to have occurred in the early 1970s at levels of life expectancy similar to those of Sri Lanka.

The gains in life expectancy in Nepal appear to have been quite large, more than 12 years between 1952-1954 and 1974-1976. Because the initial level was so low, however—only 30 years—Nepal was still a high-mortality country in the mid 1970s, with expectation of life at birth in the low forties. The bulk of the increase in life expectancy occurred after 1960, when a number of health programmes got under way, an important one being the Malaria Eradication Project which commenced in 1958.[11] Major increases in longevity may also have been achieved during the late 1940s and early 1950s in Burma and India.

In most of the cases in table IV.4, the indicated pattern of mortality change may be misleading, and comparisons risky, because of variations in the time periods covered both within and between countries. Sri Lanka may be used to illustrate the problem. The data for the interval from 1945-1947 to 1952-1954 show a spectacular gain in life expectancy of some two years per annum, as mentioned above. By the 1950s, mortality improvement had slowed considerably. If data for 1945-1947 had not been available, the very rapid increase in life expectancy in the late 1940s would not be evident. In general, where there are data for only three or four points in time and where time intervals are rather long (for example, eight to 10 years or even longer), average annual gains in life expectancy may not adequately reflect the true pace or pattern of mortality change.

Table IV.4 does not include series of life expectancy estimates for the Republic of Korea or Indonesia because of the questionable quality of the data for those countries. The life expectancy for Korean males in the late 1950s has been estimated at between 47 and 53 years (see table IV.5). For females the range is much narrower—53 to 54 years. There had been an increase in the absolute range of estimates for more recent dates. For the period from 1965 to 1971, estimates of life expectancy range from 51 to 65 years for males and from 57 to 69 years for females. Each of the three time series which provide estimates for three or more points in time suggests a different pattern of change. The Korean Bureau of Statistics series shows a gradual increase to 1970 and suggests no subsequent improvement. The Kwon series indicates a rather constant increase throughout the period, but at a lower level of life expectancy than that given in the Bureau of Statistics estimates. The third series, based on Coale and Demeny regional model life tables, shows male life expectancy stabilizing at about 60 years around the beginning of the 1960s, while female life expectancy continued to make modest gains to the end of the 1960s. These data for the Republic of Korea illustrate the uncertainty involved in attempting to assess either the levels of mortality or the patterns of mortality change from limited census-based information and incomplete vital registration statistics.

The situation is much the same with respect to the mortality decline in Indonesia. Estimates of life expectancy at birth for both sexes around 1950 vary from 35 to 38 years. The range for 1961 is from 40 to 46 years. For 1964, life expectancy was estimated at 47 years. The authors of the

[11] United States of America, Department of Commerce, Bureau of the Census, *Nepal*, by Roger G. Kramer, Country Demographic Profiles, No. 21 (Washington, D.C., 1979), p. 23.

TABLE IV.5. REPUBLIC OF KOREA, ESTIMATES OF EXPECTATION OF LIFE AT BIRTH FOR 1955-1971 BY VARIOUS AUTHORS

(Years)

Period	*Koh and Kim*[a]	*Lee*[a]	*Regional model life tables, "West" family*[a]	*Keyfitz and Flieger*[a]	*Republic of Korea, Bureau of Statistic*[a]	*Cho*[a]	*Kwon*[b]
				Males			
1955-1960	51.1	52.8	48.5	...	...	...	46.9
1960	...	...	...	54.8	...	...	...
1961	...	...	...	...	54.5	...	...
1960-1965	...	52.7	59.8	...	...	...	48.1
1966	...	...	...	...	59.7	61.2	...
1965-1970	...	...	59.5	...	...	...	50.8
1970	...	...	...	...	62.9	64.8	...
1971	...	...	...	...	61.9	...	...
				Females			
1955-1960	53.7	53.3	52.9	...	...	...	52.5
1960	...	...	...	55.7	...	...	...
1961	...	...	...	...	60.6	...	...
1960-1965	...	57.7	60.9	...	...	...	53.5
1966	...	...	...	...	64.1	65.0	...
1965-1970	...	...	62.5	...	...	...	56.5
1970	...	...	...	...	66.8	68.7	...
1971	...	...	...	...	66.8	...	...

[a] Cited in Economic and Social Commission for Asia and the Pacific, *Population of the Republic of Korea*, ESCAP Country Monograph Series, No. 2 (E/CN.11/1241) (Bangkok, 1975), p. 177.

[b] Cited in Tai Hwan Kwon and others, *The Population of Korea*, CICRED Monograph Series, World Population Year 1974 (Seoul, 1975), p. 23.

CICRED monograph concluded that "there is a general tendency of declining mortality in the years following Independence up to the late 1960s".[12] However, the United States Bureau of the Census, on the basis of changes in social, economic and health conditions in the country, rather than from demographic evidence, argued that mortality increased from about 1963 to 1968 before resuming its previous downward trend.[13]

In the light of what has been said above, it is likely that irregularities in the pace of mortality decline may have been more frequent than the available fragmentary evidence suggests. Thus, for most Asian countries, little more can be said with confidence than that there has been mortality decline of varying proportions since 1950. It is now too late to do more with respect to past levels and trends. Data do not exist and cannot be created in order to assess past mortality in greater detail. However, it is possible to look to the future and provide the means for monitoring developing trends and to investigate the interaction of demographic and non-demographic variables. To do these things it will be necessary to design appropriate studies. A multidisciplinary approach is called for in which demographic data are carefully linked with information on the implementation of health and development programmes in each country. Such studies will have to be tailored to the differing conditions in each country.

As is obvious, the health problems of small city-states such as Hong Kong and Singapore are distinct from those faced by large, populous nations such as China, India or Indonesia. In addition to the logistical problems that the latter confront in attempting to deliver preventive and curative health services to tens of millions of people dispersed over vast territories, the variety of diseases and health problems are much greater than that found in the small countries. Moreover, size alone seems to aggravate the difficulties of the development process.

The health problems of the Asian countries which have not yet achieved a low mortality level are similar to those in other less developed regions and are related to the conditions of underdevelopment itself; widespread poverty, lack of education, poor sanitary and health conditions and inadequate diet. Large gains in health and longevity are therefore not likely to come about without substantial economic development and far-reaching social change that would include redistribution of wealth. To tackle these problems requires an adequate administrative infrastructure and determination on the part of governments, as well as the involvement of the people themselves.

[12] *The Population of Indonesia*, CICRED Monograph Series, World Population Year 1974 (Jakarta, 1973; Paris, 1974), p. 17.

[13] United States of America, Department of Commerce, Bureau of the Census, *Levels and Trends of Mortality in Indonesia, 1961-1971*, by Larry Heligman, International Research Document, No. 2 (Washington, D.C., 1975), p. 8. As this publication puts it, "It is likely that because of declines in *per capita* food production, disease eradication programs, and health services, plus the effect of rampant inflation, mortality rose during much of the decade (from about 1963 to 1968). As inflation came under control, the economic situation improved, nutrition rose, *per capita* food production (especially rice) increased, and public health services strengthened, mortality has probably fallen since 1968."

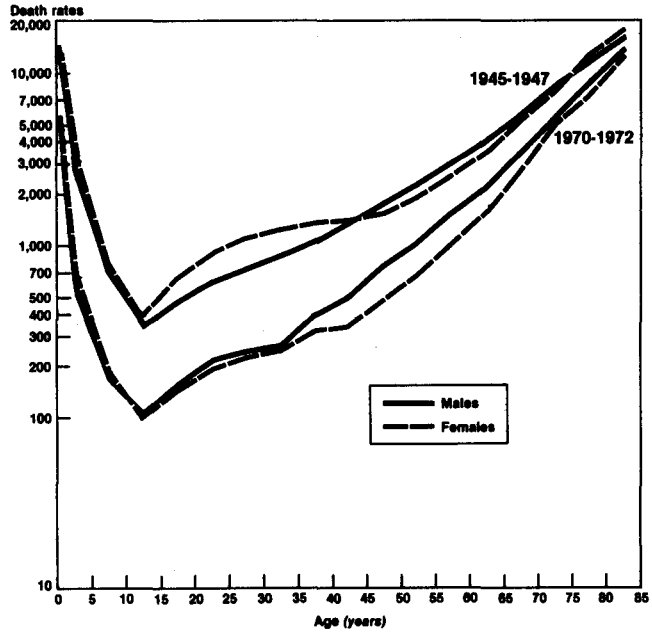
B. Age and sex patterns of mortality

Mortality rates typically decline rapidly from a high level at birth to a minimum in the early teens, after which they increase continuously, although at a varying pace, to the end of the life span. When expectation of life at birth is low, mortality rates are high all along the age curve, but particularly at the youngest ages. This results in the typical U-shaped age curve of mortality associated with low life expectancies. As mortality levels decline, deaths are increasingly postponed until the older ages, and the curve gradually becomes J-shaped. The two patterns, which are illustrated by the recent transition from high to low mortality in Sri Lanka, are shown in figure IV.1, using data for 1945-1947 and 1970-1972. (*Cf.* figures II.3 and II.4 for the more developed countries.)

In the more developed countries, death rates at every age for every country were higher among males than among females. In Africa and Latin America, in contrast, female mortality was sometimes higher than that of males in early childhood and the reproductive span. Only in Upper Volta (1960-1961) and Tunisia (1968), however, were the resulting sex differentials in life expectancy at birth found to favour males. The countries of Asia appear to exhibit higher female than male death rates to a greater extent than the other less developed regions. The age-groups particularly affected have been early childhood through the childbearing years, but in some countries another period of higher female than male mortality is found at the advanced ages when many women, often widowed, are left without the support of their families. Such excess female mortality existed in Sri Lanka at the beginning of the 1950s, but as

Figure IV.1. Age-specific death rates, Sri Lanka, 1945-1947 and 1970-1972

(Deaths per 100,000 population)



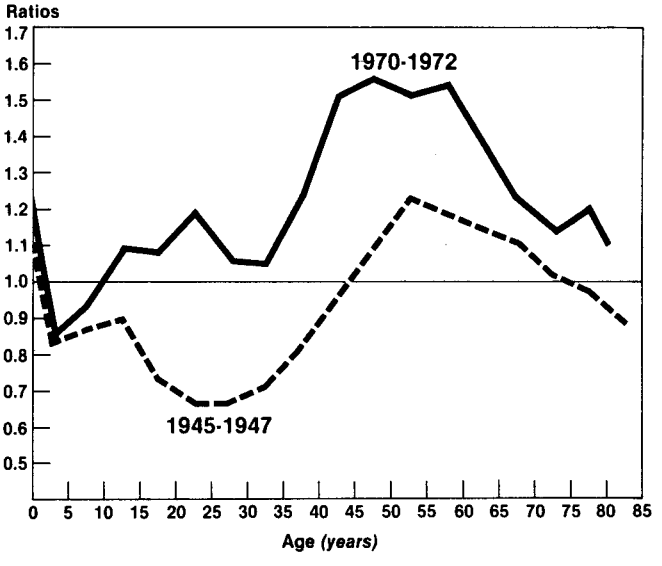
Source: United Nations model life table project. For methodology and qualifications, see forthcoming publication.

life expectancy increased, females benefited disproportionately, with the result that during more recent years the typical pattern of excess male mortality at almost every age has been exhibited in the data (fig. IV.2).

Most of the examples of higher female than male mortality, even in populations characterized by moderate and high mortality, are limited to a relatively narrow range of ages. Moreover, the poor quality of the data often raises doubts as to whether the observed differentials are real. There are only four countries in Asia where, based on the most recent available life tables, excess female mortality does appear to be real, and where it has been sufficient to result in life expectancies at birth which are shorter than those of the males. These are India, Iran, Pakistan and Sabah in Malaysia (see table IV.6). In India, the increasing disadvantage of females between 1951-1960 and 1970-1972 shown by the figures in table IV.6 may very well be artifactual, arising from poor data and different estimating techniques. The figures for 1970-1972, however, are believed to have a sounder basis than those for the two earlier periods, as they are estimated from death registration statistics adjusted for incompleteness rather than from intercensal survivorship. In Bangladesh, where the male life expectancy at birth exceeded that of females by more than two years in the early 1960s, 1974 data show a reversal of position, with females living longer than males by nearly a year. The excess mortality of females in Sri Lanka, mentioned above, resulted in their having a lower expectation of life at birth in 1945-1947 and 1952-1954, when male life expectancy exceeded that of females by 1.7 and 1.1 years, respectively. By 1962-1964, however, the advantage had passed to females, who could then expect to outlive males by half a year, on average. The female advantage increased to nearly three years by 1970-1972. It is probable that, were they available, additional data would show that other countries, like Bangladesh and Sri Lanka, have experienced a transition from excess female to excess male mortality in recent decades.

Figure IV.2. Sex ratios of age-specific death rates, Sri Lanka, 1945-1947 and 1970-1972

(Death rates for females = 1)



Source: Calculated from life tables prepared for United Nations model life table project. See forthcoming publication.

It is also possible that data on the national level for a number of countries may mask excess female mortality in subgroups of the population. As late as 1957, females in the Indian population of Peninsular Malaysia had a lower life expectancy at birth than did their male counterparts (54.6 years and 57.5 years, respectively).[14] The Malaysian Government has since published life tables for subgroups in the populations of Sabah and Sarawak for 1970 which show that female life expectancy at birth was lower than male life expectancy in three of the six groups in each area (see table IV.7).

Female mortality in Asia is most frequently higher than male mortality during early childhood and the reproductive ages. As regards early childhood, girls in the age-group from 1 to 4 years in Sri Lanka experienced death rates that exceeded those for boys by some 20 per cent in 1945-1947 and 1952-1954. According to the 1970-1972 life table, the female probability of dying during the same ages was still 17 per cent higher than that of the males, even though the life expectancy at birth was higher for females than for males.[15] The National Sample Survey of rural India, in 1958-1959, did not find a significant difference between male and female mortality in the broad age-group under 15 years, but both because male infant mortality exceeded female and because infant mortality made up a major share of all mortality under age 15, it may be inferred that female mortality in the age-group 1 to 4 years was in fact higher than that of males. Another Indian study in rural Punjab showed female mortality under 15 years of age to be about 50 per cent higher than male mortality.[16] And an Indian life table for 1970-1972 calculated for the United Nations model life table project gives a female probability of dying between ages 1 and 5 years that is nearly 30 per cent higher than that of males. According to this life table, 102 males and 132 females per 1,000 persons of each sex at age 1 year will die before reaching the age of 5 years. In discussing the likely causes for the higher female than male mortality during early childhood, the Indian Government has noted that "there is a traditional fondness for male issues in most parts of the country and a corresponding dislike for female children. All the affection and care is bestowed on male children but female children are not much cared for".[17]

Conflicting data exist for Bangladesh. A model life table based on data from the 1974 Bangladesh Retrospective Survey of Fertility and Mortality shows boys aged 1-4

[14] Malaysia, Department of Statistics, *Abridged Life Tables, Malaysia, 1970* (Kuala Lumpur, 1974).

[15] Calculated from life tables for Sri Lanka prepared for United Nations model life table project. See forthcoming publication.

[16] The two Indian surveys are cited by M. A. El-Badry in "Higher female than male mortality in some countries of South Asia: a digest", *Journal of the American Statistical Association*, vol. 64, No. 328 (December 1969), pp. 1234-1244.

[17] India, Office of the Registrar General, *Census of India, 1951, Life Tables*, Paper 2 (New Delhi, 1954), p. 26. See also T. Dyson, "Levels, trends, differentials and causes of child mortality: a survey", *World Health Statistics Report*, vol. 30, No. 4 (1977), p. 291.

TABLE IV.6. DIFFERENCE BETWEEN FEMALE AND MALE LIFE EXPECTANCIES AT SELECTED AGES, SELECTED COUNTRIES OF ASIA

(Years)

Country	Period	Difference between female and male life expectancies ($e_x^F - e_x^M$) at ages			
		0	5	15	45
Bangladesh	1962-1963[a]	−2.27	−4.05	−4.08	−0.20
	1974[b]	0.8	−0.2	−0.2	−0.3
Burma (urban)	1954[c]	3.0	1.2	1.5	4.6
	1965[d]	2.9	2.7	2.8	3.1
	1971[d]	3.2	3.3	3.4	3.1
Hong Kong	1961[c]	6.87	6.84	6.78	6.42
	1971[c]	7.65	7.32	7.26	6.49
India	1951-1960[e]	−1.34	−1.71	−1.38	0.76
	1961-1970[e]	−1.7	−1.8	−1.0	0.1
	1970-1972[f]	−2.96	−1.63	−1.20	0.60
Indonesia	1971[g]	3	...	2.2	2.0
Iran	1973-1976[f]	−0.63	1.11	1.35	1.60
Jordan	1959-1963[c]	−0.6	1.8	1.9	1.9
Kuwait	1974-1976[f]	4.40	4.23	4.11	3.20
Lebanon	1970[h]	3.95	3.74	3.64	3.10
Malaysia[c]					
Peninsular Malaysia	1956-1958	2.41	1.48	1.57	3.13
	1972	4.65	4.14	4.11	3.78
Sabah	1970	−3.36	−3.19	−3.15	0.38
Sarawak	1970	1.54	0.68	0.68	2.95
Pakistan	1962-1965[i]	−2.43	−1.08	−0.89	0.48
Philippines	1946-1949[c]	4.55	2.01	1.50	1.08
	1969-1971[f j]	5.28	4.67	4.53	2.71
Republic of Korea	1955-1960[c]	2.81	1.70	1.68	1.78
	1970[c]	4.0	3.0	3.0	3.0
	1971-1975[f]	6.83	7.08	7.22	7.20
Singapore	1969-1971[f]	6.26	6.06	6.03	5.38
Sri Lanka[f]	1945-1947	−1.74	−1.88	−1.62	1.04
	1952-1954	−1.10	−1.43	−1.24	0.55
	1962-1964	0.48	0.10	0.13	0.81
	1970-1972[k]	2.90	2.72	2.77	2.41
Syrian Arab Republic	1970[c]	4.24	3.15	3.11	2.58
Thailand	1947[l]	3.29	2.67	2.75	2.78
	1969-1971[f]	4.28	3.44	3.48	3.02
	1974-1975[m]	5.93	4.60	4.57	3.66

[a] Lee L. Bean and Masihur Rahman Khan, "Mortality patterns in Pakistan" (Karachi, February 1967) (mimeo.).

[b] United Kingdom, Ministry of Overseas Development, Population Bureau, and Bangladesh, Ministry of Planning, Census Commission, *Report on the 1974 Bangladesh Retrospective Survey of Fertility and Mortality*, vol. I (London and Dacca, 1977), pp. 89-91.

[c] *Demographic Yearbook* for *1966, 1967* and *1974* (United Nations publications, Sales Nos. E/F.67.XIII.1, E/F.68.XIII.1 and E/F.75.XIII.1.

[d] Burma, Central Statistical Organization, *Statistical Yearbook, 1973* (Rangoon, 1974).

[e] India, Office of the Registrar General, *Census of India, 1971*, Series 1, India, Paper 1, *All India Life Tables* (New Delhi, 1977).

[f] Estimates, based on death registration statistics (adjusted, as necessary, for incompleteness), prepared for United Nations model life table project. For methodology and qualifications, see forthcoming publication.

[g] Indonesia, Biro Pusat Statistik, *Estimates of Fertility and Mortality in Indonesia, Based on the 1971 Population Census*, by Lee-Jay Cho and others (Jakarta, 1976).

[h] Youssef Courbage and Philippe Fargues, *La Situation démographique au Liban*, CICRED Monograph Series, World Population Year 1974 (Beirut, Université libanaise, 1974).

[i] Mohammad Afzal, *The Population of Pakistan*, CICRED Monograph Series, World Population Year 1974 (Islamabad, 1974), p. 22.

[j] See also Zelda C. Zablan, "Trends and differentials in mortality", chap. 5, in *Population of the Philippines*, ESCAP Country Monograph Series, No. 5 (ST/ESCAP/63) (Bangkok, 1978).

[k] See also Sri Lanka, Department of Census and Statistics, *Life Tables 1970-1972, Sri Lanka* (Colombo, 1978).

[l] B. Rungpitarangsi, *Mortality Trends in Thailand: Estimates for the Period 1937-1970*, Institute of Population Studies, Chulalongkorn University, Paper No. 10 (Bangkok, 1974).

[m] Fred Arnold and others, *The Demographic Situation in Thailand*, East-West Population Institute, Paper No. 45 (Honolulu, 1977).

years having a slightly higher probability of dying than girls of the same age. According to those data, 86 males and 83 females per 1,000 population of each sex aged 1 year will die before reaching their fifth birthday.[18] In contrast, data for a small rural area in the Ganges-Brahmaputra delta indicate that female mortality has been consistently higher than male between 1 and 5 years of age (see table IV.8). During each year 1974, 1975 and 1976 this was apparently true, and in addition, in 1975, which was a year of famine, female mortality exceeded male mortality during infancy. Female mortality between 1 and 5 years of age exceeded male mortality by 73 to 105 per cent in 1974, which might be characterized as a "normal" year. During 1975 the excess mortality dropped to between 45 and 58 per cent, and it continued to fall in 1976, when it ranged from 24 to 38 per cent. In 1975 and 1976 death rates for the age-group 1 to 4 years were higher than they had been in 1974, as the nutritional status of the children had deteriorated because of the famine.[19]

Higher female mortality in early childhood was not confined to the three countries already mentioned, i.e., Sri Lanka, India and possibly Bangladesh. As can be seen from table IV.14, the following countries also had higher female mortality at ages 1-4 years: Burma (urban areas), Iran, Iraq, Pakistan, Republic of Korea (where the male advantage was slight) and Thailand. Not shown, but also falling into this group, was Sabah in Malaysia.[20]

Mortality among females is higher than that of males in other age-groups as well in a number of Asian countries. A tabulation of age-specific death rates for the 19 countries and territories appearing in table IV.6 found that in seven of these the death rates for women were higher than the ones for men in at least three of the five-year age-groups during the reproductive years (i.e., 15-49 years). Those areas were Bangladesh, India, Pakistan, Jordan, Iran and Sabah and Sarawak in Malaysia. In some of these age-groups the difference between male and female age-specific death rates is very small and may be due to random fluctuation and small numbers. At least some of the excess adult female mortality may be attributed to maternal mortality. Frequent childbearing and the almost constant nursing of infants and young children may affect the health of women adversely, adding both directly and indirectly to the risks of illness and death. A study of maternal mortality in rural Bangladesh concluded that one third of all deaths of women between 10 and 49 years of age were from maternity-related causes. If those deaths had been avoided, the age-specific death rates for women of those ages would have been below the rates for males in every five-year age-group.[21]

In assessing the reasons for male-female differentials in mortality it would appear that differing life styles, as well as differences in exposure to occupational and other hazards, contribute as much or more than do biological or genetic differences between the sexes. Although the emphasis here has been on excess female mortality, the common feature in Asia as in the rest of the world appears to have been for male mortality to exceed female. Also as in other parts of the world, Asian females seem to have benefited disproportionately from general reductions in mortality. Where time series show lower female than male mortality in the past, for example, the difference has usually increased. As can be seen from the more reliable figures presented in table IV.6 (those for Hong Kong, Singapore, Sri Lanka and Peninsular Malaysia), female life expectancies exceeded those of males by about three to over seven and a half years in the early 1970s, and the larger differentials were associated with the higher life expectancies at birth.

[18] United Kingdom, Ministry of Overseas Development, Population Bureau, and Bangladesh, Ministry of Planning, Census Commission, *Report on the 1974 Bangladesh Retrospective Survey of Fertility and Mortality*, vol. I (London and Dacca, 1977), pp. 89-91, 99.

TABLE IV.7. EXPECTATION OF LIFE AT BIRTH FOR MALES AND FEMALES BY ETHNIC GROUP, SABAH AND SARAWAK, MALAYSIA, 1970

Ethnic group	Population size (thousands)	Expectation of life at birth (e_0) (years)		Difference ($e_0^M - e_0^F$) (years)
		Males	Females	
Sabah				
Kadazan	183.2	36.2	31.8	4.4
Murut	30.8	53.0	46.6	6.4
Bajau	77.7	39.8	34.6	5.2
Other indigenous	125.7	61.3	62.8	−1.5
Chinese	138.7	66.0	74.4	−8.4
Others	94.4	69.6	72.2	−2.6
Sarawak				
Malays	180.4	63.1	63.3	−0.2
Melanau	53.2	40.5	38.9	1.6
Sea Dayak	302.9	39.7	42.5	−2.8
Land Dayak	83.1	55.8	52.2	3.6
Chinese	292.5	66.4	73.6	−7.2
Others	60.2	42.7	40.0	2.7

Source: Malaysia, Department of Statistics, *Abridged Life Tables, Malaysia, 1970* (Kuala Lumpur, 1974).

TABLE IV.8. AGE-SPECIFIC DEATH RATES FOR MALES AND FEMALES AGED 0-4 YEARS, BANGLADESH, 1974-1976 (DEMOGRAPHIC SURVEILLANCE SYSTEM—MATLAB)[a]

Age (years)	1974		1975		1976	
	Males	Females	Males	Females	Males	Females
Under 1	117.3	110.4	165.1	184.1	113.6	110.3
1	22.9	40.6	38.4	56.8	40.9	55.9
2	25.7	44.4	31.4	46.1	29.5	36.6
3	16.0	29.2	26.0	37.7	20.4	28.1
4	7.7	15.8	17.2	20.6	13.0	17.5

Source: L. T. Ruzicka and A. K. M. A. Chowdhury, *Demographic Surveillance System—Matlab; Vital Events and Migration, vol. 3/1974, vol. 4/1975, vol. 5/1976*, Cholera Research Laboratory, Scientific Reports Nos. 11, 12 and 13 (Dacca, 1978).

[a] Age-specific death rates are calculated per 1,000 population of given sex-age category; for infant deaths (under the age of 1 year), per 1,000 related births (not per 1,000 births of the same calendar year).

[19] *Demographic Surveillance System—Matlab*, Cholera Research Laboratory, Scientific Reports Nos. 9-13 (Dacca, 1978).

[20] *Demographic Yearbook, 1974* (United Nations publication, Sales No. E/F.75.XIII.1), table 34.

[21] Lincoln C. Chen and others, "Maternal mortality in rural Bangladesh", *Studies in Family Planning*, vol. 5, No. 11 (New York, Population Council, 1974), pp. 335-356. See also Derek Llewellyn-Jones, *Human Reproduction and Society* (London, Faber and Faber, 1974), pp. 499, 502-508.

1. *Infant mortality*

Infant mortality deserves special treatment because it is such a sensitive indicator of general health conditions and also because it can serve as a substitute for, or as an index of, life expectancy in the absence of information on the latter. Table IV.9 summarizes the data available on infant mortality in countries of Asia for the period from 1950 to 1975. The table includes a combination of life table probabilities of dying, infant death rates based on complete vital registration and estimates derived indirectly. Where known, the manner in which estimates were derived is indicated in the last column of the table. As late as the mid 1970s, only about 11 per cent of all infant deaths in East Asia were adequately registered, and less than 3 per cent of those in South Asia were properly registered.[22] The few countries that provide reliable data are, of course, also those which have achieved low mortality. Thus, as can be seen, the figures for most Asian countries are based on indirect estimates.

The fragmentary data for China summarized in table IV.9 suggest that both rural and urban infant mortality were quite high before 1950, the rate being estimated at 125-200 infant deaths per 1,000 live births in rural areas, and well over 100 in Peking and Ch'eng-tu. By the mid 1950s, the urban infant mortality rate had apparently been sharply reduced to about 45. The two sets of estimates of infant mortality rates for rural areas in the mid 1950s differ greatly (74 and 110-140) and may pertain to different parts of the country.

Of the other East Asian countries, only Hong Kong has dependable vital registration data. These show an extremely large decline in infant mortality, from 81.8 deaths per 1,000 live births in 1950-1954 to 15 in 1975. Although it is suspected that these rates may be understated by a few points because of under-registration of infant deaths during the first day of life, the impressive decline of infant mortality is beyond doubt. Indirect estimates for the Republic of Korea by the Korean Bureau of Statistics show that about 10 per cent of all children born did not live to celebrate their first birthday between 1955 and 1960, but by 1971 the infant mortality rate had been halved.[23]

In Eastern South Asia only Peninsular Malaysia and Singapore provide "complete" statistics for infant deaths based on registration. According to these the infant mortality rate for Peninsular Malaysia dropped from about 91 in the early 1950s to roughly 35 in 1974, an average annual rate of decline of 2.7 per cent. During the same period the rate for Singapore declined at an annual rate of 3.6 per cent from about 69 in the early 1950s to 14 in 1975. Infant mortality rates for Thailand, the Philippines and Indonesia are based mainly upon survey data because the vital statistics are incomplete. The estimate for Thailand in 1974-1975 (about 56 infant deaths per 1,000 live births) is based on a sample survey and may be on the low side. The life tables for Thailand for 1969-1971 calculated for the United Nations model life table project, and based on death registration statistics corrected for under-registration, imply an infant mortality rate for both sexes of about 70 per 1,000 live births.[24] Using these figures it would appear that between 1947 and 1969-1971 the infant death rate declined by approximately 1.6 per cent per year. The margin of error in the Philippine data is probably large enough to preclude any statement other than that there appears to have been a modest improvement in infant mortality between 1960 and 1973. The Burmese rates come from urban vital registration, and the number of towns reporting varies from year to year. This makes the data especially difficult to interpret. On the face of it, the figures show a very high infant mortality rate of 240 in the early 1950s, which fell at an average annual rate of about 3.3 per cent to about 57 in 1975. The estimates for Indonesia do not indicate a significant change from about 140-145 infant deaths per 1,000 live births during the decade covered in the table. For the remaining countries of Eastern South Asia—Democratic Kampuchea, East Timor, Lao People's Democratic Republic and Viet Nam—no dependable information exists from which to infer either recent or past levels of infant mortality.

It is conservatively estimated that in Middle South Asia, which includes the Indian subcontinent, over 4 million of the at least 30 million children born annually die before their first birthday. This comes to an average infant mortality rate of about 130-135. However, adequate information is available only for Sri Lanka, where a very small fraction of the births and deaths occur. During the early 1950s Sri Lanka's infant mortality rate averaged 75 deaths per 1,000 live births. By 1971 it had declined to 44.8, an all-time low, from which it has since risen to 51.2 (in 1974). This represents an over-all decline of about one third since the early 1950s. Data from the Indian Sample Registration System cover only a four-year period and cannot be used for estimating changes in infant mortality but they do illustrate the existence of a significant urban/rural differential. For example, in the period around 1970, rates for the rural areas included in the sample averaged about 50 per cent higher than the urban rates. The estimates for the intercensal periods given in table IV.9 show a net decline for male and female infant mortality of only about 10 per cent between the periods 1951-1961 and 1961-1971. During the latter period the infant mortality rate for India remained very high; it stood at approximately 130, which was some 2.5 times the rate for Sri Lanka in the same period.

Estimates of infant mortality in the next two largest countries in Middle South Asia after India—Pakistan and Bangladesh—offer no clear evidence of a significant fall in mortality. The figures for Bangladesh in table IV.9 show little change over the period 1960-1962 to 1974, when the infant mortality rates were estimated at 139 and 153, respectively. While the data for Pakistan show a decline from a rate of 135 in 1962-1965 to 106 in 1970, the decline may be more apparent than real, as the rate for the

[22] J. Vallin, "World trends in infant mortality since 1950", *World Health Statistics Report*, vol. 29, No. 11 (1976), pp. 646-674.

[23] Economic and Social Commission for Asia and the Pacific, *Population of the Republic of Korea*, Country Monograph Series, No. 2(E/CN.11/1241) (Bangkok, 1975), p. 176.

[24] See forthcoming United Nations publication.

TABLE IV.9. TRENDS IN INFANT MORTALITY RATES, ASIA

Major area, region and country	Period	Infant deaths per 1,000 live births: Males	Infant deaths per 1,000 live births: Females	Comments
East Asia				
China	Before 1950[a]	———	———	Rural
	1949[a]	118		Peking
	1949[a]	126		Ch'eng-tu
	1956-1958[a]	35-40		Peking
	1955[a]	74		Rural sample
		44		Urban sample
	1954-1955[b]	110-140		Rural areas
		42-47		Urban areas
Other East Asia				
Hong Kong	1950-1954[c]	81.8		Registration statistics
	1975[c]	15.0		
Republic of Korea	1925-1930[d]	180-250		
	1955[d]	125	103	
	1971[e]	54.9	43.1	
	1971-1975[f]	39.6	36.7	
South Asia				
Eastern South Asia				
Burma	1950-1954[c]	———	———	
	1965[g]	115.0		Registration statistics for a varying number of towns
	1970[g]	63.8		
	1975[g]	57.0		
Indonesia	1961[h]	151	136	
	Late 1960s[i]	———	———	Excluding Jakarta, Bali, Kalimantan, Muan, Tenggara, Maluku and West Irian
	1971[j]	143		Implied from $q(2)$ to $q(3)$
	1971[h]	132	118	
	1971[k]	152.2	128.9	
Malaysia				
Peninsular Malaysia	1950-1954[c]	———	———	
	1972[c]	43.7	33.2	
	1973[l]	50.5	38.6	
	1974[c]	———	———	
Philippines	1960[m]	98-116		Implied values based on $q(3)$ to $q(5)$ and on $q(15)$ to $q(35)$
	1968[m]	69-81		
	1973[m]	65-72		
Singapore	1950-1954[c]	69.4		Registration statistics
	1975[c]	13.9		
Thailand	1947[n]	121.8	102.7	
	1960[n]	116.9	96.0	
	1970[n]	81.5	66.5	
	1971[o]	65.0	59.6	
	1974/75[p]	91.9	59.6	
	1964/65[q]	———	84	Survey of Population Change
	1974/75[q]		56	
Middle South Asia				
Afghanistan	1972-1973[r]		217-235	Estimated from the National Demographic and Family Guidance Survey of the Settled Population of Afghanistan
	1972-1973[s]		185	
	1973-1974[t]		117	Greater Kabul
Bangladesh	1960-1962[u]		139	National impact survey
	1962-1963[v]	153.3	128.3	
	1962-1965[u]	———	147	Population Growth Estimation
	1963-1965[u]		116	National impact survey
	1966-1968[u]		113	
	1967-1969[u]		125	Cholera Research Laboratory
	1974[w]	160.2	153	145.2
India	1941-1951[x]	190	175	Life table estimates for intercensal periods
	1951-1961[x]	153.2	138.3	
	1961-1971[y]	130.1	128.4	
		Rural	*Urban*	
	1968[z]	136.8	...	Both sexes, Sample Registration Scheme
	1969[z]	139.9	...	
	1970[z]	118.7	80.3	
	1971[z]	114.8	77.5	
		Males	*Females*	
	1970-1972[f]	120.7	124.1	

TABLE IV.9 (*continued*)

Major area, region and country	Period	Infant deaths per 1,000 live births: Males		Females	Comments
Middle South Asia (*cont.*)					
		Rural		*Teheran*	
Iran	1965[aa]	176		58	
		Males		*Females*	
		99.8	104.5	109.6	Entire country
	1973-1976[bb]	122.8	126.2	129.7	Rural
		54.9	62.0	70.0	Urban
Nepal	1971[cc]		172.2		
	1971-1973[dd]		152		
	1974-1976[ee]	135	133	130	
Pakistan	1962-1965[ff]		135		Population Growth Estimation
	1961[ff]		131		National Impact Survey
	1967[ff]		121		
	1968[gg]		124		Population Growth Survey
	1969[gg]		111		
	1970[gg]		106		
Sri Lanka	1945-1947[f]	132.9		121.8	
	1951-1955[hh]		75		
	1956-1960[hh]		63		
	1961-1965[hh]		54		
	1966-1970[hh]		51		
	1971[ii]		44.8		
	1972[ii]		45.6		
	1973[ii]		46.3		
	1974[ii]		51.2		
Western South Asia					
Democratic Yemen	1973[jj]		190.7		
Iraq	1960-1965[kk]		137		
	1973[jj]		91.8		
	1975[jj]		85.8		
Jordan	1956-1961[kk]		110		Implied from $q(2)$ to $q(5)$
	1966-1972[jj]		67		
	1972[jj]		86		
	1976[jj]		89		
Kuwait	1952-1957[kk]		105		
	1965[ll]	65.5		47.6	Registration statistics
	1970[ll]	43.8		41.4	
	1975[jj]		43.4		
	1974-1976[f]	48.1		41.8	
Lebanon	1970[mm]		67		
Syrian Arab Republic	1965-1970[kk]		105		
	1970[jj]		123		
	1975[jj]		112.5		
Turkey	1955-1960[nn]		187		
	1966-1967[nn]		152		
	1968[nn]		145		
Yemen	1970[jj]		159		
	1975[jj]		210		

NOTE: The notation $q(x)$ in the "Comments" column refers to the proportion of a birth cohort dying by age x (multiplied by 1,000).

[a] Janet W. Salaff, "Mortality decline in the People's Republic of China and the United States", *Population Studies*, vol. 27, No. 3 (1973), pp. 551-576.

[b] Y. C. Yu, "The demographic situation in China", *Population Studies*, vol. 32, No. 3 (November 1978), pp. 432 and 439. These rates are believed to be estimates based on sample surveys or incomplete registration. The rate for urban and rural areas combined, obtained by weighting by the proportions of urban and rural populations for these years, is 100-125.

[c] *Demographic Yearbook, 1961; ibid., 1966; ibid., 1967; ibid., 1974* (United Nations publications, Sales Nos. 62.XIII.1, 67.XIII.1, E/F.68.XIII.1, E/F.75.XIII.1).

[d] Tai Hwan Kwon and others, *The Population of Korea*, CICRED Monograph Series, World Population Year 1974 (Seoul, Centre, 1975), p. 27.

[e] Economic and Social Commission for Asia and the Pacific, *Population of the Republic of Korea*, Country Monograph Series, No. 2 (ECN.11/1241) (Bangkok, 1975), p. 176.

[f] Estimates, based on death registration statistics (adjusted, as necessary, for incompleteness), prepared for United Nations model life table project. For methodology and qualifications, see forthcoming publication.

[g] Burma, Central Statistical Organization, *Statistical Yearbook, 1975* (Rangoon, 1976), p. 52.

[h] United States of America, Department of Commerce, Bureau of the Census, *Levels and Trends of Mortality in Indonesia, 1961-1971*, by Larry Heligman, International Research Document, No. 2 (Washington, D.C., 1975).

[i] P. F. McDonald, M. Yasin and G. Jones, *Levels and Trends in Fertility and Childhood Mortality in Indonesia*, Indonesian Fertility-Mortality Survey 1973, Monograph No. 1 (Jakarta, Universitas Indonesia, 1976).

[j] Geoffrey McNicoll and Si Gde Made Mamas, *The Demographic Situation in Indonesia*, Papers of the East-West Population Institute, No. 28 (Honolulu, East-West Center, 1973).

[k] Indonesia, Biro Pusat Statistik, *Estimates of Fertility and Mortality in Indonesia, Based on the 1971 Population Census*, by Lee-Jay Cho and others (Jakarta, 1976).

[l] Malaysia, Department of Statistics and National Family Planning Board, *The Malaysian Fertility and Family Survey, 1974*, World Fertility Survey (Kuala Lumpur, 1977).

TABLE IV.9 (*continued*)

[m] Mercedes B. Concepción and Peter C. Smith, *The Demographic Situation in the Philippines: An Assessment in 1977*, Papers of the East-West Population Institute, No. 44 (Honolulu, East-West Center, 1977).

[n] B. Rungpitarangsi, *Mortality Trends in Thailand, Estimation for the Period 1937-1970*, Institute of Population Studies Paper, No. 10 (Bangkok, Chulalongkorn University, 1974).

[o] Economic and Social Commission for Asia and the Pacific, *Population of Thailand*, Country Monograph Series, No. 3 (ST/ESCAP/18) (Bangkok, 1976).

[p] Fred Arnold, Robert D. Retherford and Anuri Wanglee, *The Demographic Situation in Thailand*, Papers of the East-West Population Institute, No. 45 (Honolulu, East-West Center, 1977).

[q] United States of America, Department of Commerce, Bureau of the Census, *Country Demographic Profiles: Thailand* (ISP-DP-15) (Washington, D.C., 1978).

[r] United States of America, Department of Commerce, Bureau of the Census, *World Population 1977* (Washington, D.C., 1978).

[s] Afghanistan and United States Agency for International Development, *National Demographic and Family Guidance Survey of the Settled Population of Afghanistan, vol. I, Demography*, by Solomon Chu, Robert N. Hill and Saxon Graham (Buffalo, N.Y., 1975).

[t] World Health Organization, *Infant and Early Childhood Mortality in Relation to Fertility: Report on an* Ad Hoc *Survey in Greater Kabul, Republic of Afghanistan, 1973-74* (Geneva, 1976).

[u] Ismail Sirageldin, Douglas Norris and Mahbubuddin Ahmad, "Fertility in Bangladesh: facts and fancies", *Population Studies*, vol. 29, No. 2 (1975), pp. 207-215.

[v] Lee L. Bean and Masihur Rahman Khan, "Mortality patterns in Pakistan" (Karachi, February 1967) (mimeo.).

[w] United Kingdom, Ministry of Overseas Development, Population Bureau, and Bangladesh, Ministry of Planning, Census Commission, *Report on the 1974 Bangladesh Retrospective Survey of Fertility and Mortality*, vol. I (London and Dacca, 1977), pp. 84-91.

[x] India, Office of the Registrar General, Vital Statistics Division, *Infant Mortality in India*, Sample Registration Scheme, Analytical Series, No. 1 (New Delhi, 1971).

[y] India, Office of the Registrar General, *Census of India, 1971*, Series 1, India, Paper 1, *All India Life Tables* (New Delhi, 1977).

[z] India, Office of the Registrar General, *Sample Registration Bulletin*, vol. VII, No. 1 (January-March 1973).

[aa] Djamchid Bebnam and Mehdi Amani, eds., *La Population de l'Iran*, CICRED Monograph Series, World Population Year 1974 (Teheran, 1974), p. 13.

[bb] Seza Tamrazian, "Population growth survey in Iran; three years of experience, 1973-1976", paper contributed to the General Conference of the International Union for the Scientific Study of Population, 8-13 August 1977, Mexico City.

[cc] Nepal, Central Bureau of Statistics, Kathmandu. Information supplied to the World Health Organization, South-East Asia Regional Office, New Delhi. Estimate is based on the Demographic Survey of the National Planning Commission.

[dd] Nepal, Family Planning and Maternal/Child Health Project, *Nepal Fertility Survey 1976, First Report* (London, 1977), cited in Economic and Social Commission for Asia and the Pacific, *Demographic Trends and Policies in ESCAP Countries, 1978*, Demographic Estimates Series, No. 1 (Bangkok, 1979), pp. 46-47.

[ee] Average of infant mortality rates for 1974-1975 and 1976 from the Demographic Sample Survey of Nepal. United States Department of Commerce, Bureau of the Census, *Nepal*, by Roger G. Kramer, Country Demographic Profiles, No. 21 (Washington, D.C., 1979), p. 7.

[ff] Mohammad Afzal, *The Population of Pakistan*, CICRED Monograph Series, World Population Year 1974 (Islamabad, 1974).

[gg] Pakistan, Ministry of Finance, Planning and Economic Affairs, *Population Growth Survey, 1969* (Islamabad, 1975).

[hh] Economic and Social Commission for Asia and the Pacific, *Population of Sri Lanka*, Country Monograph Series, No. 4 (ST/ESCAP/30) (Bangkok, 1976).

[ii] Sri Lanka, Department of Census and Statistics, *Bulletin of Vital Statistics, 1976* (Colombo, 1978).

[jj] Economic Commission for Western Asia, *Demographic and Related Socio-economic Data Sheets for Countries of the Economic Commission for Western Asia*, No. 2 (Beirut, 1978).

[kk] K. E. Vaidyanathan, "A study of infant and child mortality in Arab countries" (Cairo Demographic Centre doc. CDC/S75/12), paper presented at the Seminar on Mortality Trends and Differentials in Some Arab and African Countries, Cairo, 17-23 December 1975.

[ll] Allan G. Hill, "The demography of the Kuwaiti population in Kuwait", *Demography*, vol. 12, No. 3 (1975), pp. 537-548.

[mm] Youssef Courbage and Philippe Fargues, *La Situation démographique au Liban* (Beirut, Librairie orientale, 1973), quoted in Huda Zurayk, "Sources of demographic data in Lebanon", *Population Bulletin of the UN-ECWA* (Beirut), No. 12 (1977), pp. 27-33.

[nn] Miroslav Macura, "Components of growth, Section B — Mortality", *The Population of Turkey*, CICRED Monograph Series, World Population Year 1974 (Ankara, n.d.), p. 41.

earlier period is based on a dual system of data collection which is less likely to miss events than the one-round survey serving as the basis for the 1970 rate. The figures for Iran indicate a rural infant mortality rate in 1973-1976 which was twice as high as in urban areas. They also show a substantial decline in infant mortality between 1965 and the mid 1970s amounting to nearly 30 percent in rural areas. As can be seen in table IV.9, the figures for Afghanistan and Nepal cover a large range, and given the absence of a time series, it is not possible to determine the real levels or recent trends in infant mortality for either country.

The infant mortality rates in table IV.9 for the countries of Western South Asia suggest as great a range in levels from country to country as is found in other regions, from a rate in the forties in Kuwait to rates near 200 in Democratic Yemen and Yemen. Only in the case of Iraq, Kuwait and Turkey do the data show a clear downward trend in infant mortality since the 1950s or 1960s, although were reliable trend data available for other countries of the region some of these would also undoubtedly show declines.

The data reviewed here on infant mortality in the countries of Asia give the impression of a widening gap between a few relatively small countries with very low infant mortality, on the one hand, and the large, populous nations in Asia (with the exception of China) where infant losses still run well above 100 deaths per 1,000 live births, on the other. It is not coincidental that the latter countries are also the ones with the highest fertility rates and the lowest levels of literacy and poorest living conditions.

The distribution of infant deaths by age of infant has generally been found to vary with the level of infant mortality. At high levels, the proportion of infants dying during the first month of life—the neonatal period—has been much lower on average than at low levels of infant mortality. For example, a United Nations study found that where the infant mortality rate was below 50, between one half and two thirds of all infant deaths occurred during the first month of life, but when the infant mortality rate exceeded 100, only one third of all infant deaths were in the neonatal period. The explanation for this relationship, according to the study, was that as infant mortality declined, very little improvement was observed in the age-group under one week old, even when improvement at other ages during infancy was considerable.[25] In the mid 1970s, infant mortal-

[25] *Foetal, Infant and Early Childhood Mortality, vol. I, The Statistics* (United Nations publication, Sales No. 54.IV.7), pp. 34-38; see also J. E. Gordon, "Nutritional science and society", *Nutrition Review*, vol. 27 (1969), pp. 331-338.

ity in the more developed countries averaged a very low 16 per 1,000 live births. In these countries about two thirds of infant deaths occurred during the first month of life, and frequently the percentage exceeded 70.[26] A large part of this early infant mortality in the more developed countries results from birth injuries, congenital anomalies or diseases peculiar to early infancy. A similar inverse relationship between infant mortality level and proportion of infant deaths occurring in the neonatal period is often mentioned as characterizing the less developed countries as well.[27] However, several studies carried out in Pakistan, Bangladesh and Bombay, India, suggest that while the proportion of infant deaths which occur during the first month of life may vary substantially from country to country or from one period to another, on average it does not differ markedly from the proportions found in countries with low infant mortality. The Pakistan study, for the period 1962-1965, estimated that three fifths of infant deaths in that country occurred during the neonatal period. A Bangladesh report covering the period 1967-1969 reached the same conclusion. The infant mortality rate was quite high in these two countries at the time, around 125-150.[28] A hospital-based study of Greater Bombay during the 1960s found that neonatal deaths accounted for between 46 and 56 per cent of all infant deaths. These findings were, in effect, confirmed by a retrospective survey conducted in 1966.[29]

In table IV.10, infant and neonatal mortality rates are presented for the rural populations in 10 states of India as obtained from the Sample Registration Scheme during 1968. These data exhibit a negative association between the level of infant mortality and the proportion of all infant deaths occurring during the first month of life. The coefficients of correlation between these two variables—−0.50 and −0.58, respectively, for males and females—suggest that the proportion of neonatal deaths increases as infant mortality decreases and vice versa. The figures in table IV.11, on the other hand, show varying relationships between the level of infant mortality and the percentage of neonatal deaths. For India and Iran, the association between the two variables is positive, while for Lebanon and Turkey it is negative.

In many instances it is difficult to determine whether the distribution of infant deaths by age reflects special risks to the newborn in high-mortality societies—such as neonatal tetanus, respiratory diseases and other infectious diseases—or merely defective data. Defects in the data may be due to misreporting of the age at death. In such cases, the infant mortality rate would be correct but the proportion attributable to the neonatal period would not, unless

TABLE IV.10. INFANT MORTALITY RATES[a] AND PERCENTAGE OF NEONATAL DEATHS, 10 STATES IN INDIA, RURAL POPULATION, 1968 (SAMPLE REGISTRATION SCHEME)

Males			Females		
State	IMR	Percentage neonatal	State	IMR	Percentage neonatal
Uttar Pradesh	176.6	56.9	Uttar Pradesh	182.6	43.8
Assam	151.9	60.4	Rajastan	168.8	46.7
Rajastan	145.5	55.6	Assam	140.2	58.8
Gujarat	132.7	57.8	Jammu and Kashmir	129.2	60.6
Jammu and Kashmir	125.2	65.6	Gujarat	124.0	49.3
Andhra Pradesh	117.0	58.6	Punjab	104.4	53.1
Mysore	98.9	64.3	Maharashtra	103.9	59.8
Punjab	97.3	66.2	Andhra Pradesh	100.7	58.1
Maharashtra	88.2	60.7	Mysore	93.4	60.9
Kerala	72.0	60.1	Kerala	59.7	53.6

Source: India, Office of the Registrar General, Vital Statistics Division, *Infant Mortality in India*, Sample Registration Scheme, Analytical Series, No. 1 (New Delhi, 1971).

[a] Infant mortality rates (IMR) are infant deaths per 1,000 live births.

TABLE IV.11. NEONATAL, POST-NEONATAL AND INFANT MORTALITY IN FIVE COUNTRIES OF ASIA

Country and culture or residence categories	Number of live births	Death rates per 1,000 live births			Percentage neonatal deaths
		Neonatal	Post-neonatal	Infant	
India	22,110	102	37	139	73.4
Muslims		76	40	116	65.5
Hindu Scheduled Castes[a]		102	42	144	70.8
Hindu Kongu Vellalas[b]		129	32	161	80.1
Other Hindus[b]		112	35	147	76.2
Iran	14,602	37	59	96	38.5
Muslims		48	65	113	42.5
Armenians		25	52	77	32.5
Lebanon	12,268	18	21	39	46.2
Shiites		19	26	45	42.2
Maronites		17	14	31	54.8
Philippines	16,017	28	22	50	56.0
Urban		30	24	54	55.6
Rural		27	21	48	56.2
Turkey	15,289	38	94	132	28.8
Semi-urban		36	78	114	31.6
Rural		39	104	143	27.3

Source: M. R. Bone, C. C. Standley and A. R. Omran, "Family formation and childhood mortality", in A. R. Omran and C. C. Standley, eds., *Family Formation Patterns and Health* (Geneva, World Health Organization, 1976), pp. 201-255.

NOTE: Neonatal rates refer to deaths of infants under 1 month of age, post-neonatal rates to deaths of infants aged 1-11 months.

Data are based on sample surveys conducted in the five countries in the early 1970s. The study areas were as follows:
India—34 villages in Tamil Nadu State
Iran—3 sections in north-eastern Teheran
Lebanon—3 communities in the suburbs of Beirut
Philippines—an urban area (Metropolitan Manila) and a rural area (Rizal Province)
Turkey—Etimesgut District (83 villages and 2 towns).

[a] Mainly agricultural labourers.

[b] Mainly landowning cultivators.

[26] Compiled from data in *Demographic Yearbook, 1977* (United Nations publication, Sales No. E/F.78.XIII.1), table 16.

[27] For example, Robinson, in his study of Pakistan data, maintained that "In the developing countries ... deaths are spaced more evenly over the entire first year of life with only 20 per cent or so occurring in the first month. Environmental and infectious causes loom larger than congenital or birth related factors and gastric and respiratory ailments account for about two-thirds of all infant deaths." (W. C. Robinson, *Studies in the Demography of Pakistan* (Karachi, Pakistan Institute of Development Economics, 1967), p. 11.)

[28] W. Seltzer, *Benchmark Demographic Data for Pakistan: A Review of Summary Estimates Derived from the PGE Experiment* (Karachi, Pakistan Institute of Development Economics, 1968), p. 23; John Stoeckel and A. K. M. Alauddin Chowdhury, "Neonatal and post-neonatal mortality in a rural area of Bangladesh", *Population Studies*, vol. 26, No. 1 (1972), pp. 113-120.

[29] L. T. Ruzicka and T. Kanitkar, "Infant mortality in an urban setting: the case of Greater Bombay", in K. E. Vaidyanathan, ed., *Studies on Mortality in India* (Madurai (Gandhigram), Gandhigram Institute of Rural Health and Family Planning, 1972).

there were compensating errors in reporting age. Probably a greater source of error is that early infant deaths are more frequently not reported at all than infant deaths at other ages, in which case both the infant mortality rate and the proportion of neonatal deaths would be understated.

Without resolving the issue of the proportion of infant deaths that occur during the neonatal period, it can nevertheless be said that the distribution of infant deaths by age is closely associated with causes of death. The importance of a particular disease may vary from one country to another, and from season to season and year to year within a country. Although it is not possible to document the incidence of particular causes of death with reliable data for high-mortality countries, it is well known that the infectious, parasitic and respiratory diseases play a major role in infant mortality. Deaths from these diseases can be more readily prevented than mortality from what are often called endogenous causes of death, such as congenital anomalies, and diseases and injuries resulting from pregnancy and the birth process. As the impact of the first-mentioned group of diseases is reduced and the infant mortality rate declines, the remaining causes of death tend to be concentrated in the first month of life. A major contributor to mortality during the post-neonatal period is undernutrition or malnutrition which often acts synergistically with infectious diseases.

In general, when a population is undernourished or malnourished and suffers from endemic and debilitating diseases such as malaria, premature births are common and the infant mortality rate is elevated because prematurely born infants are more susceptible to disease. In addition, especially in rural areas where births are attended by traditional midwives or members of the mother's family, mortality from neonatal tetanus is a serious threat arising not only from failure to observe basic hygienic practices but from employing certain traditional practices which in themselves are harmful. The large average size of families also adversely affects a newborn's chances of survival, as infant death rates generally increase with birth order after the third or fourth child. Thus, the reduction of fertility in itself could lower the infant mortality rate substantially in high-fertility areas.[30] Important gains could also be realized by improving the nutritional status of the mother and by providing better pre-natal and post-natal care.

To summarize, the countries in table IV.9 may be grouped into low, medium and high infant mortality categories by using an infant mortality rate of less than 40 to define the low-mortality and one in excess of 120 to define the high-mortality category. The results are presented in table IV.12. (Burma and China have been excluded from this classification, the former because the data pertain to urban areas only, the latter because current infant mortality

TABLE IV.12. DISTRIBUTION OF 22 ASIAN COUNTRIES BY LEVEL OF INFANT MORTALITY IN THE EARLY 1970s

Infant mortality rate in the early 1970s (per 1,000 live births)	*Number of countries*	*Estimated population, 1974 (millions)*	*Estimated annual number of events, early 1970s (thousands)*	
			Live births	*Infant deaths*
Under 20	2	6.5	126	1.8
20-39	2	43.4	1,523	56.4
40-59	3	55.6	2,200	121.1
60-79	3	76.2	3,372	220.5
80-99	2	13.4	661	57.2
100-119	2	75.3	2,794	318.2
120-139	2	598.4	25,633	3,133.2
140-159	3	240.8	11,390	1,654.1
160 and over	3	26.9	1,355	273.4
TOTAL	22	1,136.5	49,054	5,835.9

Sources: Infant mortality levels by country from table IV.9, but excluding Burma and China. Population estimates from *Demographic Yearbook, 1974* (United Nations publication, Sales No. E/F.75.XIII.1), table 3. The number of live births was derived using the crude birth rates as given in table 4 of the source.

levels are not known.) On the basis of this scheme and the most recent estimates of the infant mortality rate for each country, only four territories are found to fall into the low infant mortality category. These are Hong Kong, Singapore, Peninsular Malaysia and the Republic of Korea, which altogether have only 4 per cent of the population of the countries represented in table IV.12, and an even smaller percentage of the births and infant deaths. At the other end of the distribution are eight high infant mortality countries containing about three quarters of the population and births, and over 85 per cent of the infant deaths. The remaining 10 countries and territories fall in the medium infant mortality range of 40 to 120 infant deaths per 1,000 live births. These countries contain about two fifths of the population and births, and 12 per cent of the infant deaths of the countries included in table IV.12.

2. *Mortality during early childhood*

After infancy, death rates for children are, comparatively speaking, usually quite low. In Hong Kong and Singapore, which have good data, the death rates per 1,000 children between ages 1 and 4 years—the conventional definition of early childhood—have averaged around 1 or less per 1,000 population during recent years (see table IV.13). This was only a small fraction—less than 10 per cent—of the infant mortality rates in these areas. Recent early childhood mortality rates in Peninsular Malaysia and Sri Lanka, the only other Asian countries with reliable registration statistics, have been several times higher than those of Hong Kong and Singapore. The Malaysian data indicate that rates dropped substantially during the 1970s.

Information for the remaining countries of Asia is fragmentary. As in the case of infant mortality, a variety of estimation techniques have been used to derive rates from sample surveys and censuses. The results suggest that in many of the countries of Asia for which it can be estimated, mortality among children aged 1-4 years has remained substantially higher than the rates given above. Estimates of age-specific death rates in this age-group for the

[30] In India, for example, where about 25 per cent of all births are sixth and higher order births, it has been estimated that over-all infant mortality levels could be lowered markedly if women did not bear any children beyond the fifth child. (F. A. Gulick, "Parity, contraception and infant mortality: a note on some parallel relationships", paper presented at the All India Seminar on Demography and Statistics, Demographic Research Centre, Banaras Hindu University, Vanarasi (V.P.), 1971, and cited in P. Singha, "Infant mortality and the level of fertility in India: a review", *Demography (India)*, vol. 4, No. 2 (1975), pp. 457-476.)

early 1970s for Afghanistan, India and Indonesia, for example, vary from about 25 to the low thirties for both sexes combined, but most figures are lower (see table IV.14).[31] With the exceptions of urban Burma, India, Pakistan, Iran and Iraq, the estimated mortality rates for male children appear to have been consistently higher than those for female children.

In the few cases where there are time series, early childhood mortality has usually appeared to be declining and it might be inferred from this that, despite the paucity of information, mortality in the age-group from 1 to 4 years has declined in most Asian countries since 1950. Between 1947 and the early 1970s, early childhood mortality was apparently reduced by 75 to 80 per cent in Sri Lanka, 85

[31] The age-specific death rates for the age-group 1-4 years ($_4m_1$) are about one third to one fourth as high as the probability of dying between ages 1 and 4 years ($_4q_1$).

TABLE IV.13. EARLY CHILDHOOD DEATH RATES IN COUNTRIES OF ASIA WITH "COMPLETE" VITAL REGISTRATION, 1970-1976

(Deaths of children aged 1-4 years per 1,000 population in that age-group)

Country	*1970*	*1971*	*1972*	*1973*	*1974*	*1975*	*1976*
Hong Kong							
Males[a]	1.13	1.07	1.00	1.15	1.17	0.79	0.90
Females[a]	1.24	0.82	0.90	1.01	1.04	0.76	0.77
Malaysia							
Peninsular Malaysia							
Males[b]	4.36	4.50	3.74	4.0	...	3.1	...
Females[b]	4.41	4.24	3.55	3.9	...	3.1	...
Singapore							
Males[a]	1.60	1.12	...	1.27	1.03	0.79	0.75
Females[a]	1.32	1.11	...	1.03	1.09	0.93	0.58
Sri Lanka							
Males[c]	—	5.51	—	...	...	...	...
Females[c]	—	6.47	—	...	...	...	...

NOTE: "Complete" registration refers to coverage of at least 90 per cent of deaths occurring each year.

[a] World Health Organization data bank.

[b] *Demographic Yearbook, 1974, ibid., 1976* and *ibid., 1977* (United Nations publications, Sales Nos. E/F.77.XIII.1 and E/F.78.XIII.1).

[c] Estimates, based on death registration statistics (adjusted, as necessary, for incompleteness), prepared for United Nations model life table project. For methodology and qualifications, see forthcoming publication.

TABLE IV.14. ESTIMATES OF EARLY CHILDHOOD MORTALITY (AGES 1-4 YEARS) IN SELECTED COUNTRIES OF ASIA

Country	*Period*	*Age-specific death rate* ($1{,}000\ _4m_1$)	*Probability of dying* ($1{,}000\ _4q_1$)	*Survivors from birth to age x (l_x) out of 1,000 live births*		
				l_2	l_3	l_5
Afghanistan (Greater Kabul) ...	1972-1973[a]	24.1	...	...	...	...
	1973-1974[b]	33.7 (1)	...	...	...	...
		25.4 (2)	...	820	800	770
Bangladesh	1974[c]	...	86.0 (M)	801	784	768
		...	83.0 (F)	817	800	784
Burma (urban)[d]	1965	...	57.6 (M)	...	...	803
			65.3 (F)	...	...	815
	1971	12.4	46.9 (M)	...	...	887
			50.3 (F)	...	...	891
	1974	12.9	47.8 (M)	...	...	898
			52.2 (F)	...	...	902
China (Peking)[e]	1949	55.4	...	...	...	...
	1953	12.6	...	...	...	...
	1957	6.4	...	...	...	...
India	1961-1970[f]	...	67.8 (M)	837	827	811
		...	75.6 (F)	842	828	806
	1970-1972[g]	27.5 (M)	102.4	...	...	789
		36.1 (F)	131.8	...	...	760
Indonesia	1961[h]	...	118.6 (M)	...	...	...
		...	104.2 (F)	...	...	...
	1971[h]	...	112.4 (M)	...	...	...
		...	99.5 (F)	...	...	...
	1971[i]			837	805	783
	1973[j]	...	...	...	...	791
Iran	1973-1976[g]	15.3 (M)	58.8	...	...	829
		19.2 (F)	73.1	...	...	806
Iraq	1974-1975[k]	16.2 (M)	...	...	...	...
		16.9 (F)	...	...	...	...

TABLE IV.14 (*continued*)

Country	Period	Age-specific death rate ($1{,}000\ {}_4m_1$)	Probability of dying ($1{,}000\ {}_4q_1$)	Survivors from birth to age x (l_x) out of 1,000 live births		
				l_2	l_3	l_5
Jordan[l]	1956-1961	...	...	846	874	802
	1966-1972	...	...	905	890	875
	1972	10.3 (M)	...	...	...	...
		9.4 (F)	...	...	...	...
Kuwait	1952-1957[l]	...	...	853	832	810
	1970[l]	3.9 (M)	...	...	...	...
		3.5 (F)	...	...	...	...
	1974-1976[g]	2.7 (M)	10.5	...	...	942
		2.8 (F)	11.2	...	...	948
Lebanon	1970[m]	...	22.5 (M)	...	...	910
		...	21.9 (F)	...	...	918
Pakistan	1962-1965[a]	25 (M)	88.6	...	...	786
		38 (F)	124.9	...	...	752
	1968[o]	17.0 (M)	...	...	...	...
		17.7 (F)	...	...	...	...
Philippines[p]	1960	...	...	...	883	876
	1968	...	...	...	920	919
	1973	...	...	...	929	923
Republic of Korea	1965[q]	6.0 (M)	...	941	932	912
		5.9 (F)	...			
	1970[q]	3.6 (M)[r]	...	959	948	930
		3.2 (F)[r]	...			
	1971-1975[g]	2.3 (M)	9.2	...	...	952
		2.7 (F)	10.8	...	...	953
Syrian Arab Republic	1965-1970[l]	14.8 (M)	...	...	...	...
		14.0 (F)	...	...	...	...
	1970[s]	...	...	865	851	828
Thailand	1964-1965[t]	...	32.4 (M)	...	...	875
		...	31.6 (F)	...	...	895
	1969-1971[g]	9.3 (M)	36.1	...	...	886
		9.8 (F)	38.2	...	...	905
	1974-1975[s]	...	30.9 (M)	...	...	880
		...	35.7 (F)	...	...	907

NOTE: (M) refers to males, (F) to females.

[a] World Health Organization, *Infant and Early Childhood Mortality in Relation to Fertility; Report on an* Ad Hoc *Survey in Greater Kabul, Republic of Afghanistan, 1973-74* (Geneva, 1976).

[b] Afghanistan, Ministry of Public Health, and World Health Organization Regional Office for the Eastern Mediterranean, *Infant and Early Childhood Mortality in Relation to Fertility Patterns; Report of an* Ad Hoc *Survey in Greater Kabul, Afghanistan, 1972-75* (Kabul, 1978), pp. 80, 161-164. (1) is direct estimate based on data from Prospective Survey; (2) is estimate based on Prospective Survey data adjusted by Brass technique.

[c] United Kingdom, Ministry of Overseas Development, Population Bureau, and Bangladesh, Ministry of Planning, Census Commission, *Report on the 1974 Bangladesh Retrospective Survey of Fertility and Mortality*, vol. I (London and Dacca, 1977), pp. 89-91.

[d] Burma, Central Statistical Organization, *Statistical Yearbook, 1975* (Rangoon, 1976). Data are for a varying number of towns.

[e] Janet W. Salaff, "Mortality decline in the People's Republic of China and the United States", *Population Studies*, vol. 27, No. 3 (1973), pp. 551-576.

[f] India, Office of the Registrar General, *Census of India, 1971*, Series 1, India, Paper 1, *All India Life Tables* (New Delhi, 1977).

[g] Estimates, based on death registration statistics (adjusted, as necessary, for incompleteness), prepared for United Nations model life table project. For methodology and qualifications, see forthcoming publication.

[h] United States of America, Department of Commerce, Bureau of the Census, *Levels and Trends of Mortality in Indonesia, 1961-1971*, by Larry Heligman, International Research Document, No. 2 (Washington, D.C., 1975).

[i] Geoffrey McNicoll and Si Gde Made Mamas, *The Demographic Situation in Indonesia*, Papers of the East-West Population Institute, No. 28 (Honolulu, East-West Center, 1973).

[j] P. F. McDonald, M. Yasin and G. W. Jones, *Levels and Trends in Fertility and Childhood Mortality in Indonesia*, Indonesian Fertility-Mortality Survey 1973, Monograph No. 1 (Jakarta, Universitas Indonesia, 1976).

[k] Based on separate rates for urban and rural population given in Iraq, Central Statistical Organization, *Results of the Vital Events Survey in Iraq for 1974-1975* (July 1976), p. 40, adjusted by the United Nations Economic Commission for Western Asia, and weighted assuming 63 per cent of the population to be urban.

[l] K. E. Vaidyanathan, "A study of infant and child mortality in Arab countries" (Cairo Demographic Centre doc. CDC/S75/12), paper presented at the Seminar on Mortality Trends and Differentials in Some Arab and African countries, Cairo, 17-23 December 1975.

[m] Youssef Courbage and Philippe Fargues, *La Situation démographique au Liban*, CICRED Monograph Series, World Population Year 1974 (Beirut, Université libanaise, 1974), p. 36.

TABLE IV.14 (*continued*)

[n] Mohammad Afzal, *The Population of Pakistan*, CICRED Monograph Series, World Population Year 1974 (Islamabad, 1974), tables 8 and 9.

[o] *Demographic Yearbook, 1974* (United Nations publication, Sales No. E/F.75.XIII.1). Rates were derived from the Population Growth Survey.

[p] Mercedes B. Concepción and Peter C. Smith, *The Demographic Situation in the Philippines: An Assessment in 1977*, Papers of the East-West Population Institute, No. 44 (Honolulu, East-West Center, 1977), p. 67. Somewhat higher mortality, and therefore fewer survivors, was estimated by the United Nations (see footnote *g*), which found survivors to age 5 in 1969-1971 numbering 892 for males and 908 for females.

[q] Lee-Jay Cho, *The Demographic Situation in the Republic of Korea*, Papers of the East-West Population Institute, No. 29 (Honolulu, East-West Center, 1973).

[r] 1971.

[s] K. E. Vaidyanathan, *Estimation of Infant and Child Mortality in Syria from the 1970 Census Data*, Syrian Population Studies Series, No. 2 (Damascus, Centre of Population Studies and Research, 1976), p. 13. The l_x values were derived by the Sullivan method.

[t] *The Population of Thailand*, CICRED Series, World Population Year 1974 (Bangkok, 1974), pp. 78-79.

[u] Economic and Social Commission for Asia and the Pacific, *Population of Thailand*, Country Monograph Series, No. 3 (ST/ESCAP/18) (Bangkok, 1976), pp. 56-57.

per cent in Peninsular Malaysia and over 90 per cent in Singapore. The estimates for Peking indicate a dramatic decline in early childhood mortality from about 55 in 1949 to about 6 in 1957—a 90 per cent reduction in a period of only eight years. The improved chances of surviving from birth to age 5, rather than from the first to the fifth birthday, are well documented for Indonesia. According to the figures in table IV.15, between 21 and 38 per cent of every 1,000 children born alive in the period 1945-1949 died before their fifth birthday. In contrast, children born in the period 1965-1967 had a considerably better chance of surviving to their fifth birthday, as the mortality rate for the first five years of life had by then been reduced to between 11 and 19 per cent of live births. The range of regional variation in proportions of children dying was also sharply reduced between the late 1940s and the mid 1960s.

While mortality among children aged 1-4 years has been reduced in many countries of Asia during the past quarter century, its change in others has been minimal, even though the general level of mortality may have declined.[32] Early childhood is a particularly vulnerable period in the high-mortality countries because nutritional deficiencies associated with weaning, which generally occurs after the first year of life in these countries, act synergistically with infectious diseases to impair the health of the young child. Mortality improvement at these ages tends to lag behind gains at other ages, and it is also during this period that differences in death rates between the more and the less developed countries are greatest. In India, for example, the life table for 1970-1972 constructed for the United Nations model life table project gives a death rate for persons aged 1-4 years of 36 per 1,000 population for girls and 27 for boys,[33] compared with average death rates of 0.83 per 1,000 population for boys and 0.66 for girls in the more developed countries.[34] Thus, mortality in India for this age-group was 33 times as high for boys and 55 times as high for girls as in the more developed countries!

The patterns of mortality for shorter segments of the early childhood period, i.e. for single years of age or even for months of age, is of great interest, but data giving such detail are scarce. In some countries of sub-Saharan Africa, the mortality patterns in early childhood were found to differ fundamentally from those of the more developed countries. Not only was mortality for this age-group as a whole in relation to infant mortality higher than in reference models based on the experience of the more developed countries but the relationships within the age-group also departed from the usual patterns. These patterns are discussed in chapter III. Unfortunately, there are virtually no data for the high-mortality countries of Asia on early childhood mortality by single years of age. The data given for India in the table which follows are based on 338 deaths recorded in a field study in a rural area of the Punjab in 1957-1959. Corresponding rates are given for a more developed country (Sweden) for comparison purposes, and it can be seen that the patterns for the two sets of data differ markedly. However, it is not, of course, possible to generalize from such limited data.

Death rates per 1,000 live births by year of age

Age (years)	*Rural Punjab, 1957-1959*	*Sweden 1963*
Under 1	186.9	15.4
1	72.2	0.9
2	21.0	0.7
3	8.1	0.5
4	3.9	0.5
1-4	27.4	0.7

Source: J. E. Gordon and others, "The second year death rate in the less developed countries", *American Journal of the Medical Sciences*, vol. 254 (September 1967), p. 363.

To reduce the excessive levels of child mortality, actions across a broad front are needed. In addition to maternal and child health programmes, programmes that aim to improve nutrition and provide sanitation services and safe water supplies, particularly in rural areas, are essential. Health education at the village level and community involvement have been found to contribute significantly to the implementation of health programmes.

[32] See T. Dyson, "Levels, trends, differentials and causes of child mortality: a survey", *World Health Statistics Report*, vol. 30, No. 4 (1977), pp. 282-311.

[33] United Nations model life table project, publication forthcoming.

[34] Chapter II, More developed countries, table II.4.

TABLE IV.15. PROPORTION OF CHILDREN DYING BEFORE AGE 5 YEARS OUT OF EVERY 1,000 LIVE BIRTHS, AND AVERAGE ANNUAL PERCENTAGE DECLINE IN PROPORTION DYING, INDONESIAN BIRTH COHORTS OF 1945-1949 THROUGH 1965-1967

Place of residence and region	Year of birth of child					Average annual percentage decline		
	1945-1949	1950-1954	1955-1959	1960-1964	1965-1967	1945-1949 to 1955-1959	1955-1959 to 1965-1967	1945-1949 to 1965-1967
Urban								
West Java	269	216	180	161	136	4.0	4.0	4.0
Central Java	253	171	161	126	117	4.5	4.6	4.5
East Java	228	168	137	120	108	5.1	3.4	4.4
Sumatra	263	154	137	131	117	6.5	2.3	4.8
Sulawesi	212	184	178	138	152	1.8	2.3	2.0
Rural								
West Java	282	271	245	217	188	1.4	3.8	2.4
Central Java	301	218	178	164	157	5.3	1.8	3.8
East Java	261	231	192	143	117	3.1	7.1	4.7
Sumatra	383	251	192	180	175	6.9	1.3	4.6
Sulawesi	263	244	236	208	177	1.1	4.1	2.3
Bali	245	239	212	194	185	1.5	2.0	1.7

Source: P. F. McDonald, M. Yasin and G. W. Jones, *Levels and Trends in Fertility and Childhood Mortality in Indonesia*, Indonesian Fertility-Mortality Survey 1973, Monograph No. 1 (Jakarta, Universitas Indonesia, 1976), p. 69.

3. *Mortality above the age of 5 years*

While in the absence of complete vital registration statistics or good census data infant and early childhood mortality can be estimated indirectly, mortality at other ages tends to remain largely conjectural. This is because indirect methods of estimating mortality at ages above 5 years give highly questionable results, and it is often difficult to determine whether those results reflect true levels and patterns of mortality or simply those of the model life tables used in the estimation procedure. Because of these uncertainties, the present analysis will focus on mortality above ages 15 and 45 years as summarized by the life expectancies at those ages.

(a) *Expectation of life at age 15*

Estimates of life expectancy at ages 15 and 45 years are presented in table IV.16 for the latest available date, which in all but two cases is 1970 or later. The figures for four countries—Hong Kong, Peninsular Malaysia, Singapore and Sri Lanka—are based on complete vital registration statistics. The others were derived by various indirect estimation techniques. The male life expectancies at age 15 ranged from a low of 40 years in Indonesia to a high exceeding 55 years in Kuwait, while the female figures varied from 39 years in Sabah, Malaysia, to 62 years in Hong Kong. Were the additional countries of Asia not represented in table IV.16 to be included, the lower end of the

TABLE IV.16. DIFFERENCE BETWEEN FEMALE AND MALE LIFE EXPECTANCIES AT AGES 15 AND 45 YEARS, SELECTED COUNTRIES OF ASIA, LATEST AVAILABLE DATA

(Years)

Country	Period	e_{15}			e_{45}		
		Females	Males	Difference (females minus males)	Females	Males	Difference (females minus males)
Bangladesh[a]	1974	46.1	46.3	−0.2	24.1	24.4	−0.3
Burma (urban)[a]	1971	52.7	49.3	3.4	27.3	24.2	3.1
Hong Kong[b]	1971	61.9	54.6	7.3	33.4	26.9	6.5
India[c]	1970-1972	47.6	49.1	−1.5	23.8	23.2	0.6
Indonesia[a]	1971	42.0	39.8	2.2	20.7	18.7	2.0
Iran[c]	1973-1976	56.2	54.8	1.3	29.2	27.6	1.6
Jordan[b]	1959-1963	50.1	48.2	1.9	26.7	24.8	1.9
Kuwait[c]	1974-1976	59.5	55.4	4.1	31.1	27.9	3.2
Lebanon[a]	1970	57.6	54.0	3.6	30.2	27.2	3.0
Malaysia[b]							
Peninsular Malaysia	1972	58.6	54.0	4.6	31.3	26.9	4.4
Sabah	1970	39.4	42.5	−3.1	17.6	17.2	0.4
Sarawak	1970	45.6	45.0	0.6	22.9	19.9	3.0
Pakistan[a]	1962-1965	46.2	47.1	−0.9	21.8	21.3	0.5
Philippines[c]	1969-1971	56.4	51.8	4.5	30.2	27.5	2.7
Republic of Korea[c]	1971-1975	55.5	48.3	7.2	29.6	22.4	7.2
Singapore[a]	1969-1971	59.1	53.1	6.0	30.7	25.3	5.4
Sri Lanka[c]	1970-1972	57.5	54.8	2.8	30.6	28.2	2.4
Syrian Arab Republic[b]	1970	55.0	51.8	3.2	29.0	26.4	2.6
Thailand[a]	1974-1975	56.2	51.6	4.6	30.2	26.6	3.6

[a] For sources, see table IV.6.

[b] *Demographic Yearbook, 1974* (United Nations publication, Sales No. E/F.75.XIII.1), table 33.

[c] Estimates, based on death registration statistics (adjusted, as necessary, for incompleteness), prepared for United Nations model life table project. For methodology and qualifications, see forthcoming publication.

range might be extended downwards by several years, but the upper boundary would probably remain roughly the same. In four places—Bangladesh, India, Pakistan and Sabah, Malaysia—male life expectancy at age 15 exceeded female life expectancy, but only in Sabah was the differential of 3 years large enough to be called substantial. Among the other countries listed in table IV.16, female life expectancy at age 15 exceeded that of the males by amounts of up to 7 years. The largest differentials occurred in Hong Kong (7.3 years), the Republic of Korea (7.2 years) and Singapore (6.2 years), while differentials of between 4 and 5 years were found in Kuwait, Peninsular Malaysia, the Philippines and Thailand. These seven countries were among the top 10 with respect to life expectancy at 15 years, of the 19 countries included in table IV.16. This suggests that, for the countries of Asia, a similar positive relationship exists between the level of life expectancy and the size of the differential between male and female life expectancy as was found in Africa, Latin America and the more developed countries. The linear correlation coefficient for the countries in table IV.16 between female life expectancy at age 15 and the excess of female over male life expectancy at this age is 0.82. Along the regression line, there is no difference between male and female life expectancy at age 15 when the remaining expectation of life for females at this age is just over 45 years, but by the time the remaining female life expectancy at 15 years reaches 60 years, it exceeds that of males by over 5 years (see figure IV.3).

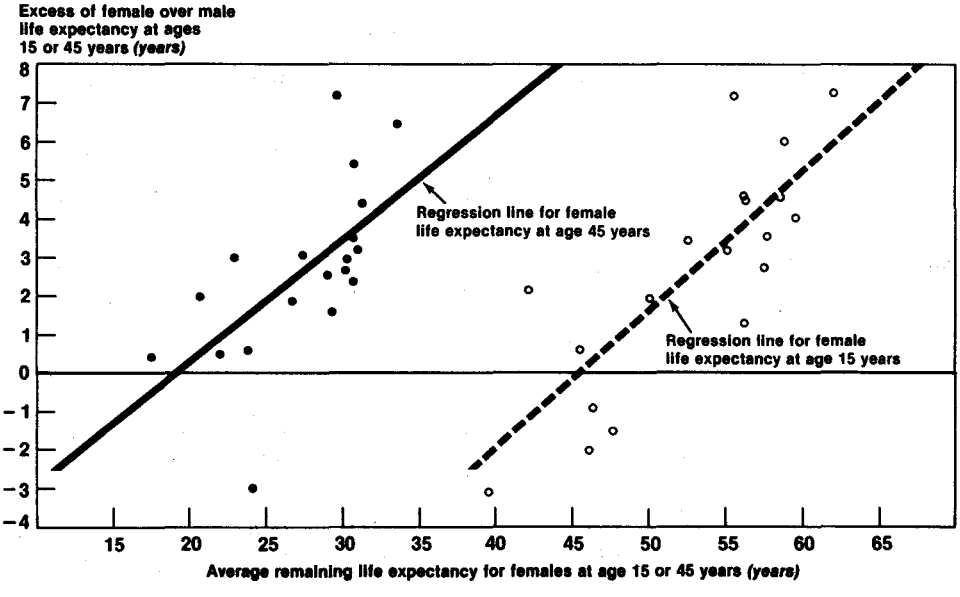
(b) *Expectation of life at age 45*

According to the figures in table IV.16, men and women in Sabah, Malaysia, who survived to age 45 could expect to live, on the average, only another 17 or 18 years. At the other extreme, women in Hong Kong at the same age had a remaining expectation of life of over 33 years, while men in Kuwait and Sri Lanka had a remaining life expectancy of 28 years. For both males and females the range of life expectancies at age 45 was smaller than it had been at age 15, but at both ages the range was greater for females than for males. Only in the Bangladesh data did the male life expectancy at age 45 exceed that for females, and there the differential was arguably insignificant. Thus it would appear that whatever advantage males in some countries had over females at younger ages was effectively lost by the time they reached the age of 45 years. As in the case of the female life expectancies at age 15, those for age 45 were paired with the difference between male and female life expectancies at this age for the countries in table IV.16, and a linear regression equation fit to these data (figure IV.3). In this case a positive relationship is also exhibited, but it is much weaker, the coefficient of correlation being only 0.68. A comparison of the regression lines in figure IV.3 for ages 15 and 45 years suggests that above both ages the male/female differential increases at about the same rate, and that at all ages above 15 years, females benefit proportionately more than men from general reductions in mortality.

4. *Conclusion*

The range of life expectancies at birth found among the countries of Asia reflect, of course, differences in mortality levels and patterns in all age-groups. As mortality declines, change is generally not uniform in every age-group. Rather, death rates tend to decline more rapidly at some ages than at others. The change in expectation of life at birth between two dates can be disaggregated into contributions arising from mortality changes in specified age-groups if life tables are available for the two dates. This is illustrated for selected countries of Asia in table IV.17,

Figure IV.3. Relation between female life expectancy at ages 15 and 45 years and the difference between male and female life expectancy at those ages, selected countries of Asia



Source: Table IV.16.

TABLE IV.17. CHANGES IN EXPECTATION OF LIFE AT BIRTH AND CONTRIBUTION TO CHANGES FROM SIX AGE-GROUPS, SELECTED COUNTRIES OF ASIA

Country and period	Change in e_0 (years)	Residual[a]		Contributions, in years and percentage, to change in e_0 attributable to mortality change in specified age-groups						
				Total	0-4	5-14	15-24	25-44	45-64	65 and over
						Males				
Bangladesh										
1962-1963 to 1974	−3.38	−0.09	Years	−3.29	−0.46	0.00	−1.39	−1.50	−0.07	0.12
			Percentage	100.0	−13.9	0.0	−42.2	−45.5	−2.1	3.7
Burma										
1954-1965	6.30	−0.49	Years	6.79	3.07	0.38	0.36	0.40	1.84	0.74
			Percentage	100.0	45.2	5.5	5.4	5.9	27.1	10.9
1965-1971	8.80	−0.63	Years	9.43	5.27	0.30	0.30	1.54	0.94	1.08
			Percentage	100.0	55.8	3.2	3.2	16.4	10.0	11.4
Hong Kong										
1961-1971	3.72	−0.11	Years	3.83	1.95	0.18	0.05	0.08	0.85	0.72
			Percentage	100.0	50.8	4.7	1.4	2.1	22.3	18.7
India										
1941-1950 to 1951-1960	9.44	−1.11	Years	10.55	3.93	2.89	1.39	1.48	0.46	0.40
			Percentage	100.0	37.3	27.3	13.1	14.1	4.4	3.8
1951-1960 to 1961-1970	4.51	−0.31	Years	4.82	1.96	−0.43	0.01	1.23	1.58	0.47
			Percentage	100.0	40.7	−9.0	0.2	25.6	32.7	9.8
Malaysia										
Peninsular Malaysia										
1956-1958 to 1970	7.74	−0.48	Years	8.22	3.91	0.58	0.39	1.16	1.28	0.90
			Percentage	100.0	47.5	7.1	4.7	14.1	15.6	11.0
1970-1972	1.10	−0.01	Years	1.11	0.47	0.12	0.05	0.03	0.06	0.38
			Percentage	100.0	42.2	10.8	4.3	2.6	5.3	34.8
Sri Lanka										
1945-1947 to 1950	9.57	−0.97	Years	10.54	3.64	0.66	1.17	2.35	2.16	0.56
			Percentage	100.0	34.6	6.3	11.1	22.3	20.4	5.3
1950-1954	3.94	−0.12	Years	4.06	1.82	0.27	0.26	0.63	0.84	0.24
			Percentage	100.0	44.7	6.7	6.3	15.7	20.6	6.0
1954-1967	4.50	−0.04	Years	4.54	3.80	0.56	−0.09	0.10	−0.17	0.33
			Percentage	100.0	83.7	12.3	−1.9	2.2	−3.7	7.4
1967 to 1970-1972	−0.60	0.00	Years	−0.60	0.40	−0.06	−0.04	−0.32	−0.57	−0.01
			Percentage	100.0	66.6	−10.0	−7.1	−52.9	−94.5	−2.1
Thailand										
1947-1960	10.74	−1.57	Years	12.31	2.31	1.89	1.67	3.77	2.06	0.61
			Percentage	100.0	18.8	15.4	13.6	30.6	16.7	4.9
1960-1970	4.60	−0.09	Years	4.69	3.34	0.67	0.00	0.32	0.45	−0.09
			Percentage	100.0	71.1	14.2	0.0	6.9	9.6	−1.8
1947-1948 to 1969-1971	8.86	−0.94	Years	9.80	2.33	1.14	1.11	2.51	1.35	1.36
			Percentage	100.0	23.8	11.6	11.3	25.6	13.8	13.9
						Females				
Bangladesh										
1962-1963 to 1974	−0.29	0.00	Years	−0.29	−0.36	0.13	−0.21	0.18	−0.09	0.05
			Percentage	100.0	−123.7	44.8	−72.1	63.2	−30.5	18.3
Burma										
1954-1965	6.20	−0.51	Years	6.71	1.63	0.60	0.36	2.52	0.73	0.86
			Percentage	100.0	24.3	9.0	5.4	37.6	10.9	12.8
1965-1971	9.10	−0.66	Years	9.76	5.03	0.32	0.58	1.78	0.90	1.16
			Percentage	100.0	51.5	3.3	5.9	18.2	9.2	11.9
Hong Kong										
1961-1971	4.50	−0.13	Years	4.63	2.26	0.18	0.07	0.44	0.59	1.09
			Percentage	100.0	48.8	3.9	1.6	9.4	12.6	23.6
India										
1941-1950 to 1951-1960	8.89	−0.86	Years	9.75	4.74	2.68	0.68	0.99	0.26	0.40
			Percentage	100.0	48.6	27.5	7.0	10.2	2.6	4.1
1951-1960 to 1961-1970	4.15	−0.22	Years	4.37	1.68	−0.77	0.31	1.68	1.35	0.11
			Percentage	100.0	38.4	−17.4	7.1	38.6	30.9	2.5
Malaysia										
Peninsular Malaysia										
1956-1958 to 1970	10.02	−0.89	Years	10.91	3.67	0.67	1.00	2.44	1.54	1.58
			Percentage	100.0	33.7	6.2	9.1	22.4	14.1	14.5
1970-1972	1.55	−0.02	Years	1.57	0.49	0.13	0.05	0.20	0.06	0.64
			Percentage	100.0	31.4	8.1	3.2	12.7	3.8	40.7
Sri Lanka										
1945-1947 to 1950	10.11	−1.48	Years	11.59	4.06	0.76	1.57	0.62	2.89	1.68
			Percentage	100.0	35.0	6.6	13.6	5.4	25.0	14.5
1950-1954	4.57	−0.21	Years	4.78	1.71	0.32	0.39	0.90	0.83	0.63
			Percentage	100.0	35.8	6.7	8.1	18.9	17.3	13.2

TABLE IV.17 (*continued*)

Country and period	Change in e_0 (years)	Residual[a]		Contributions, in years and percentage, to change in e_0 attributable to mortality change in specified age-groups						
				Total	0-4	5-14	15-24	25-44	45-64	65 and over
Sri Lanka (*cont.*)										
1954-1967	7.50	−0.33	Years	7.83	4.18	0.91	0.52	1.09	0.34	0.79
			Percentage	100.0	53.4	11.7	6.6	14.0	4.3	10.1
1967 to 1970-1972	0.13	0.00	Years	0.13	0.31	−0.00	−0.07	−0.10	−0.19	0.18
			Percentage	100.0	240.2	−1.9	−51.8	−78.5	−146.9	138.9
Thailand										
1947-1960	11.6	−1.80	Years	13.40	2.46	2.08	1.65	3.58	2.40	1.23
			Percentage	100.0	18.3	15.5	12.3	26.7	17.9	9.2
1960-1970	4.72	−0.07	Years	4.79	3.14	0.67	0.36	0.95	0.44	−0.78
			Percentage	100.0	65.6	14.0	7.5	19.9	9.2	−16.2
1947-1948 to 1969-1971	8.96	−0.83	Years	9.79	2.67	1.28	1.01	2.28	0.88	1.66
			Percentage	100.0	27.3	13.1	10.3	23.3	9.0	17.0

Sources: The life table values serving as the basis for the decomposition procedure are from the sources cited in table IV.6 for the corresponding countries, with this addition: Thailand life table for 1969-1971 from Economic and Social Commission for Asia and the Pacific, *Population of Thailand*, Country Monograph Series, No. 3 (ST/ESCAP/18) (Bangkok, 1976), p. 57.

For methodology, see Alan D. Lopez and L. T. Ruzicka, "The differential mortality of the sexes in Australia", in N. D. McGlashan, ed., *Studies in Australian Mortality*, University of Tasmania, Environmental Studies, Occasional Paper No. 4 (Hobart, 1977).

[a] Component of change which cannot be attributed to any specific age-group, but is, rather, a mathematical artifact of the methodology employed.

which shows the contributions made by each of six age-groups to over-all changes in life expectancy. In the case of Bangladesh, for example, the life tables show a decrease in life expectancy among males of over 3 years between 1962-1963 and 1974. Nearly half a year of that loss was attributable to increased mortality under the age of 5 years, and almost 3 years were lost because of increased mortality in the age-groups from 15 to 44 years. Changes in the remaining age-groups were negligible. In percentage terms, nearly 90 per cent of the total decline in life expectancy over the interval could be accounted for by the increased mortality at ages 15-44 years. However, the Bangladesh life tables for both dates are based on sample survey data, and are probably not mutually compatible. Age reporting is known to be very unreliable, and it is doubtful that the life tables faithfully, or even approximately, reflect either the true levels or age patterns of mortality in the country.

In the countries in table IV.17 where life expectancy increased, the largest proportion of the increase was usually due to reductions in mortality under 5 years of age. In most cases, this age-group accounted for an average of one third to one half of the gains in longevity. The principal exception to this generalization is Thailand, where reduced mortality under the age of 5 years contributed less than one fifth to the average increment for both sexes of 11 years between 1947 and 1960. During that period a highly successful malaria control programme lowered the malaria death rate from 300 to 30 per 100,000 population. As in Sri Lanka between 1945-1947 and 1950, the largest part of the increases in life expectancy at birth arose from reductions in mortality between the ages of 15 and 65 years, but was most heavily concentrated in the age-group of 25 to 45 years. The period in Sri Lanka was also one of successful anti-malaria activity.[35] In recent years, there has been a resurgence of malaria in some countries of Asia. The number of autochthonous malaria cases reported for South-East Asia increased from 1.9 million in 1972 to 6.5 million in 1976. These figures refer to morbidity rather than mortality, but the latter is believed to have increased as well.[36]

Aside from the large contributions made by the 0-4 year age-group to increased life expectancy, there is in the table IV.17 data little else that lends itself to easy generalization except, perhaps, that the contributions from ages 15-24 years were, on average, rather small for males and females alike, and that among females in a number of countries, the 25-44 year age-group made an important contribution to improvements in life expectancy. It may be conjectured that reduction of maternal mortality played some role in the latter. The lack of uniformity in patterns of age-specific mortality decline among these countries is not surprising, given differences in their initial levels of mortality, the diversity of their social, economic, cultural and environmental situations and the uneven quality of the data. Much better data will have to be obtained before either levels or trends in mortality by age can be identified accurately in the countries of Asia.

C. Differential mortality

1. *Urban/rural differentials in mortality*[37]

There is often considerable variation in mortality levels within countries, e.g., among different geographical re-

[35] See, for example, United States of America, Department of Health, Education and Welfare, Public Health Service, Office of International Health, *Syncrisis: The Dynamics of Health, vol. XII, Thailand* (Washington, D.C., Government Printing Office, 1974), p. 28; Fred Arnold, Robert D. Retherford and Anuri Wanglee, *The Demographic Situation in Thailand*, Papers of the East-West Population Institute, No. 45 (Honolulu, East-West Center, 1977), p. 19; *The Population of Sri Lanka*, CICRED Monograph Series, World Population Year 1974 (Colombo, 1974), pp. 23-28.

[36] "Malaria control—a reoriented strategy", *WHO Chronicle*, vol. 32, No. 6 (June 1978), pp. 226-227.

[37] Definitions of "urban" and "rural" may differ considerably from one country to another.

gions or population groups with different economic or social characteristics. One of the most common distinctions made in demographic studies is between the urban and rural areas of a country, and as already noted with reference to infant mortality, urban areas usually experience lower mortality than rural areas. A number of reasons have been offered in explanation of urban/rural mortality differentials. Among others, it has been noted that infant mortality is generally high where fertility is high, and since fertility tends to be lower in urban than in rural areas, infant mortality could also be expected to be lower in these areas. In addition the water supply is assumed to be better in towns than in the countryside, and the public health measures more fully developed and implemented. But the explanations have most frequently focused on the availability of health services. Mortality tends to be relatively low in urbanized areas where health facilities are located and are accessible to the population because of modern transport and communications.

In India, for example, there was one physician for every 1,400 people in the urban areas in 1961, as opposed to only one for every 18,000 in the rural areas. During the succeeding decade the urban and rural ratios narrowed, but the differences were still enormous. By 1971 there was one physician for every 1,500 population in urban areas and one for every 12,000 rural inhabitants. In 1973-1974, although the number of hospital beds had more than doubled since 1950, there were still only two beds for every 10,000 people in rural areas as opposed to 17 for every 10,000 urban inhabitants.[38] These data are suggestive of a serious problem in many less developed countries concerning the allocation of resources for the health sector. In addition to inadequate levels of government spending on health care, emphasis is often placed, inappropriately, on the expansion of Western-style hospital-based services which are concentrated in urban areas, rather than on community services.

This is not to say that urban areas in the less developed countries do not have health problems of their own. The urban infrastructure in these countries is often frail and inadequate to meet the needs of a population growing rapidly from rural-to-urban migration as well as natural increase. As a consequence, sewage disposal may be inadequate, pure drinking water in short supply and housing overcrowded. On balance, however, health conditions generally remain more favourable in the urban areas.

As can be seen from the data in table IV.18, differentials between urban and rural mortality in the countries of Asia encompass a broad range. With one exception—Sri Lanka—these data show urban mortality to be lower than rural. For several countries in the table, namely, India, Iran, Iraq and the Syrian Arab Republic, infant mortality in recent years was 40 to 50 per cent higher in rural than in urban areas. The greatest differential was in Iran in 1965, where the infant mortality rate in rural areas was three times the rate in Teheran (176 and 58, respectively). At the other extreme is the apparently negligible difference between urban and rural mortality rates in Bangladesh. The childhood survival figures in table IV.18 imply an urban/rural differential for Bangladesh of no more than 6 or 7 per cent. Although such a narrow gap may result from deficiencies in the data, the possibility cannot be dismissed that the grinding poverty and unsanitary conditions in urban areas have resulted in mortality levels among the most vulnerable age-groups, i.e., infants and young children, which are nearly as high as those of rural areas.

[38] P. M. Visaria and Anrudh K. Jain, *India*, Country Profiles (New York, The Population Council, 1976); *The Population of India*, CICRED Monograph Series, World Population Year 1974 (New Delhi, 1974), pp. 36-39.

TABLE IV.18. URBAN/RURAL DIFFERENTIALS IN MORTALITY, ASIA, 1952-1975

Country	Period	Area	Deaths per 1,000 population	Infant deaths per 1,000 live births	Survivors to a given age, (1x) per 1,000 live births: 2 years	3 years	5 years
Bangladesh[a]	1974	Urban	...	...	809[b]	844[b]	808[b]
		Rural	...	...	801	789	774
India	1969[c]	Urban	11.4[d]	...	...	...	...
		Rural	19.1[d]	139.9	...	...	...
	1970[c]	Urban	...	80.3	...	...	...
		Rural	...	118.7	...	...	...
	1971[c]	Urban	...	77.5	...	...	...
		Rural	...	114.8	...	...	...
	July 1974[c]	Urban	9.6[d]	...	...	...	...
	June 1975[c]	Rural	16.1[d]	...	...	...	...
	1970-1972[f]	Cities and towns by population size *(thousands)*					
		100 and over	8.8[d]	...	...	...	...
		50-100	10.0[d]	...	...	...	...
		20- 50	11.4[d]	...	...	...	...
		Under 20	11.4[d]	...	...	...	...
Indonesia[g]		Urban					
		Java	...	...	872	857	826
		Other islands	...	...	859	839	815
		Rural					
		Java	...	...	838	809	786
		Other islands	...	...	818	775	759

TABLE IV.18 (*continued*)

Country	Period	Area	Deaths per 1,000 population	Infant deaths per 1,000 live births	Survivors to a given age, (1x) per 1,000 live births: 2 years	3 years	5 years
Iran[h]	1965	Teheran	...	58	...	...	...
		Rural	...	176	...	...	...
	1974	Urban	...	75	...	...	...
		Rural	...	110	...	...	...
Iraq[i]	1973-1974	Urban	9.4[d]	77	...	...	...
		Rural	13.3[d]	111	...	...	...
Malaysia							
Peninsular Malaysia[j]	1964-1968	Metropolitan					
		Malays	...	38.8	...	...	...
		Chinese	...	31.3	...	...	...
		Indians	...	46.6	...	...	...
		Other urban					
		Malays	...	48.3	...	...	...
		Chinese	...	26.5	...	...	...
		Indians	...	40.0	...	...	...
		Rural					
		Malays	...	61.6	...	...	...
		Chinese	...	33.1	...	...	...
		Indians	...	57.1	...	...	...
Pakistan[k]	1968-1971	Urban	7-10[d]	...	...	...	...
		Rural	12-13[d]	...	...	...	...
Philippines[l]	1968	Urban					
		Present[m]	...	47.3	...	...	...
		Past[m]	...	72.2	...	...	...
		Rural					
		Present[m]	...	61.0	...	...	...
		Past[m]	...	76.4	...	...	...
	1973	Urban					
		Present[m]	...	49.1	...	...	...
		Past[m]	...	63.8	...	...	...
		Rural					
		Present[m]	...	61.0	...	...	...
		Past[m]	...	77.6	...	...	...
Republic of Korea	1966[n]	Urban	...	...	951	942	926
		Rural	...	...	938	927	905
	1970[n]	Urban	...	...	969	958	941
		Rural	...	...	952	942	922
	1973-1974[o]	Urban	5.6	...	...	...	...
		Rural	9.6	...	...	...	...
Sri Lanka[p]	1952-1954	Urban	11.6[d]	79.5	...	...	...
		Rural	10.8[d]	72.8	...	...	...
	1962-1964	Urban	7.8	64.6	...	...	...
		Rural	8.8	53.4	...	...	...
Syrian Arab Republic[q]	1970	Urban	...	80.7	888	873	865
		Rural	...	112.3	846	827	810

[a] M. Kabir, "Levels and patterns of infant and child mortality in Bangladesh", *Social Biology*, vol. 24, No. 2 (1977), pp. 158-165.

[b] Irregularities probably due to deficient data.

[c] India, Office of the Registrar General, *Sample Registration Bulletin*, vol. X, No. 2 (April 1976).

[d] Not standardized for sex and age differences in population structure.

[e] India, Office of the Registrar General, *Sample Registration Bulletin*, vol. VII, No. 1 (January-March 1973).

[f] Sent Ram Gupta, "Variations in vital rates in India", *Sample Registration Bulletin*, vol. IX, No. 3 (1975), pp. 29-32.

[g] Geoffrey McNicoll and Si Gde Made Mamas, *The Demographic Situation in Indonesia*, Papers of the East-West Population Institute, No. 28 (Honolulu, East-West Center, 1973).

[h] Djmchid Bebnam and Mehdi Amani, eds., *La Population de l'Iran*, CICRED Monograph Series, World Population Year 1974 (Teheran, 1974), p. 13.

[i] Iraq, Ministry of Health, Directorate of Vital and Health Statistics, *Statistical Compass for 1974/1975, Based on Vital Rates Survey 1973-74*, p. 13, table 4-A.

[j] Malaysia, Department of Statistics, *Evaluation of Mortality Data in the Vital Statistics of West Malaysia*, Research Paper No. 5 (Kuala Lumpur, 1971).

[k] Pakistan, Ministry of Finance, Planning and Economic Affairs, Statistical Division, *Population Growth Survey 1968* (Karachi, 1973) and *Population Growth Survey 1971* (Karachi, 1974).

[l] Adelamar N. Alcantara, "Differential mortality among population subgroups", Research Note No. 63 (Manila, Population Institute, University of the Philippines, 1975) (mimeo.).

[m] "Present" values estimated on the basis of $q(2)$ and $q(3)$; "past" estimated on the basis of $q(5)$ to $q(35)$. The "present" estimates therefore reflect more recent mortality conditions. In both sets of estimates, Coale-Demeny "West" model life tables were used.

[n] Lee-Jay Cho, *The Demographic Situation in the Republic of Korea*, Papers of the East-West Population Institute, No. 29 (Honolulu, East-West Center, 1973), p. 35.

[o] Economic and Social Commission for Asia and the Pacific, *Population of the Republic of Korea*, Country Monograph Series, No. 2 (E/CN.11/1241) (Bangkok, 1975), pp. 182-184.

[p] Economic and Social Commission for Asia and the Pacific, *Population of Sri Lanka*, Country Monograph Series, No. 4 (ST/ESCAP/30) (Bangkok, 1976), pp. 141-143.

[q] K. E. Vaidyanathan, *Estimation of Infant and Child Mortality in Syria from the 1970 Census Data*, Syrian Population Studies Series, No. 10 (Damascus, Centre of Population Studies and Research, 1976).

In Sri Lanka, the infant death rate reported for urban areas was higher than for rural areas in 1952-1954 as well as in 1962-1964. More recently, the preliminary results of the 1975 World Fertility Survey found no significant difference between infant mortality levels in urban and rural areas, but on the tea and rubber estates it was twice as high.[39] It has been suggested that the higher urban than rural mortality at the earlier dates arose from the poor economic conditions, unsanitary housing and inadequate environmental hygiene of the poorer sections of urban centres.[40] An additional, or alternative, explanation might be, as Rao has noted in attempting to explain mortality variations by geographical districts in Sri Lanka, that there is differential under-reporting of deaths among the districts, or a disparity in the actual place of residence of the deceased and that reported in the death certificate[41] The latter could occur if persons from rural areas who are admitted to hospitals in urban areas give a local (urban) address, which then becomes the basis for classification of mortality data according to residence.

The differences between urban and rural mortality levels are not necessarily the same in all parts of any country. Infant mortality rates for 17 states in India in 1970 and 1971, for example, show that in each state in both years the urban rates were lower than the rural, but that there was a large area of overlap between the urban and rural rates (table IV.19). The urban rates varied from 11 to 134 while the rural ones ranged from 27 to 173. The accuracy of these figures, particularly the lowest ones, is uncertain, and this may exaggerate the area of overlap. The overlap between the urban and rural rates can be explained, at least in part, by the fact that in many Asian countries, certain areas may be designated urban according to criteria such as population size or density, whereas in fact only a fraction of the population of the area benefits from such urban amenities as a clean water supply and sanitation and health services.

The same general features are evident in data for Indonesia (table IV.15). Urban mortality, as measured by the proportion of children who died during the first five years of life, was consistently lower than rural mortality in each part of the country, and, as in India, the range of urban and rural figures overlapped, but the amount of overlap was much smaller in Indonesia. The Indonesian data also provide some indication of time trends in both urban and rural areas. Between the late 1940s and the mid 1960s there were substantial declines in mortality in all regions. However, in three of the five regions having urban and rural components (West and Central Java and Sumatra), urban mortality declined more rapidly than mortality in the rural hinterland, thus widening the gap between urban and rural mortality in these regions.

TABLE IV.19. INFANT MORTALITY IN INDIA BY STATES AND URBAN AND RURAL AREAS, SAMPLE REGISTRATION SCHEME, 1970 AND 1971

(Infant deaths per 1,000 live births)

State	Urban		Rural	
	1970	1971	1970	1971
Andhra Pradesh	79	64	123	113
Assam (including Meghalaya)	83	73	142	131
Bihar	69	...	...	...
Gujarat	134	109	160	145
Haryana	57	52	79	64
Himachal Pradesh	69	69	138	115
Jammu and Kashmir	58	49	85	74
Kerala	41	45	56	58
Madhya Pradesh	106	76	142	141
Maharashtra	79	82	100	107
Manipur	26	11	32	27
Mysore	65	...	96	...
Orissa	103	79	135	133
Punjab	84	72	107	109
Rajasthan	87	74	144	113
Tamil Nadu	82	91	127	127
Tripura	61	77	96	100
Uttar Pradesh	113	121	162	173
West Bengal	59	69	...	...

Source: India, Office of the Registrar General, *Sample Registration Bulletin*, vol. VII, No. 1 (January-March 1973).

2. *Socio-economic differentials in mortality*

Table IV.18 shows urban and rural infant mortality rates for three subgroups of the population of Peninsular Malaysia. The Chinese have the lowest infant mortality rates in all three regional categories. In the metropolitan area, the Malays have the second lowest infant mortality rate and the Indians have the highest, while in the "other urban" and rural areas, the Malays have the highest rates. The figures for the Chinese are of interest because the range of rates in the three types of areas is quite small. The Chinese are, on average, better educated and occupy a higher socio-economic stratum than either of the other two subgroups. In these facts lies the key to understanding the urban/rural differentials, for, from all the available data, it would seem that such differentials are largely, if not exclusively, reflections of differences in the socio-economic composition of each population. When infant mortality or child survival rates, for example, are calculated for groups differentiated according to the educational attainment of the parents, the urban/rural mortality differentials often all but disappear.

The relationship between socio-economic and urban/rural mortality differentials is discussed at some length in the chapter on Latin America. For the present, the only illustration for Asia that can be offered is from Indonesia. In table IV.20 mortality is measured in terms of deaths to members of the 1965-1967 birth cohort. The number of children who died before reaching the age of 5 years, out of every 1,000 born alive during 1965-1967, is shown for each of three categories of mother's educational level and father's economic status. With two exceptions, both of them in Java, the highest childhood mortality occurred in the lowest educational and economic status categories. The lowest mortality, on the other hand, was consistently found in the highest educational and economic categories. In many cases, the difference between the urban and rural proportions of children dying for a given geographical re-

[39] Sri Lanka, Department of Census and Statistics, *World Fertility Survey-Sri Lanka, 1975, First Report* (Colombo, 1978).

[40] Economic and Social Commission for Asia and the Pacific, *Population of Sri Lanka*, Country Monograph Series, No. 4 (ST/ESCAP/30) (Bangkok, 1976), p. 143.

[41] S. L. N. Rao, "Mortality and morbidity in Sri Lanka", in University of Sri Lanka, Demographic Training and Research Unit, *Population Problems of Sri Lanka* (Colombo, 1976), p. 32.

TABLE IV.20. PROPORTION OF CHILDREN DYING BEFORE AGE 5 YEARS OUT OF EVERY 1,000 LIVE BIRTHS BY MOTHER'S EDUCATIONAL STATUS AND FATHER'S ECONOMIC STATUS, INDONESIA, BIRTH COHORT OF 1965-1967

	Sulawesi	Sumatra	Java			Bali
			West	Central	East	
Place of residence and education of mother						
Urban						
None	215	165	133	153	128	...
Some primary	153	149	151	145	115	...
Completed primary and above	105	75	122	59	84	...
Rural						
None	210	184	194	162	128	207
Some primary	158	182	193	157	109	181
Completed primary and above	126	136	149	134	108	85
Place of residence and father's economic status (based on "economic score")[a]						
Urban						
0-5	195	185	...	165	108	...
6-14	154	112	...	131	120	...
15-36	73	48	...	40	58	...
Rural						
0-5	183	220	...	192	131	202
6-14	180	156	...	144	108	174
15-36	37	124	...	[b]	[b]	53

Source: Universitas Indonesia, Fakultas Ekonomi, Lembaga Demografi, "Preliminary report, Indonesian Fertility-Mortality Survey 1973" (Jakarta, 1974) (mimeo.).

[a] The economic score is based on the possession of selected items by the household, each item receiving an assigned weight, e.g., electricity in the house, 5; piped drinking water, 4; ownership of land, 4; bicycle, 1.

[b] Fewer than 50 births.

gion and socio-economic status was slight. However, in the highest educational category, infant and early childhood mortality in the rural areas greatly exceeded that of the urban areas. The reason for such large differentials between what are presumably groups with the same educational level may be that within that category, the most highly educated are concentrated in the urban areas.

The concept of socio-economic status is often a rather elusive one and only a few studies of Asian countries have attempted to classify the socio-economic status of individuals and families by a composite index which might permit a refined analysis. One of the earliest to do so was the Mysore Study, which found that infant mortality rates varied inversely with a family's socio-economic status.[42] Among the more recent studies that have investigated the relationships between mortality and socio-economic variables, the following may be singled out for discussion. In a survey of Greater Bombay in the early 1970s, the socio-economic status of households was assessed by interviewers on the basis of their observations of, among others, general living conditions, type of housing, household possessions, and occupation of the head of household. The households were then classified as belonging to one of three socio-economic groupings, and the resulting infant mortality rates showed a strong inverse relationship to group status.[43]

Important factors in the high mortality among the lowest classes, in addition to poverty and privation *per se*, are culturally determined attitudes with respect to health and medical care. Often there is lack of knowledge and awareness of health problems among these groups, but beyond this there is also a reluctance to seek medical assistance that is deeply rooted in the history of oppression and neglect of the poor, which has generated feelings of mistrust that are difficult to overcome.

Mortality often varies among ethnic, racial and religious groups within the same country, with higher than average mortality prevailing among members of groups which have been relegated to the lower strata of society. Earlier in this subsection, differences in the infant mortality rates for the three principal ethnic groups in Peninsular Malaysia were discussed. Mortality at other ages, as reflected in the expectation of life at birth, shows the same general features, as can be seen from the text table below. Life expectancy at birth was highest for the Chinese and lowest for the Indians.

Ethnic group	Expectation of life at birth, 1971, Peninsular Malaysia (Years)	
	Males	Females
Malays	63.0	65.2
Chinese	64.6	72.2
Indians	58.8	61.6

Source: Malaysia, Department of Statistics, *Vital Statistics, Peninsular Malaysia, 1972* (Kuala Lumpur, 1974).

The high life expectancy of the Chinese population in Malaysia may not only reflect their relatively favourable economic position but also the impact of the cultural patterns emphasizing cleanliness and attention to the preservation

[42] *The Mysore Population Study* (United Nations publication, Sales No. 61.XIII.3).

[43] L. T. Ruzicka and Tara Kanitkar, "Infant mortality in Greater Bombay", *Demography (India)*, vol. 2 (1973), pp. 41-55.

of good health. The better education of Chinese mothers may also contribute to lower infant and child mortality as may the fact that the Chinese women have lower fertility and therefore a smaller proportion of high-order births. Such births carry a greater than average risk of mortality.

A review of Indian data for the late 1960s found an inverse relationship between infant and child mortality, on the one hand, and socio-economic status, income, education and occupation, on the other. Some of these findings are presented in table IV.21. Of particular interest is the way in which mortality levels, with a single exception, varied inversely by caste among the Hindu population, and the varying position of Muslim mortality relative to that of the Hindu castes. However, interpretation of these data is complicated by the lack of information on additional characteristics of the groups in the sample, such as mean educational attainment and average standard of living, which might have a significant bearing on the observed differentials in mortality.

TABLE IV.21. DIFFERENTIALS IN INFANT MORTALITY AND PROPORTIONS OF CHILDREN DEAD BY SOCIAL AND ECONOMIC CHARACTERISTICS OF THE FAMILY, TWO INDIAN SURVEYS

Social or economic category	Shadnagar Survey, 1966-1968		Lucknow Survey, 1967-1968	
	Infant mortality rate (per 1,000 live births)	Percentage of children dead out of total ever born to women aged 45-49 years	Infant mortality rate (per 1,000 live births)	Percentage of children dead out of total ever born to women aged 45 years and over
Religion and caste				
Hindus				
Upper castes ..	119	28	59	27
Middle castes .	111	33	69	52
Low castes ...	118	34	136	62
Muslims	70	30	94	40
Occupation of father				
Cultivator (owner and tenant) ...	104	31	...	...
Agricultural and casual labourer	101	35	...	...
White-collar worker	100	37	...	...
Blue-collar worker	150	28	...	...
Income (rupees per month)				
Under 75	...	...	136	37
75-150	...	...	87	51
151-300	...	...	80	27
Over 300	...	...	18	26

Source: K. E. Vaidyanathan, "Some indices of differential mortality in India", in K. E. Vaidyanathan, ed., *Studies in Mortality in India* (Tamil Nadu, India, Gandhigram Institute of Rural Health and Family Planning, 1972), pp. 145-160.

A series of World Health Organization surveys of family formation and health conducted in the early 1970s in five Asian countries offers further evidence of mortality differentials by socio-economic characteristics (table IV.22). Of the four religious groups surveyed in rural India, the greatest losses during the first five years of life were experienced by Hindu children born into the Scheduled Castes. For each of these groups, however, the death rates for the low- and middle-class families differed only slightly. Of the other four areas shown in table IV.22, childhood mortality was higher for the low social status samples than for

TABLE IV.22. NUMBER OF CHILDREN DYING BEFORE AGE 5 YEARS OUT OF EVERY 100 LIVE BIRTHS BY SOCIAL CLASS OF THE FAMILY, FIVE COUNTRIES OF ASIA

Country and culture or residence categories	Social status	
	Middle	Low
India		
Muslims	17.8	19.8
Hindu Scheduled Castes[a]	25.2	24.3
Hindu Kongu Vellalas[b]	18.8	21.8
Other Hindus[b]	20.5	22.1
Iran		
Muslims	13.9	17.3
Armenians	7.7	11.2
Lebanon		
Shiites	5.2	6.7
Maronites	4.1	4.2
Philippines		
Rural	6.3	9.4
Urban	7.6	14.9
Turkey		
Rural	18.9	20.1
Semi-urban	15.0	12.9

Source: M. R. Bone, C. C. Standley and A. R. Omran, "Family formation and childhood mortality", in A. R. Omran and C. C. Standley, eds., *Family Formation Patterns and Health* (Geneva, World Health Organization, 1976), pp. 201-255.

NOTE: Data are based on sample surveys conducted in the five countries in the early 1970s. The study areas were as follows:
India—34 villages in Tamil Nadu State
Iran—3 sections in north-eastern Teheran
Lebanon—3 communities in the suburbs of Beirut
Philippines—an urban area (Metropolitan Manila) and a rural area (Rizal Province)
Turkey—Etimesgut District (83 villages and 2 towns).

[a] Mainly agricultural labourers.

[b] Mainly landowning cultivators.

the middle-status groups for all but the semi-urban population of Turkey. The differences were greatest in the Philippines and smallest in Lebanon. Ethnic group differences in mortality of children were large in Teheran, Iran, with mortality among Muslim children greatly exceeding that of the Armenians. In Lebanon childhood mortality among Shiites was somewhat higher than among Maronites.

One of the most important factors contributing to high mortality among the disadvantaged groups is high fertility and its concomitant, the close spacing of births. This combination often results in premature deliveries and low birth-weight infants, both of which increase the risk of infant deaths. Frequent pregnancies also have adverse effects on the health of women, undoubtedly contributing to the anaemias which are widespread among Asian women and increasing the risk of maternal deaths. Ignorance of the population with respect to matters of health and hygiene contributes further to high mortality. The importance of a knowledge of health matters is seldom measured directly, but can be inferred from the inverse relationship usually found between educational attainment, or some other measures of socio-economic status, and the mortality level. Thus, in the Republic of Korea, infants born to mothers with no formal education were found to be twice as likely to die during their first year of life as those born to mothers who had completed high school.[44] The differential

[44] H. J. Park, "A study of infant deaths in Korean rural areas", *The Seoul Journal of Medicine*, vol. 3, No. 4 (1962).

in infant mortality rates between Philippine women with no formal education and those with more than one year of college was even greater—approximately 100 and 30 deaths per 1,000 live births, respectively.[45]

Analyses of socio-economic mortality differentials generally include an examination of occupational mortality when the requisite data are available. Occupational death rates, in addition to reflecting the general levels of living of persons in various occupational groups, reflect also the specific hazards associated with the occupations. Only one study has attempted to analyse such data for a country in Asia: a study of 1970 data for Singapore,[46] which, to be sure, is demographically atypical of Asian countries. The main findings of the study were that men in the work force who were under 50 years of age had higher mortality rates than those not working, but at ages 50 years and over the mortality of the working men was lower. In contrast, women in the work force had lighter mortality than non-working women at all ages except 10-19 years. It was suggested, in explanation, that the higher mortality of the working men at the younger ages was due to occupational hazards. At the older ages, however, selectivity had operated whereby men with impaired health had withdrawn from the work force, thereby increasing the proportion of such persons in the non-working population. Regarding the low mortality among working women, it was suggested that, as most of these women were single or divorced, they were not exposed to the health risks associated with childbearing. However, such risks would be very low in Singapore, and not sufficient to explain the differential. Among the employed males, age-standardized death rates ranged from 2.5 per 1,000 in the professional, technical and related occupations to 5.0 per 1,000 among craftsmen, production process workers and labourers. Aside from educational and life style differences between these two groups, the occupational hazards of the latter group are much greater.

On the basis of data on child survivorship collected in the 1973 National Demographic Survey in the Philippines, values of expectation of life at birth were estimated, and the estimates tabulated by occupation of mother. It was found that children born to mothers in the professional, administrative and managerial occupations had an estimated life expectancy at birth of about 68 years. Children of mothers in the white-collar occupations had a life expectancy of 61 to 68 years, and those of mothers who worked on farms had a life expectancy of around 54 years. In sum, according to this analysis, children born into high-status families could expect to live about 15 years longer, on average, than those born into the poorest families.[47]

Data on trends in mortality differentials by socio-economic variables are virtually non-existent for the countries of Asia, so it is not known whether these differentials are contracting or increasing. However, there is some evidence that the proportion of the population living below the "poverty line" in some parts of Asia is increasing.[48] It has been observed, with respect to the more developed countries (see chap. II), that in the early stages of the transition from high to low mortality levels, mortality differentials between the classes increased as the upper classes benefited first from various health and medical innovations. Eventually these benefits filtered down to the lower classes, and the gap narrowed. Some of the less developed countries, including those in Asia, may be at a stage where mortality differentials are increasing, and efforts to raise the income and educational levels of the poorest classes, among other measures, should have a favourable effect on their mortality.

D. Morbidity and causes of death

The structure of mortality in a population is determined not simply by the incidence and prevalence of various diseases but also by the differential fatality rates of those diseases.[49] Fatality rates, in addition to reflecting the inherent severity of the diseases, are greatly influenced by the environment in which a population lives, by social and economic factors and by the general health condition of the population. In the less developed countries, a complex of factors is responsible for the high levels of morbidity and mortality. These factors are associated with underdevelopment and include illiteracy, ignorance and prejudice due to very low educational levels; poor housing and sanitation; inadequate diets with respect to both quantity and quality; scarcity of pure drinking water; and shortcomings in the delivery of health care.

Reliable data on causes of death in Asia are available for only three territories which have fairly accurate and complete vital statistics registration. The territories—Hong Kong, Singapore and Peninsular Malaysia—have high life expectancies and are therefore not representative of the mainland of Asia. Although death registration is also virtually complete in Sri Lanka, the classification of deaths by cause is not satisfactory. As can be seen from table IV.23, nearly 25 per cent of all deaths fall into the category of "symptoms and ill-defined conditions" and a further 25 per cent are classified in the residual category "all other diseases", an unusually high proportion.

The reporting systems in other countries of Asia are often limited to deaths occurring in urban areas or in hospitals only, so the distributions of deaths by cause are not at all representative of the country as a whole. Moreover, the cause of death is frequently not reported at all, or the de-

[45] Adelamar N. Alcantara, "Differential mortality among population subgroups," (Manila, Population Institute, University of the Philippines, 1975) (mimeo.).

[46] Saw Swee-Hock, "Occupational mortality variations in Singapore, 1970", *Journal of the Royal Statistical Society*, vol. 139, No. 2 (Series A, 1976), pp. 218-226.

[47] Adelamar N. Alcantara, "Differential mortality among population subgroups", Research Note No. 63 (Manila, Population Institute, University of the Philippines, 1975) (mimeo.).

[48] On India, see Joginder Kumar, "Recent demographic transition in India and a viable population policy", paper presented at the Seventh Summer: Seminar on Population, East-West Population Institute, Honolulu, June-July 1976. Some evidence on the deterioration of the nutritional status of the population in Bangladesh is presented in A. K. M. A. Chowdhury and L. C. Chen, "The dynamics of contemporary famine", in *Proceedings of the International Population Conference, Mexico City, 1977* (Liège, International Union for the Scientific Study of Population, 1977), pp. 409-426.

[49] The fatality rate, or case fatality rate, is the proportion of fatal cases among the reported cases of a specified disease.

TABLE IV.23. PERCENTAGE DISTRIBUTION OF CAUSES OF DEATH IN ASIAN COUNTRIES WITH "COMPLETE" DEATH REGISTRATION

Cause of death	*Cause-of-death code*[a]	*Hong Kong, 1973*	*Peninsular Malaysia, 1972*	*Singapore, 1973*	*Sri Lanka, 1968*
Cholera, dysentery and other diarrhoeal diseases	1,3,4	0.1	3.2	1.0	1.8
Tuberculosis	5,6	5.4	4.2	3.8	0.6
Other infectious and parasitic diseases	2,7-18	1.0	3.7	1.7	8.1
Neoplasms	19,20	21.4	8.3	16.1	1.3
Cardiovascular and cerebrovascular diseases	25-30	24.0	19.0	26.0	8.3
Influenza, pneumonia, bronchitis etc.	31-33	14.8	6.9	11.6	5.9
Other diseases of digestive system	34-37	2.7	2.2	2.6	6.1
Complications of pregnancy	40,41	0.0	0.4	0.1	1.3
Congenital anomalies and diseases of early infancy	42-44	4.2	16.3	5.6	10.9
Symptoms and ill-defined conditions	45	9.2	13.3	11.4	24.4
All other diseases	21-24,38, 39,46	9.5	13.9	11.9	24.8
Total, natural causes	1-46	92.3	91.4	91.7	93.5
External causes (accidents, sucide, homicide, other violence)	47-50	7.7	8.6	8.3	6.5
TOTAL *(percentage)*		100.0	100.0	100.0	100.0
Number of deaths		21 251	22 275	11 920	94 903

Source: Demographic Yearbook, 1974 (United Nations publication, Sales No. E/F.75.XIII.1), table 27.

NOTE: "Complete" death registration refers to coverage of at least 90 per cent of deaths. For Peninsular Malaysia, data are for medically certified deaths only, comprising about one third of all deaths.

[a] Numbers refer to the abbreviated ("B") list of 50 causes of the International Classification of Diseases, 1965 Revision.

tails of the deaths that are reported are vague or insufficient to classify them appropriately. As a result, a large proportion of all deaths are included in the category "symptoms and ill-defined conditions" (as in Sri Lanka) while deaths in other categories are correspondingly understated. For these and other reasons, such as the age and sex selectivity inherent in the under-reporting of deaths, very little that is quantifiable can be said about the structure of mortality in Asia outside the three territories mentioned above.

The pattern of causes of death in Hong Kong and Singapore is very close to that found in the more developed countries, with their very low proportions of deaths from infectious and parasitic diseases and high proportions from the chronic, degenerative diseases. Peninsular Malaysia has a cause of death structure that is somewhat less "Western" than the other two territories, which is not surprising in view of its somewhat lower life expectancy. As can be seen from the first three cause-of-death groups listed in table IV.23, the percentage of total deaths from infectious and parasitic diseases was 6.5 in Hong Kong and Singapore, and 11.1 in Peninsular Malaysia. While these percentages were still high compared with the more developed countries as a group—where deaths from the infectious and parasitic diseases averaged only 1 per cent in the 1970s—they were far below those of countries with higher mortality. The cardiovascular (including cerebrovascular) diseases and neoplasms have become the principal killers in Hong Kong and Singapore, where they exceeded 40 per cent of total deaths. In Peninsular Malaysia the proportion was much lower, only around one quarter of all deaths. These proportions compare with an average of some two thirds of all deaths in the more developed countries. It should be noted that differences in age structure between the three territories and the more developed countries tend to exaggerate the differentials in the percentages being compared.

The available information on the cause-of-death structure of mortality in the medium- and high-mortality countries of Asia is, for the most part, too questionable in quality to afford a satisfactory basis for discussion. Certain qualitative aspects of morbidity and mortality in these countries are well known, however. One relates to the pervasiveness of nutritional deficiencies and their role in illness and death. It has been reported, for example, that 80 per cent of the families in Java consume grossly inadequate diets that do not provide minimal daily energy requirements.[50] In the Philippines, it was found that 80 per cent of children under 6 years of age suffer from malnutrition and that one in 14 suffers from severe, third-degree malnutrition. Malnutrition was found to be as great a problem in urban squatter settlements as in rural areas of the Philippines.[51] High percentages of deaths from the infectious, parasitic and respiratory diseases are invariably associated with widespread malnutrition.

An alarming aspect of the relationship between poverty, malnutrition and high mortality is that the situation in many countries seems not to be improving, or to be doing so only at a disappointing pace. The failure of India to at-

[50] T. H. Hull and J. E. Rohde, *Prospects for Rapid Decline of Mortality Rates in Java*, Universitas Gadjah Mada, Population Institute, Working Paper Series, No. 16 (Yogyakarta, 1978), p. 42.

[51] M. B. Concepción and Peter C. Smith, *The Demographic Situation in the Philippines: An Assessment in 1977*, Papers of the East-West Population Institute, No. 44 (Honolulu, East-West Center, 1977), p. 17.

tain even a medium level of mortality (i.e., an expectation of life at birth of at least 50 years) by 1970-1972 is almost certainly related to the increasing proportion of the population living below the poverty line. It has been estimated that, by the late 1960s, some 250 million Indians—about half of the country's population at the time—were living in abject poverty.[52] The author of a detailed study of Indian development between 1961 and 1971 concluded that:

> "currently the three largest causes of death are gastro-enteric disease, tetanus, and tuberculosis. Infant mortality, although greatly reduced, is still around 140 per thousand live births . . . . India now faces a situation where further death rate reduction depends on basic improvements in nutrition, sanitation, hygiene, and education. And this reduction does not now appear to be occurring. Previously it has been possible to argue that socio-economic conditions could not have been worsening as the expectation of life was rising. But that argument cannot currently be used."[53]

The situation is much the same in Bangladesh and Pakistan, and undoubtedly in other parts of Asia, and ought to be considered as very grave. To solve the health problems of these countries requires a multifaceted approach. It is not sufficient only to raise income levels. The appalling health conditions in which the urban and rural poor live must be improved by, *inter alia*, providing the populations with a basic education, an adequate food supply, and the minimum public health provisions of safe drinking water and sanitation services. Finally, improvements in the system of health care delivery, to make services and facilities available within easy access of the population, particularly the large numbers of rural dwellers who are often inadequately served, would further contribute to mortality decline.

[52] Joginder Kumar, "Recent demographic transition in India and a viable population policy", paper presented at the Seventh Summer Seminar on Population, East-West Population Institute, Honolulu, June-July 1976.

[53] Robert Cassen, "Welfare and population: notes on rural India since 1960", *Population and Development Review*, vol. 1, No. 1 (September 1975), pp. 33-70.

Chapter V

LATIN AMERICA

Latin American data on mortality are generally of higher quality than those in other parts of the developing world. Not only do they record with greater accuracy the frequency of vital events at one particular point in time, but they also cover longer time periods. Regrettably, however, there has been, and still is, substantial heterogeneity in the quality of the data both among regions and across time. Recent efforts have resulted in estimates of demographic measures being obtained from the application of various direct or indirect techniques which permit the identification and correction of errors in the vital statistics. Those estimates constitute the basis of the present chapter. After all available data and estimates were evaluated, those showing obviously large biases and those based on unsound or erroneous assumptions were eliminated. The estimates that were retained appeared to be based on sound procedures or to show no significant inconsistencies with other estimates judged to be accurate. In a few cases, alternative estimates for the same country and time period were retained to provide examples of the magnitude of the discrepancies and thus the extent of the uncertainty. The estimates cover the period following the end of the Second World War and have been selected and organized in such a way as to provide coverage in regular intervals of five or 10 years. The mortality estimators serving as the basis of analysis in the chapter are the expectation of life at birth and at ages 5, 15, 30 and 65 years, and the probabilities of dying before attaining age 1, and in the interval from 1 to 5 years.

Despite the careful selection and evaluation of the data, some errors and biases undoubtedly remain. Great caution should therefore be exercised in interpreting the data, particularly when drawing conclusions connected with time trends, as they are very sensitive to changes in the estimation procedures or to departures of the data from the underlying assumptions.

The chapter is organized into four sections. The first section presents a summary of general mortality trends during the past 25 years, with emphasis on current conditions. The second section explores the issue of age and sex variations in mortality both from a purely static perspective (disregarding the time dimension) and as they have evolved since 1950. The third section discusses variations in mortality by regions, urban/rural residence and socio-economic categories (defined mainly by levels of education). Finally, in the fourth section, causes of death are discussed and the incidence of various groups of diseases for the years 1970-1975 is examined.

A. General levels and trends

With a few exceptions, Latin American countries began to experience very rapid changes in mortality after the Second World War. Countries such as Argentina, Chile, Costa Rica, Uruguay and, very likely, Panama had already undergone moderate mortality declines and had attained levels of life expectancy which were no longer indicative of high mortality. Countries such as Bolivia and Haiti, on the other hand, began their mortality transition at a much later date and lag far behind the others. Apart from the considerable variability in timing, two general characteristics of the process should be pointed out. First, the average rates of gain in life expectancy at birth were unprecedented, in many cases exceeding 1 year per year.[1] In contrast, the European mortality transition proceeded at a much slower pace, with annual gains never exceeding 0.5 year.[2] Secondly, it has become apparent that the gains in longevity were attained, if not in the complete absence of, at least to a considerable extent unaccompanied by, substantial improvements in the levels of living of the population. With the notable exceptions of Argentina, Chile, Uruguay and Costa Rica, no other country made substantial progress in industrialization until after 1960, that is, only after the attainment of a large proportion of the total gains in life expectancy. This is, again, in contrast to the experience of Western Europe and Northern America. In those areas, mortality decline went hand in hand with the industrialization process and the general improvement in standards of living which accompanied it.[3] Most authors who have observed the phenomenon in Latin America or in developing countries in other regions have attributed the reduction of mortality to the introduction of medical preventive and curative techniques and to advances in the process of vector eradication.[4] New technology in chemo-

[1] For discussions of post-war mortality trends in Latin America, see George J. Stolniz, "A century of international mortality trends: I", *Population Studies*, vol. 9, No. 1 (July 1955); "A century of international mortality trends: II", *Population Studies*, vol. 10, No. 1 (July 1956); "Recent mortality trends in Latin America, Asia and Africa", *Population Studies*, vol. 19, No. 2 (November 1965), pp. 117-138; *Population Bulletin of the United Nations, No. 6, 1962; with Special Reference to the Situation and Recent Trends of Mortality in the World* (United Nations publication, Sales No. 62.XIII.2); Eduardo E. Arriaga and Kingsley Davis, "The pattern of mortality change in Latin America", *Demography*, vol. 6, No. 3 (August 1969), pp. 223-242; Eduardo E. Arriaga, *Mortality Decline and its Demographic Effects in Latin America*, Population Monograph Series, No. 6 (Berkeley, Calif., Institute of International Studies, 1970).

[2] George J. Stolnitz, "A century of international mortality trends: I", *Population Studies*, vol. 9, No. 1 (July 1955); Nathan Keyfitz and Wilhelm Flieger, *World Population: an Analysis of Vital Data* (Chicago, Ill., University of Chicago Press, 1968).

[3] Thomas McKeown, *The Modern Rise of Population* (London, Academic Press, 1976).

[4] Eduardo E. Arriaga and Kingsley Davis, "The pattern of mortality change in Latin America", *Demography*, vol. 6, No. 3 (August 1969); Samuel H. Preston, *Mortality Patterns in National Populations: with Special Reference to Recorded Causes of Death*, Studies in Population (New York, Academic Press, 1976); "Causes and consequences of mortality decline in less developed countries during the twentieth century", in Richard A. Easterlin, *ed., Population and Economic Change in Developing Countries* (Chicago, Ill., University of Chicago Press, 1980).

therapy, vaccination and insecticides was in fact diffused from more to less industrialized regions quite independently of the latter's degree of wealth or economic development. In part, this occured because such technology could be directly obtained by the recipient country at very low costs. In part, the diffusion was made possible by the considerable increase in numbers, size and influence of international organizations supporting, directly or indirectly, the promotion of public health programmes. It has been estimated that about 80 per cent of the total increase in life expectancy that occurred between 1950 and 1970 in developing countries could be attributed to improved medical and public health technology.[5] However, utilizing a different sample of countries and a slightly different model gives an estimate of 50 per cent.[6]

The two aforementioned characteristics of the process of mortality decline in Latin America, i.e., its rapidity and its occurrence in the absence of substantial socio-economic progress, led to considerable optimism and a view of the Latin American experience as one converging towards that of Europe. There are, however, some indications that the mortality decline in Latin America has followed and will continue to follow a unique course, as will be seen presently.

An examination of recent mortality data for Latin American countries (tables V.1 and VA.1) reveals that life expectancy at birth for both sexes in the early 1970s, based on data for all countries having at least one estimate for 1970 or later, ranged from about 48 years in Haiti to about 72 years in Puerto Rico. The mean and median of the life expectancies at birth in these countries were 62 years and 62.5 years, respectively. Large contrasts are found both among regions and among countries in the same region. As can be seen from the text table below, the countries of the Caribbean and Temperate South America had a similar average life expectancy at birth of around 65 years in the early 1970s, while those of Middle America and Tropical South America had one of around 59 years. Within the Caribbean region, Cuba and Puerto Rico, with current levels of life expectancy close to 70 years, co-exist with Haiti, whose life expectancy at birth in 1971 was only around 48 years. This is a level which most of the other Latin American countries experienced 10 to 20 years earlier. A similar contrast in life expectancy at birth is evident from a comparison of Costa Rica (69.3 years in 1972-1974) and Honduras (52.5 years in 1973-1974) in Middle America, and Venezuela (66.6 years in 1970-1972) and Bolivia (48.7 years in 1975) in Tropical South America.

Region[a]	*Life expectancy at birth (both sexes) in early 1970s (years)*
Caribbean	64.5[b]
Middle America	59.5[c]
Temperate South America	65.4
Tropical South America	58.8[d]

Source: Unweighted averages of country data in table VA.1.

[a] The regional groupings of Latin American countries with 250,000 or more inhabitants employed in the present chapter are as follows:

Region	*Countries*
Caribbean	Barbados, Cuba, Dominican Republic, Guadeloupe, Haiti, Jamaica, Martinique, Puerto Rico, Trinidad and Tobago
Middle America	Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama
Temperate South America	Argentina, Chile, Uruguay
Tropical South America	Bolivia, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Venezuela

[b] Excluding Guadeloupe and Martinique with life expectancy at birth of 64.8 years and 65.3 years, respectively, in 1963-1967.

[c] Excluding Nicaragua, with life expectancy at birth for females of 54.9 years in 1971.

[d] Excluding Brazil, with life expectancy at birth of 59.2 years in 1960-1970.

A number of Latin American countries have made substantial gains in longevity since the early 1950s. Table V.2 illustrates the changes in the distribution of countries by levels of life expectancy at birth between 1950-1955 and 1970-1975. Although countries in all regions have moved towards medium and high levels of life expectancy, the pace of change has varied substantially, and a considerable degree of heterogeneity persists.

A feature of recent mortality trends in Latin America, one which has become apparent only during the past few years, has been a considerable slowing down of gains. Some of the evidence supporting this observation can be found in table V.1, which presents values of life expectancy at birth in countries of Latin America from 1950 to 1975, as well as the average annual changes in life expectancy during two intervals—the 1950s and the 1960s. Data for all the countries for which calculations are possible, with the exception of Chile and Costa Rica, indicate the existence of declining rates of gain in life expectancy. Three groups of countries can be distinguished based on their mortality levels and patterns of change. The first includes countries with relatively high life expectancy at birth: Argentina, where life expectancy actually declined between the 1960s and 1970s; Uruguay, with virtually no change; and Jamaica, Puerto Rico and Trinidad and Tobago, all with reductions of over 50 per cent in their rates of gain in life expectancy between the earlier and later intervals. The second group includes countries with medium levels of life expectancy and sharply diminished rates of gain. Mexico, El Salvador, Colombia and the Dominican Republic fall into this category. Finally, several countries show some gains during the second period, but have no information on the first period. This group consists of Nicaragua, Panama and Venezuela. The observed rates of gain in life expectancy at birth for these countries in the recent period are very low, and judging from the values of their life expectancies at the beginning of the period—which ranged from about 53 to 63 years—the rates of mortality decline in the earlier period must have been much higher to attain these values by the 1960s.

[5] Samuel H. Preston, *Mortality Patterns in National Populations: with Special Reference to Recorded Causes of Death*, Studies in Population (New York, Academic Press, 1976).

[6] Samuel H. Preston, "Causes and consequences of mortality decline in less developed countries during the twentieth century", in Richard A. Easterlin, ed., *Population and Economic Change in Developing Countries* (Chicago, Ill., University of Chicago Press, 1980).

TABLE V.1. TRENDS IN EXPECTATION OF LIFE AT BIRTH, COUNTRIES OF LATIN AMERICA, BOTH SEXES, 1950 - 1975

Region and country	Expectation of life at birth (years)					Average annual absolute change (years)		Average annual percentage change	
	1950-1955	1955-1960	1960-1965	1965-1970	1970-1975	1950 to 1960[a]	1960 to 1970[a]	1950 to 1960[a]	1960 to 1970[a]
Caribbean									
Barbados	55.6[b]	...	65.0[c]	...	68.4[d]	1.04	0.34	1.88	0.53
Cuba	55.7[e]	...	64.0[f]	67.1[g]	69.9[h]	0.83	0.59	1.49	0.92
Dominican Republic	—46.7—		—54.3—		58.9[i]	0.76	0.46	1.63	0.85
Guadeloupe	57.3	...	...	64.8[l]	...	0.68	...	1.19	...
Haiti	...[j,k]	...	...	...	47.6[m]	...	...	...	...
Jamaica	57.3[b]	...	64.6[c]	...	68.4[n]	0.81	0.38	1.42	0.59
Martinique	...	...	...	65.3[l]	...	...	...	...	...
Puerto Rico	60.9[o]	67.8[p]	69.4[c]	...	72.2[q]	0.85	0.28	1.40	0.40
Trinidad and Tobago	57.4[r]	62.4	...	...	66.1[s]	1.00	0.31	1.74	0.49
Middle America									
Costa Rica	55.9[o]	...	62.3[t]	...	69.3[u]	0.49	0.70	0.88	1.12
El Salvador	47.2[o]	...	56.0[c]	...	57.4[v]	0.88	0.13	1.86	0.23
Guatemala	40.2[e]	...	48.3[w]	...	52.8[v]	0.58	0.64	1.44	1.33
Honduras	...	...	42.3[x]	...	52.5[y]	...	0.85	...	2.01
Mexico	49.5[o]	...	58.0[c]	...	60.8[d]	0.85	0.28	1.72	0.48
Nicaragua	...	...	53.2[z,aa]	...	54.9[m,z]	...	0.21[z]	...	0.40[z]
Panama	...	...	61.9[bb]	...	64.9[d]	...	0.30	...	0.48
Temperate South America									
Argentina	61.3[cc]	...	66.5[c]	...	65.7[d]	0.40	−0.08	0.65	−0.12
Chile	54.9[dd]	...	57.1[bb]	...	61.5[n]	0.28	0.44	0.50	0.74
Uruguay	...	...	68.5[ee]	...	69.0[ff]	...	0.04	...	0.06
Tropical South America									
Bolivia	...	...	...	...	48.7[i]	...	...	...	...
Brazil	—53.8—		—59.2—		...	0.54	...	1.00	...
Colombia	...	...	58.7[w]	...	58.9[u]	...	0.02	...	0.04
Guyana	54.7[b]	...	61.6[c]	...	...	0.77	...	1.24	...
Peru	...	...	...	...	55.1	...	...	...	...
Suriname	...	...	64.6[aa]	...	...	...	...	...	...
Venezuela	...	...	61.9[gg]	...	66.6[v]	...	0.37	...	0.59

Source: Table VA.1.

[a] The exact time periods to which average annual changes in life expectancy pertain can be deduced from dates given in foot-notes to life expectancy values in first five columns.

[b] 1950-1952.
[c] 1959-1961.
[d] 1969-1971.
[e] 1950.
[f] 1960.
[g] 1965.
[h] 1970. Life expectancy in 1974 was 70.1 years.
[i] 1975.
[j] Including also mortality experience of Martinique.
[k] 1951-1955.
[l] 1963-1967.
[m] 1971.
[n] 1969-1970.
[o] 1949-1951.
[p] 1954-1956.
[q] 1969-1973.
[r] 1952-1954.
[s] 1970.
[t] 1962-1964.
[u] 1972-1974.
[v] 1970-1972.
[w] 1963-1965.
[x] 1960-1962.
[y] 1973-1974.
[z] Females only.
[aa] 1963.
[bb] 1960-1961.
[cc] 1946-1948.
[dd] 1952-1953.
[ee] 1963-1964.
[ff] 1974-1976.
[gg] 1961-1962.

Some caution should be observed with respect to the conclusions based on comparisons between the two time periods in the preceding discussion. The estimates of life expectancy at birth for the more recent dates are generally based on more reliable data or on more accurate estimation techniques than are the earlier estimates. For example, the omission of deaths, particularly of infants and young children, is likely to have been greater in the earlier period. These differences in the quality of data between the earlier and later figures would tend to bias downward the estimates of the rates of gain in life expectancy in the later period.[7] Of the seven countries which traditionally have had good statistics, and where this downward bias would therefore be minimal, Chile and Costa Rica showed increased rates of gain in the more recent period while Argentina and Uruguay followed the general pattern of slower rates of gain in this period.

With the above reservations noted, it is nevertheless to be expected that negative slopes for the curve of rates of

[7] The estimates for Puerto Rico, however, seem to be subject to the opposite error due to an apparent slight exaggeration of life expectancy in the more recent years.

gain in life expectancy will eventually occur during the process of mortality decline. As the more preventable causes of death, mainly the infectious and parasitic diseases, are successfully controlled, and mortality is determined more and more by diseases of the newborn and of old age as well as by accidental death, the pace of mortality improvement slows. This has been the pattern in the more developed countries. Recent mortality trends in the countries of Latin America, however, depart from those of Western Europe or Northern America in the past, in that the magnitude of the slow-downs in mortality improvement is, for most of the Latin American countries, premature compared with the Western European experience.[8] A reduction of the rates of gain in life expectancy at birth of magnitudes comparable to those experienced by Latin American countries occurred in Western Europe only at higher levels of life expectancy. This departure may reflect the convergence towards "ceiling" values of life expectancy which are lower than was the case for Western Europe. If this interpretation is accurate, how can the facts be explained? Part of the explanation lies in the relative importance of economic factors *versus* health interventions in bringing about mortality decline. As already noted at the beginning of this section, a large fraction of the dramatic mortality declines experienced by Latin American countries during the 10 to 15 years following the Second World War can be imputed to the introduction and dissemination of new, low-cost medical technology independently of improvements in economic conditions.[9] This process may have reached a stage where a qualitative change is needed to avoid stagnation at levels of life expectancy which are lower than those attained by the low-mortality countries. The "soft rock" portion of mortality, in Bourgeois-Pichat's image,[10] can only be dissolved through improvements in nutrition, housing, access to pure water supplies and sewage facilities, educational levels and, last but not least, in the social distribution of medical services. These are all factors whose modification requires not only efficient governmental machinery but also an increased rate of economic development and of access of the population to the fruits of such development. The observed slow-down in the rates of gain of life expectancy may arise from economic and social transformations that have either been too slow in coming or have not succeeded in altering all segments of society. This interpretation has been partially supported by studies of mortality conditions and trends in Argentina[11] and Brazil,[12] which impute increases in mortality, or stagnation of mortality decline, to a deterioration in living conditions of major sectors of the population.

The case of Cuba also supports the same argument, but in a different sense from those of Brazil and Argentina. The exceptional character of the Cuban experience lies not so much in the effective utilization of the products of rapid economic growth as in a more egalitarian distribution of

TABLE V.2. CLASSIFICATION OF LATIN AMERICAN COUNTRIES ACCORDING TO BROAD CATEGORIES OF EXPECTATION OF LIFE AT BIRTH (e_0), 1950-1955 AND 1970-1975

Region and level of life expectancy at birth	*1950-1955*	*1970-1975*
Caribbean		
Low life expectancy (e_0 under 50 years)	Dominician Republic	Haiti
Medium life expectancy (e_0 50 to 59 years)	Barbados; Cuba; Guadeloupe; Jamaica; Trinidad and Tobago	Dominician Republic
High life expectancy (e_0 60 years and over) ..	Puerto Rico	Barbados; Cuba; Guadeloupe; Jamaica; Martinique; Trinidad and Tobago
Middle America		
Low life expectancy (e_0 under 50 years)	El Salvador; Guatemala; Honduras; Mexico	
Medium life expectancy (e_0 50 to 59 years) .	Costa Rica; Nicaragua	El Salvador; Guatemala; Honduras; Mexico; Nicargua
High life expectancy (e_0 60 years and over) .		Costa Rica; Panama
Temperate South America		
Medium life expectancy (e_0 50 to 59 years)	Chile	
High life expectancy (e_0 60 years and over) .	Argentina	Argentina; Chile; Uruguay
Tropical South America		
Low life expectancy (e_0 under 50 years)		Bolivia
Medium life expectancy (e_0 50 to 59 years)	Brazil; Colombia; Guyana	Brazil; Colombia; Ecuador; Peru
High life expectancy (e_0 60 years and over) .		Guyana; Paraguay; Surinam; Venezuela

Source: Table VA.1.

[8] Davidson R. Gwatkin, "The end of an era" (manuscript) (Washington, D.C., Overseas Development Council).

[9] Alternative treatments of the problem of the degree of independence of these two groups of factors can be found in Samuel H. Preston, *Mortality Patterns in National Populations: with Special Reference to Recorded Causes of Death*, Studies in Population (New York, Academic Press, 1976); T. Paul Schultz, "Interpretation of relations among mortality, economics of the household, and the health environment", in *Proceedings of the Meeting on Socioeconomic Determinants and Consequences of Mortality, El Colégio de Mexico, Mexico City, 19-25 June 1979* (New York and Geneva, United Nations and World Health Organization [1980].

[10] *Population Bulletin of the United Nations, No. 6, 1962; with Special Reference to the Situation and Recent Trends of Mortality in the World* (United Nations publication, Sales No. 62.XIII.2), p. 48.

[11] M. Accinelli and M. Müller, "Un hecho inquietante: la evolución reciente de la mortalidad en la Argentina", *Notas de Población*, vol. 6, No. 17 (August 1978).

[12] José A. M. Carvalho and Charles H. Wood, "Mortality, income distribution and rural-urban residence in Brazil", *Population and Development Review*, vol. 4, No. 3 (September 1978).

certain resources. The substantial gains in Cuba's longevity during part of the 1950s and 1970s were achieved utilizing the same medical technology available to other countries and during a stage of rather sluggish economic growth. Gains during the 1970s were slightly above those achieved in the past in Western Europe at similar levels of life expectancy. These improvements can be attributed to a social organization that guaranteed greater access to the medical technology, and a more efficient social distribution of available health services.[13]

Additional evidence for the interpretation given above comes from an examination of age patterns of mortality and the structure of causes of death. With respect to the former, it appears that in most Latin American countries, levels of infant and childhood mortality are higher relative to the over-all mortality levels than was the case in Western Europe and Northern America in the past at similar over-all mortality levels. Mortality during infancy and childhood is composed to a greater degree than at other ages of the "soft rock" in countries of medium and high mortality, and is much more sensitive to changes (or a lack thereof) in socio-economic conditions than at other ages.[14] An examination of the structure of causes of death in infants and young children in Latin American countries suggests that there has been a shift from a predominance of diseases which can be readily controlled by vaccination, vector eradication or chemotherapy, to a cause-of-death pattern strongly influenced by nutritional deficiencies and their associated conditions (e.g., diarrhoea).[15] This shift may not be simply a result of the lowered incidence of deaths due to other causes or to the persistence of poverty; it could also be an unfavourable consequence of changes in the behaviour patterns of parents adopted in the belief that they are beneficial. The abandonment of breast-feeding, for example, and its replacement by bottle feeding, may have serious adverse effects on the health of the newborn even if the levels of poverty should remain constant.[16] Although a high incidence of diarrhoea and malnutrition has been found in some of the countries, there are notable exceptions. Thus, in a recent paper, Taucher[17] confirmed a sustained decrease of infant mortality in Chile. The decrease in respiratory complications and conditions linked with diarrhoea seem to be the major factors responsible for this trend. It will be recalled, however, that Chile also departed from the general pattern of decreasing rates of gain in life expectancy.

In sum, this brief examination of general mortality levels and trends reveals persistent regional variations in both. The relatively modest changes in mortality that most of these countries underwent during the past decade depart from the mortality transition as it occurred in Western Europe and Northern America, and could indicate the beginning of a stage in which there is increased resistance to further change. Additional gains in life expectancy will probably require more drastic transformations in the levels of living of the population than have previously occurred. These generalizations, however, should be viewed with caution, as data supporting them are scanty and rarely refer to more than a handful of countries.

B. Age and sex differentials

1. *Age differentials: rates of change*

Table V.3 presents the absolute and the proportional gains per year in life expectancy at ages 0, 15 and 65 years, as well as the proportional changes per year in the probabilities of dying before attaining age 1, and between ages 1 and 5 years. As would be expected, the absolute gains in life expectancy decrease monotonically with age.[18] There are some exceptions to this regularity. The most notable is El Salvador, where the gain in life expectancy at age 65 exceeded the gain in life expectancy at birth by a substantial margin among males and a small fraction among females. This is attributable to increases in mortality under the age of 5 years of a magnitude which more than offset the gains in life expectancy at older ages. It is difficult to determine, however, whether this reflects reality or is merely an artifact arising from changes in the accuracy of the observed age patterns of mortality. The pattern of relative gains in life expectancy per year is U-shaped with the smallest gains generally occurring at age 15. This is due in part to the sharp declines in mortality at very young ages, which contribute to the substantial increases in life expectancy at birth, while mortality changes in the adult years are more modest. In a few cases (Puerto Rico, Trinidad and Tobago, Guatemala, Panama, Chile) life expectancy at ages 15 and 65 declined in spite of increases in life expectancy at birth. In Argentina and Colombia, declines in life expectancy occurred at birth as well as at ages 15 and 65 among males. Since in most of these countries the largest declines occurred at 65 years, rather than at 15, it is possible that differential errors in coverage of deaths at old

[13] Sergio Diaz-Briquets, "Income redistribution and mortality change: the Cuban case", paper presented at the Annual Meetings of the Population Association of America, 13-15 April 1978, Atlanta, Ga. (Washington, D.C. 1978).

[14] Puffer and Serranto state that in some parts of Latin America, nutritional deficiencies have been found to be an underlying or associated cause in up to 46 per cent of deaths under 5 years of age (Ruth R. Puffer and Carlos V. Serrano, *Patterns of Mortality in Childhood: Report of the Inter-American Investigation of Mortality in Childhood,* Scientific Publication No. 262 (Washington, D.C., Pan American Health Organization, 1973), p. 165); see also Ch. Teller and W. W. Bent, "Demographic factors and their food and nutrition policy relevance: the Central American situation", paper presented at the Annual Meetings of the Population Association of America, 13-15 April 1978, Atlanta, Ga. (Washington, D.C., 1978).

[15] The evidence offered in support of this generalization—data on mortality by cause during the pre- and post-decline periods—is, admittedly, far from conclusive. Alberto Palloni, "Mortality decline in Latin America", paper presented at the Annual Meetings of the Population Association of America, 26-28 April 1979, Philadelphia, Pa. (Washington, D.C., 1979).

[16] Derrick B. Jelliffe and E. F. P. Jelliffe, *Human Milk in the Modern World* (Oxford and New York, Oxford University Press, 1978); John Knodel, "Breastfeeding and population growth", *Science,* vol. 198, No. 4322 (16 December 1977).

[17] Erica Taucher, *Chile: Mortalidad desde 1955-1975, tendencias y causas,* CELADE Publicaciones, Serie A, No. 162 (Santiago de Chile, Centro Latinoamericano de Demografia, 1978).

[18] This occurs in part because the causes of death which predominate at the younger ages in countries of medium and high mortality are, on average, more tractable than those which characterize middle- and old-age mortality, thus offering greater opportunities for mortality reduction.

TABLE V.3. ABSOLUTE AND RELATIVE CHANGES[a] IN SELECTED MORTALITY INDICATORS, COUNTRIES OF LATIN AMERICA, 1950-1975

Region, country and period	Males					Females				
	Changes in life expectancy at ages:			Changes in the probability of dying between ages:		Changes in life expectancy at ages:			Changes in the probability of dying between ages:	
	0	15	65	0 and 1 ($_1q_0$)	1 and 4 ($_4q_1$)	0	15	65	0 and 1 ($_1q_0$)	1 and 4 ($_4q_1$)
Caribbean										
Barbados										
1950-1952 to 1959-1961										
Absolute change (*years*)	9.30	4.40	1.80			9.40	3.70	1.30		
Percentage change	1.94	0.97	1.89	5.07	...	1.80	0.75	1.02	5.47	...
1959-1961 to 1969-1971										
Absolute change (*years*)	3.10	0.50	0.40			3.80	1.10	0.0		
Percentage change	0.49	0.09	0.32	3.59	6.22	0.56	0.19	0.0	4.25	5.89
Cuba										
1960-1974										
Absolute change (*years*)	6.40	4.10	1.50			5.40	3.60	1.80		
Percentage change	0.75	0.54	0.86	1.93	...	0.62	0.45	0.92	1.88	...
Dominican Republic										
1965-1975										
Absolute change (*years*)	4.90	5.30	1.50			4.30	4.00	0.50		
Percentage change	0.93	1.09	1.17	0.24	...	0.77	0.78	2.89	0.07	...
Guadeloupe										
1953-1964										
Absolute change (*years*)	7.10	5.40	1.10			8.10	6.40	1.50		
Percentage change	1.17	1.03	0.89	1.49	5.38	1.24	1.15	1.02	1.49	5.00
Jamaica										
1951-1960										
Absolute change (*years*)	7.00	4.20	1.40			7.70	5.30	1.60		
Percentage change	1.40	0.94	1.36	3.25	4.49	1.45	1.13	1.35	3.11	4.41
1960-1970										
Absolute change (*years*)	4.00	1.70	1.10			3.60	1.50	1.10		
Percentage change	0.64	0.31	0.86	3.90	...	0.54	0.06	0.74	3.55	...
Puerto Rico										
1950-1960										
Absolute change (*years*)	7.60	4.50	2.10			9.50	6.10	0.80		
Percentage change	1.28	0.86	−1.21	3.08	...	1.52	1.11	0.49	3.23	...
1960-1972										
Absolute change (*years*)	1.80	−0.30	−0.50			4.20	0.30	0.10		
Percentage change	0.22	−0.04	0.00	3.16	...	0.49	0.22	0.19	3.39	...
Trinidad and Tobago										
1953-1958										
Absolute change (*years*)	4.30	2.70	0.10			5.80	3.80	0.60		
Percentage change	1.70	1.11	0.19	2.74	...	2.20	1.51	0.96	3.17	...
1958-1970										
Absolute change (*years*)	3.50	1.30	−0.40			3.80	2.10	0.00		
Percentage change	0.46	0.21	−0.31	3.94	...	0.47	0.32	0.00	3.92	...
Middle America										
Costa Rica										
1950-1963										
Absolute change (*years*)	6.20	4.10	1.70			6.60	5.30	1.70		
Percentage change	0.87	0.62	1.10	1.46	3.97	0.89	0.78	1.03	0.99	3.72
1963-1974										
Absolute change (*years*)	6.60	2.70	1.70			7.50	2.90	2.40		
Percentage change	1.08	0.49	1.25	3.35	5.92	1.18	0.50	3.82	4.18	6.12
El Salvador										
1960-1971										
Absolute change (*years*)	0.40	2.40	2.50			2.60	4.80	2.90		
Percentage change	0.07	0.43	1.88	−0.71	−7.39	0.41	1.63	4.37	−0.02	−7.77
Guatemala										
1950-1964										
Absolute change (*years*)	8.10	3.50	0.50			8.00	3.10	−0.30		
Percentage change	1.46	0.58	0.50	2.29	1.87	1.40	0.50	−0.18	2.43	1.66
1964-1971										
Absolute change (*years*)	4.10	2.70	0.40			5.00	3.90	0.90		
Percentage change	1.23	0.83	0.48	3.10	1.58	1.46	1.17	1.08	3.16	2.12
Honduras										
1961-1973										
Absolute change (*years*)	10.10	6.70	3.70			10.2	6.60	1.90		
Percentage change	2.07	1.31	2.94	1.77	3.69	1.93	1.22	1.43	2.16	4.10

TABLE V.3 (*continued*)

Region, country and period	Males					Females				
	Changes in life expectancy at ages:			Changes in the probability of dying between ages:		Changes in life expectancy at ages:			Changes in the probability of dying between ages:	
	0	15	65	0 and 1 ($_1q_0$)	1 and 4 ($_4q_1$)	0	15	65	0 and 1 ($_1q_0$)	1 and 4 ($_4q_1$)
Middle America (*cont.*)										
Mexico										
1950-1960										
Absolute change (*years*)	8.30	4.50	1.60			8.60	4.30	1.90		
Percentage change	1.73	0.97	1.29	2.30	4.60	1.69	0.86	1.51	2.35	4.78
1960-1970										
Absolute change (*years*)	2.40	1.80	0.60			3.30	2.30	1.00		
Percentage change	0.43	1.72	0.43	−0.70	3.03	0.55	0.42	0.69	−0.30	3.07
Panama										
1960-1970										
Absolute change (*years*)	3.00	2.50	0.40			2.90	1.70	−1.00		
Percentage change	0.50	0.47	0.31	1.13	. . .	0.46	0.30	−0.63	2.47	. . .
Temperate South America										
Argentina										
1947-1960										
Absolute change (*years*)	4.60	3.30	1.20			5.90	4.70	1.70		
Percentage change	0.60	0.50	0.79	1.39	2.92	0.71	0.66	0.95	1.47	2.77
1960-1970										
Absolute change (*years*)	−1.80	−1.60	−0.13			0.20	0.30	0.10		
Percentage change	−0.28	−0.30	−1.01	−0.95	2.38	0.03	0.05	0.06	−0.67	2.73
Chile										
1952-1960										
Absolute change (*years*)	1.40	1.00	−0.10			3.10	2.40	0.10		
Percentage change	0.33	0.26	−0.11	0.57	2.19	0.68	0.57	0.09	0.58	2.64
1960-1970										
Absolute change (*years*)	4.10	0.70	0.90			4.8	1.40	0.80		
Percentage change	0.75	0.14	0.77	3.22	4.76	0.80	0.26	0.58	3.36	5.36
Uruguay										
1963-1975										
Absolute change (*years*)	0.20	0.30	0.20			1.9	1.0	0.50		
Percentage change	0.03	0.05	0.13	−0.28	−0.15	0.10	0.14	0.27	0.08	−1.12
Tropical South America										
Brazil										
1955-1965										
Absolute change (*years*)	5.30	2.90	0.70			5.5	3.10	0.40		
Percentage change	1.02	0.60	0.54	2.54	. . .	0.99	0.61	0.30	0.74	. . .
Colombia										
1964-1973										
Absolute change (*years*)	−0.60	−0.30	−1.10			1.10	0.50	−0.80		
Percentage change	−0.12	−0.07	−0.97	−0.19	−0.81	0.20	0.10	−0.65	0.70	1.68
Guyana										
1951-1960										
Absolute change (*years*)	6.30	4.30	1.60			7.40	5.30	2.20		
Percentage change	1.32	1.04	1.93	3.60	. . .	1.46	1.21	2.09	3.26	. . .
Venezuela										
1961-1971										
Absolute change (*years*)	3.70	3.00	1.40			3.70	3.00	1.10		
Percentage change	0.60	0.57	1.09	0.67	. . .	0.57	0.54	0.77	1.00	. . .

Source: Based on data in table VA.1.

[a] Values for absolute changes pertain to the entire period, whereas the relative changes are average annual changes. The latter were calculated by dividing the difference in the value of the parameters at the beginning and end of the period by the initial value, dividing the result by the time interval elapsed, and multiplying by 100.

ages, or in age reported for the deceased, may be responsible for such reversals rather than real increases in mortality. Temporary increases in adult mortality are, nevertheless, possible, even under improving medical conditions. Thus, an influenza epidemic in Chile that took its immediate toll during 1957 may have resulted in higher mortality among the older and weakened cohorts in subsequent years. Also, with the diminishing importance of infectious diseases and respiratory ailments, increases in mortality due to degenerative processes can occur, particularly when environmental factors reinforce and intensify such processes. Puerto Rico, Trinidad and Tobago and Argentina are relatively developed and urbanized nations in which such shifts may already have begun.

An examination of the rates of gain in life expectancy by country in the 1950s and 1960s, based on the data in table V.3, reveals smaller gains during the latter time interval. Only Costa Rica and Chile showed larger gains in life expectancy at birth and at age 65 in conjunction with smaller gains at age 15. Guatemala and Mexico, on the other

hand, showed reductions in gains at birth and age 65 that were accompanied by increased gains at age 15.

The relative gains in life expectancy presented in table V.3 show that as a country moves from higher to lower levels of mortality, the pace of gains in life expectancy at birth decreases more rapidly than at 15 years. This may be a result of increased resistance to mortality decline in the 0-5 year age-group, as the mortality experience of this age-group strongly influences the value of life expectancy at birth. This issue will be discussed again in connexion with mortality levels at ages 0-1 and 1-5 years.

An examination of the differentials in the age patterns of mortality improvement reveals that in 19 out of 29 cases female life expectancy at birth improved faster than that of males, relatively. The absolute gains favoured females even more strongly, with 24 cases showing greater female gains. In 19 of 29 cases, gains in life expectancy at 15 years were higher among females than among males, both absolutely and relatively. These higher rates of gain among females can be explained in part by the sharp reduction in mortality due to causes associated with pregnancy and childbirth. In addition, relative increases in the incidence of accidents among the adult male population, which occur as urbanization increases, may act as a brake for more marked improvements in male death rates above age 15. The male/female differences (absolute) in the rates of gain in life expectancy at 15 years are slightly higher than at birth.

The higher rates of gain in life expectancy at birth among females are a little harder to explain. They cannot all be accounted for by greater gains for females above age 15, although the latter are obviously a contributing factor. A significant fraction of the sex differential in gains in life expectancy at birth is associated with differential improvement in infant and childhood mortality among males and females. It is well known that females show biological advantages over males in terms of mortality levels. These are particularly visible at very young ages. To what extent the same biological edge interacts with medical improvements to produce advantages in terms of rates of change of mortality, is uncertain.

To summarize, the pattern of changes in life expectancy at birth and at ages 15 and 65 years reveals, in general, decreasing rates of gain in the more recent periods, and more so at birth than at age 15. Sex differentials in life expectancy favour females, particularly at age 15—probably an effect of the reduction in mortality from causes arising from pregnancy and childbirth—but also at birth. The sex differentials at birth may be explained in part by those prevailing at age 15, and in part by the more rapid decline in infant and childhood mortality among females.

2. *The levels of mortality in infancy and childhood*

The rates of decline in infant mortality (measured by ${}_1q_0$) and early childhood mortality (measured by ${}_4q_1$) which appear in table V.3 are as high as or higher than those experienced by Western and Northern European countries during their transition from high to low mortality.[19] Nevertheless, the decline of mortality in infancy and childhood appears to have proceeded at a slower pace in countries of Latin America than would have been expected given the pace of decline in the over-all mortality levels. Furthermore, current and past levels of infant and early childhood mortality are substantially higher than those to be expected if the pattern of mortality prevailing in Western European countries had been followed.

In order to determine the degree to which Latin American mortality trends parallel or depart from those of countries which had achieved low mortality earlier, Latin American mortality experience was compared with the patterns represented by model "West" of the Coale-Demeny model life tables.[20] For all countries in the sample, the expected values of ${}_1q_0$ in model "West" were calculated for the same over-all level of mortality, as measured by life expectancy at 15 years.[21] The ratio of the observed to the expected values was then computed. These ratios are given in table V.4. It is apparent from the table that the departure from model "West" patterns is greater among female infants and children than among males. A partial explanation for this may lie in the strong preference for male children that has been observed in Latin America, as well as in other developing regions. This may lead to an increase in the risks of death for females as a result of more favourable treatment accorded to the males.[22] Female infant and childhood mortality would then exceed the expected values to a greater extent than in the case of males. The levels of excess male mortality should be a more or less accurate reflection of contrasts in environmental and economic conditions regardless of sex discriminatory practices. One indication confirming this hypothesis is that the countries of Temperate South America, which because of their cultural heritage would be less likely to discriminate strongly against female children, do in fact show a reversal in the differences by sex: the ratios for males are higher than for females. The main objective of this comparison is not, however, to estimate exactly the sex differentials in the magnitude of excess mortality but to try to account for the existence of the excess itself. It is hypothesized here that the departure of Latin American countries from the European experience is related to a disequilibrium between improvements in socio-economic conditions and health interventions. While the latter may have a significant influence on adult mortality in the complete absence of the former, the connexions between one and the other are more subtle at the beginning of life. The longer the population is ex-

[19] The average annual rates of decline in infant mortality experienced by Sweden, England and Wales and France when their life expectancy at birth increased from about 45 years to about 65 years were 1.9 per cent, 2.4 per cent and 2.6 per cent, respectively. These figures were calculated from life tables for these countries in Nathan Keyfitz and Wilhelm Flieger, *World Population: an Analysis of Vital Data* (Chicago, Ill., University of Chicago Press, 1968).

[20] Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966).

[21] The results obtained using this indicator of over-all mortality exaggerate somewhat, but do not distort, the pattern of departures that would be obtained using life expectancy at age 10, or, for that matter, at birth.

[22] N. E. Williamson, "Preference for sons around the world", unpublished Ph.D. dissertation, Department of Sociology, Harvard University, 1973.

TABLE V.4. RATIOS OF ACTUAL TO EXPECTED VALUES OF INFANT MORTALITY ($_1q_0$), EARLY CHILDHOOD MORTALITY ($_4q_1$) AND EXPECTATION OF LIFE AT 65 YEARS (e_{65}), COUNTRIES OF LATIN AMERICA, 1950 TO 1975

Region, country and period	Males			Females		
	$_1q_0$	$_4q_1$	e_{65}	$_1q_0$	$_4q_1$	e_{65}
Caribbean						
Barbados						
1950-1952	1.94	...	0.91	2.93	...	1.04
1959-1961	1.94	1.76	0.97	2.39	2.18	1.06
1969-1971	1.33	0.75	1.00	1.56	1.17	1.04
Cuba						
1960	1.56	1.84	0.99	1.58	2.07	0.99
1965	1.65	2.30	1.02	1.51	2.12	1.00
1970	1.71	2.79	1.04	1.42	2.57	1.01
1974	2.01	...	1.03	1.85	...	1.05
Dominican Republic						
1950-1960	1.02	...	1.16	1.21	...	1.17
1960-1970	1.21	...	1.12	1.37	...	1.13
1975	2.45	4.42	1.13	2.27	3.41	1.07
Guadeloupe						
1951-1955	0.59	0.93	1.01	0.68	1.18	1.08
1963-1967	1.04	1.24	0.99	1.30	1.98	1.06
Jamaica						
1950-1952	1.08	1.68	0.98	1.15	1.62	1.03
1959-1961	1.37	2.51	1.02	1.63	2.89	1.04
1969-1970	1.05	...	1.07	1.28	...	1.09
Martinique						
1963-1967	0.95	1.30	1.03	1.12	1.85	1.09
Puerto Rico						
1959-1961	1.67	...	1.15	2.04	...	1.12
1969-1971	1.12	0.61	1.17	1.47	1.21	1.12
1971-1973	0.99	0.52	1.14	1.49	1.00	1.13
Trinidad and Tobago						
1955-1960	1.02	...	0.89	1.09	...	0.98
1970	0.64	0.53	0.84	0.75	0.70	0.94
Middle America						
Costa Rica						
1962-1964	2.25	3.38	1.05	2.61	4.07	1.00
1972-1974	2.17	2.50	1.13	2.22	2.86	1.11
El Salvador						
1959-1961	1.64	1.87	1.13	1.71	1.88	1.01
1970-1972	2.31	5.73	1.18	3.12	9.34	1.03
Guatemala						
1963-1965	0.97	1.78	1.03	1.23	3.48	1.03
1970-1972	1.11	2.86	1.06	1.16	3.13	1.02
Honduras						
1960-1962	0.81	0.82	1.06	1.03	1.11	1.02
1973-1974	1.61	2.01	1.23	1.79	2.19	1.02
Mexico						
1959-1961	1.27	2.58	1.18	1.51	3.48	1.08
1969-1971	1.74	2.68	1.18	2.10	3.86	1.11
Nicaragua						
1963	1.12	1.00	1.15	1.56	1.57	1.22
1971	...	...	...	1.92	2.86	1.12
Panama						
1960-1961	1.29	...	1.04	1.54	...	1.15
1969-1971	1.62	4.28	1.02	1.44	3.93	1.04
Temperate South America						
Argentina						
1946-1948	1.03	0.87	0.99	1.43	1.40	1.02
1959-1961	1.34	1.12	1.02	2.11	2.37	1.05
1969-1971	1.17	0.60	0.95	2.33	1.82	1.05
Chile						
1952-1953	1.47	1.07	1.03	1.89	1.63	1.06
1960-1961	1.61	1.09	1.00	2.46	2.11	1.01
1969-1970	1.20	0.67	1.06	1.96	1.30	1.05
Uruguay						
1963-1964	1.27	0.60	1.00	1.91	1.13	1.05
1974-1976	1.37	0.65	1.01	2.15	1.55	1.00
Tropical South America						
Bolivia						
1975	1.76	2.42	1.12	2.25	2.31	1.10
Brazil						
1950-1960	1.15	...	1.14	0.74	...	1.09
1960-1970	1.28	...	1.13	1.19	...	1.05

TABLE V.4 (*continued*)

Region, country and period	Males			Females		
	$_1q_0$	$_4q_1$	e_{65}	$_1q_0$	$_4q_1$	e_{65}
Tropical South America (*cont.*)						
Colombia						
1963-1965	1.24	1.84	1.05	1.48	2.75	1.03
1972-1974	1.21	1.83	0.97	1.48	2.59	0.96
Guyana						
1959-1961	1.26	...	0.92	1.54	...	1.04
Ecuador						
1973-1975	3.07	7.50	1.17	3.09	7.88	1.03
Peru						
1970-1975	1.92	2.92	1.09	1.85	2.45	1.05
Venezuela						
1961-1962	1.15	1.85	1.04	1.30	2.29	1.03
1970-1972	1.62	...	1.09	1.72	...	1.05

Sources: Table VA.1 and Ansley J. Coale and Paul Demeny, *Regional Model Life Tables and Stable Populations* (Princeton, N.J., Princeton University Press, 1966).

NOTE: The expected values of $_1q_0$, $_4q_1$ and e_{65} were calculated for each observation by interpolation of the observed value of e_{15} (the measure of over-all mortality level employed) in the Coale-Demeny "West" model life tables.

posed to health interventions in the absence or under conditions of precarious improvements in standards of living the greater will be the disparity between child and adult mortality when measured against the standard of model "West". In fact, table V.4 shows that at the country level there is a marked tendency for the values of the ratios to depart further from unity as time goes by (that is, as the effects of medical technology have had more time to operate). This tendency is weaker or non-existent among countries in which socio-economic development played an important role in early mortality decline, namely, Argentina, Chile, Costa Rica and Uruguay,[23] and among those that have been parts of the colonial periphery of more developed countries (Barbados, Trinidad and Tobago, Jamaica, Martinique). For some countries such excess mortality is accompanied by extremely high levels of the incidence of diarrhoea or other conditions related to malnutrition.[24] Against these processes and their consequences, vaccination, chemotherapy or other public or private health interventions that do not improve levels of living are not very effective.

To provide evidence that the age pattern of mortality decline in Latin America has differed from the European experience as described by model "West", it is again necessary to select a standard for comparison. The relation between the expectation of life at age 15 (e_{15}), as a measure of over-all mortality level, and the logarithms of the probabilities of dying before age 1 ($1n\ _4q_0$), on the one hand, and between 1 and 4 years ($1n\ _4q_1$), on the other, is nearly linear in model "West", at least within the relevant range of e_{15}. With the values of e_{15} and $1n\ _1q_0$ as the independent and dependent variables, respectively, a logarithmic curve was fitted for both males and females using ordinary least squares procedures. The same was done with respect to values from model "West". The results of the estimation using $1n\ (1{,}000\ _1q_0)$ as the dependent variable were as follows:

		Constant (α)	Regression coefficient (β)	r^2
Males	Latin America	8.866	−0.087	0.56
	Model "West"	11.244	−0.1383	0.97
Females	Latin America	7.774	−0.066	0.49
	Model "West"	10.831	−0.1283	0.94

The curve fitted to the Latin American data is always above the curve fitted to model "West" for values of life expectancy at age 15 above 46.0 years for males and above 49.1 years for females. This is, of course, reflected in table V.4 in which the ratios of observed to expected values of $_1q_0$ and $_4q_1$ exceed unity. The regression coefficient, (β), represents the relative change in $_1q_0$ per unit of change in e_{15}. At all points along the curve for model "West", one additional year of life expectancy at age 15 would be accompanied by a reduction in $_1q_0$ of about 14 per cent among males and 13 per cent among females. The data for Latin America, however, reveal that $_1q_0$ is less responsive to changes in the over-all level of mortality. An increment of one year in life expectancy would reduce $_1q_0$ by only 9 per cent among males and 7 per cent among females.

One might conclude from these results that, as the process of mortality decline continues, the levels of excess mortality at the very young ages will tend to increase (provided that past conditions, as revealed in the cross-sectional data, are maintained in the future). However, there are two factors that may weaken the validity of such an assessment. First of all, the relation between e_{15} and $1n\ _1q_0$ is not close enough to permit unequivocal judgements about the relative sensitivity of $_1q_0$ to changes in the over-

[23] Eduardo E. Arriaga and Kingsley Davis, "The pattern of mortality change in Latin America", *Demography*, vol. 6, No. 3 (August 1969), pp. 223-242.

[24] Ruth R. Puffer and Carlos V. Serrano, *Patterns of Mortality in Childhood: Report of the Inter-American Investigation of Mortality in Childhood*, Scientific Publication No. 262 (Washington, D.C., Pan American Health Organization, 1973).

all level of mortality. Secondly, what appears to be true of cross-sectional data is not necessarily valid for individual countries at different moments in their evolution. Based on the data in table V.4, in about half the cases for each sex there is no increase in the ratios of the observed to the expected values of ${}_1q_0$ with time. This occurs despite a bias towards such an increase as life expectancy at 15 years increases and ${}_1q_0$ declines, the bias being an artifact of the absolute size of the numbers (i.e., a given absolute difference results in a higher ratio at reduced levels of ${}_1q_0$).

3. *The levels of mortality at old ages*

Table V.4 also gives the ratios of life expectancy observed in the country at age 65 to the corresponding value in model "West" for the same level of e_{15}. In general, the ratios exceed unity for both sexes. Thus, it would appear that the population that survives past age 65 in Latin American countries enjoys better conditions than did the population of Western Europe at comparable levels of mortality. An appealing argument to explain this phenomenon would be that conditions of heavy mortality at the beginning of life would eliminate the least fit, thus increasing the over-all vitality of the surviving population. However, it is also possible that both death under-registration and exaggeration of the age of the deceased are the underlying factors explaining the relatively high levels of life expectancy. One confirmation of this alternative explanation is the fact that countries such as Argentina, Chile, Uruguay, Guatemala, Costa Rica, Trinidad and Tobago and Barbados, which have good vital statistics data, are also the ones showing the lowest values of the ratios. On the other hand, however, the virtual absence of the old-age advantages in these countries could reflect certain unfavourable health conditions which have been found to accompany higher standards of living, e.g., increased consumption of fats, cigarette smoking, pollution. Since at this stage it is not possible to separate what is due to real processes and what to defective data, it is probably more reasonable not to make too much of the finding and to hope that more and better information will confirm or disprove it.

4. *Sex differentials*

Male mortality has generally been found to be higher than that of females, but the phenomenon is not as pervasive as was once thought and there are exceptions to the rule which go beyond the reversals at childbearing ages.[25] The differentials can be traced to purely biological factors,[26] to environmental factors operating through the pattern of causes of death, or to an interaction of both.[27] The biological advantages of females are probably best summarized by statistics of infant mortality, although even at the youngest ages they do not act alone but in combination with environmental factors.

In none of the cases presented in table VA.1 do females show higher infant mortality than males. The differentials, as measured by the ratios of male to female probability of dying before age 1, vary widely from a low of about 1.07 in Panama (1960-1961) to a high of about 2.0 in Brazil (1950-1960).[28] These differentials tend to contract in the age interval 1-4 years. Not only do the sex mortality ratios decline but there are a number of cases of a reversal of the differential. Thus, Guadeloupe, Costa Rica, Guatemala, Mexico, Argentina, Chile, Uruguay, Colombia and Ecuador show some evidence of higher female mortality, as indicated by the probabilities of dying between exact ages 1 and 5. In some of these countries, e.g., Uruguay, Chile and Argentina, the reversal is weak and observed at only one point in time. As a consequence it is difficult to distinguish between the effects of errors and real patterns. In some of the other countries, such as Guatemala, where the differentials are substantial and occur in several time periods, they probably reflect the true situation.[29]

In any study of sex differentials in mortality, there is a problem of expressing the differentials in such a way that they do not vary, or vary only minimally, with the type of parameter being used to measure the mortality. Thus, for example, when measuring the differentials in the age interval 0-1 year through the absolute differences in the probability of dying before 1 year (${}_1q_0$), one would normally except these differences to increase as the levels of (${}_1q_0$), increase. In contrast, the differentials as measured by the ratios should decrease as the levels of mortality increase. This poses comparability problems not only for the cross-sectional and time series comparisons but also for comparisons of differentials for different age-groups. A similar problem (but an inverted one) would be faced if, instead, the life expectancy at age x (e_x) were taken as the mortality parameter: as the level of mortality increased, the ratios of e_x would tend to increase and the absolute differences to decrease.

An alternative procedure would be to compare an observed differential with a predicted one and to study the deviations of one from the other. This procedure succeeds in characterizing "normal" sex mortality differentials and national or temporal departures from those normal patterns. One possibility is to estimate statistically the relation of female and male mortality parameters in Latin America and to determine the departures of the observed values from the estimated ones. Figures V.1 through V.5 display the relation between male and female life expectancies at ages 0, 5, 15, 30 and 65 years, respectively. It is apparent in all cases that the relation could be closely approximated by a line fitted through some least squares procedure. Use of ordinary least squares requires the definition of a depen-

[25] M. A. El-Badry, "Higher female than male mortality in some countries of South Asia: a digest", *Journal of the American Statistical Association*, vol. 64, No. 328 (December 1969), pp. 1234-1244.

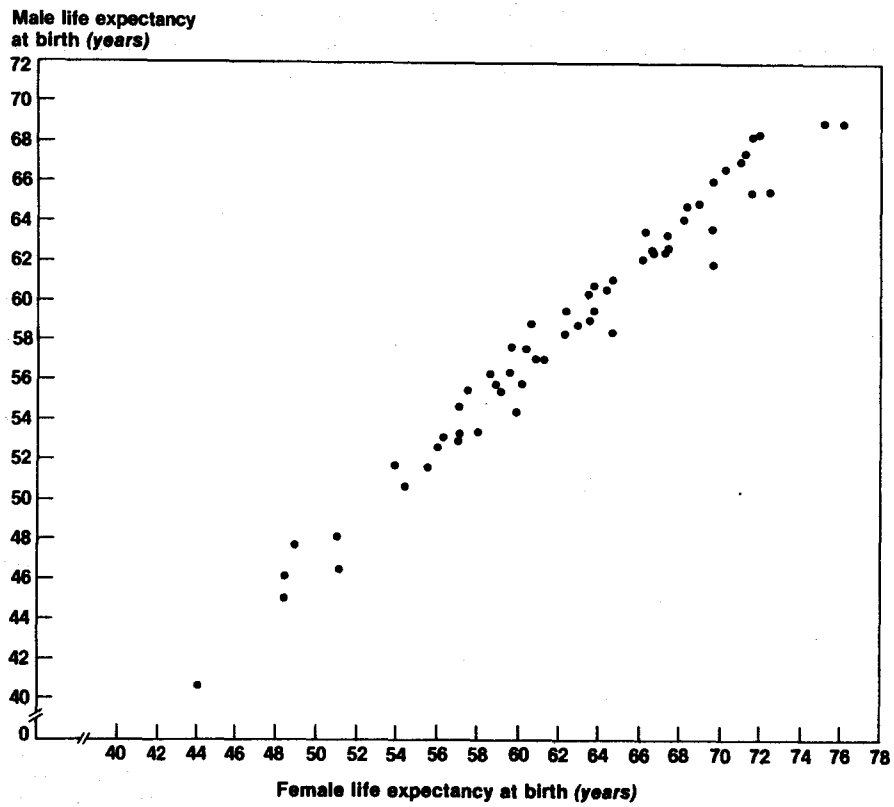
[26] R. L. Noeye and others, "Neonatal mortality, the male disadvantage", *Pediatrics*, vol. 48, No. 6 (1971); L. B. Shettles, "Biological sex differences with special reference to disease, resistance, and longevity", *British Journal of Obstetrics and Gynecology*, vol. 65, No. 2 (1958); Francis Madigan, "Are sex mortality differentials biologically caused?", *Milbank Memorial Fund Quarterly*, vol. 35, No. 2 (April 1957), pp. 202-223.

[27] Samuel H. Preston, *Mortality Patterns in National Populations: with Specific Reference to Recorded Causes of Death*, Studies in Population (New York, Academic Press, 1976).

[28] This high ratio is likely to be, in part, a product of differential error in the estimates.

[29] Ursula M. Cowgill and G. E. Hutchinson, "Sex-ratio in childhood and the depopulation of the Petén, Guatemala", *Human Biology*, vol. 35, No. 1 (February 1963), pp. 90-103.

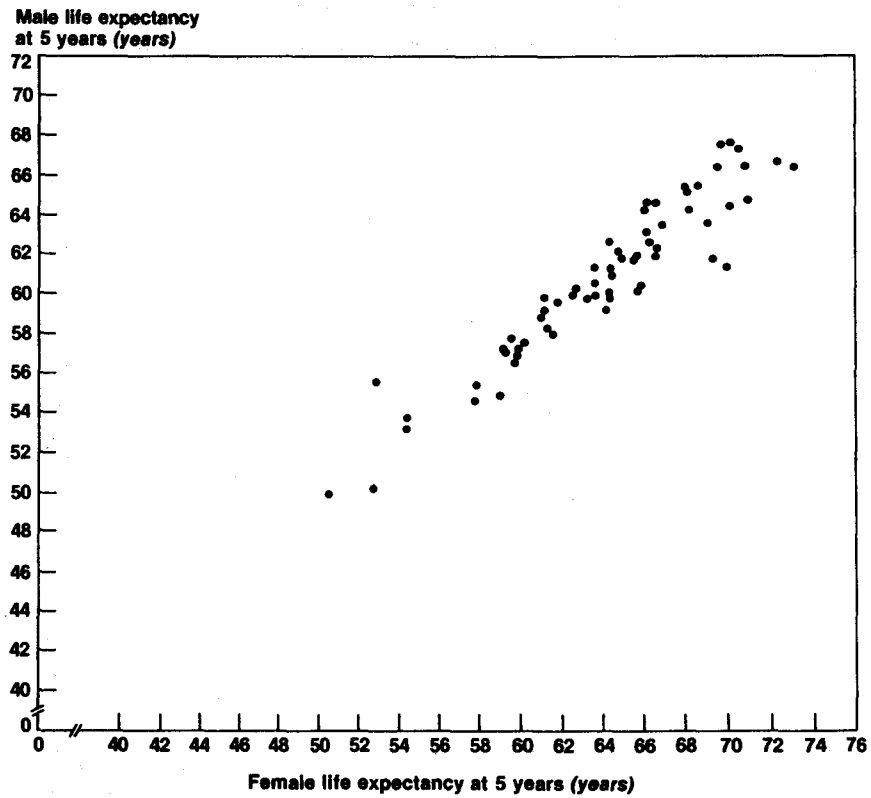
Figure V.1. Relation between male and female life expectancy at birth, countries of Latin America, 1950-1975



Source: Table VA.1.

NOTE: Data pertain to 28 countries, for one or more periods between 1950 and 1975.

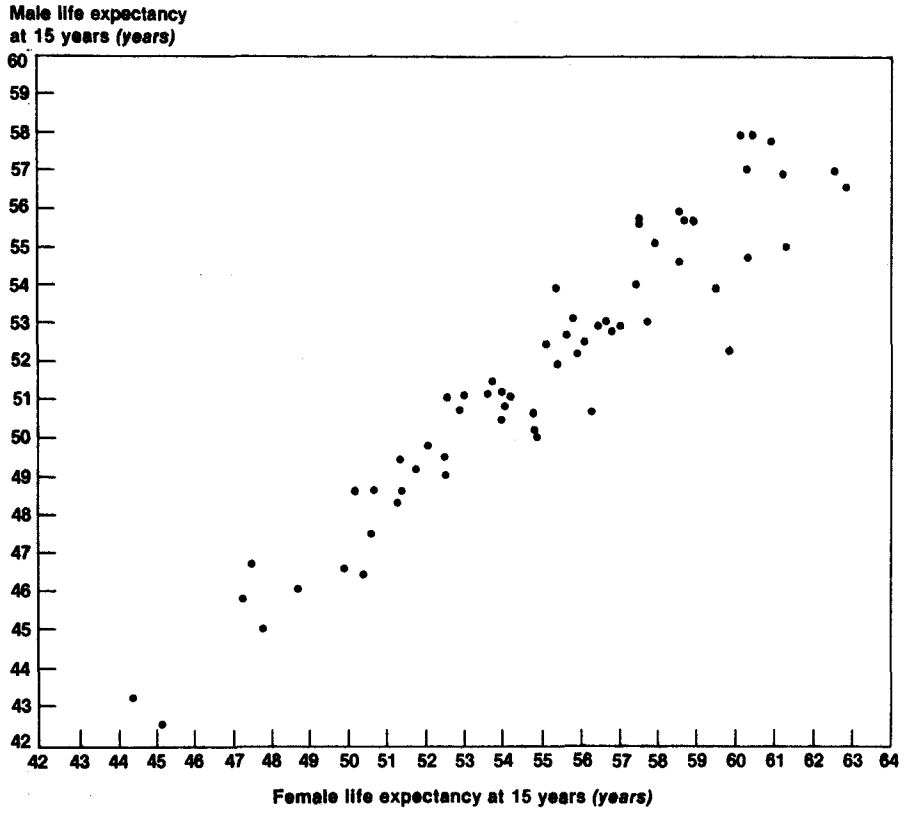
Figure V.2. Relation between male and female life expectancy at 5 years, countries of Latin America, 1950-1975



Source: Table VA.1.

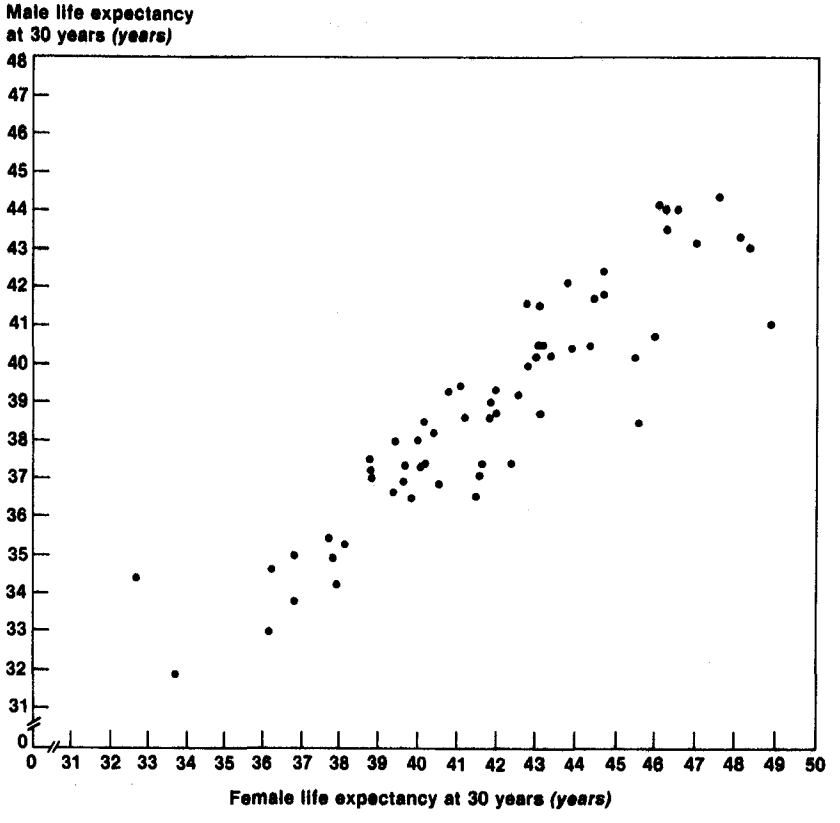
NOTE: Data pertain to 28 countries, for one or more periods between 1950 and 1975.

Figure V.3. Relation between male and female life expectancy at 15 years, countries of Latin America, 1950-1975



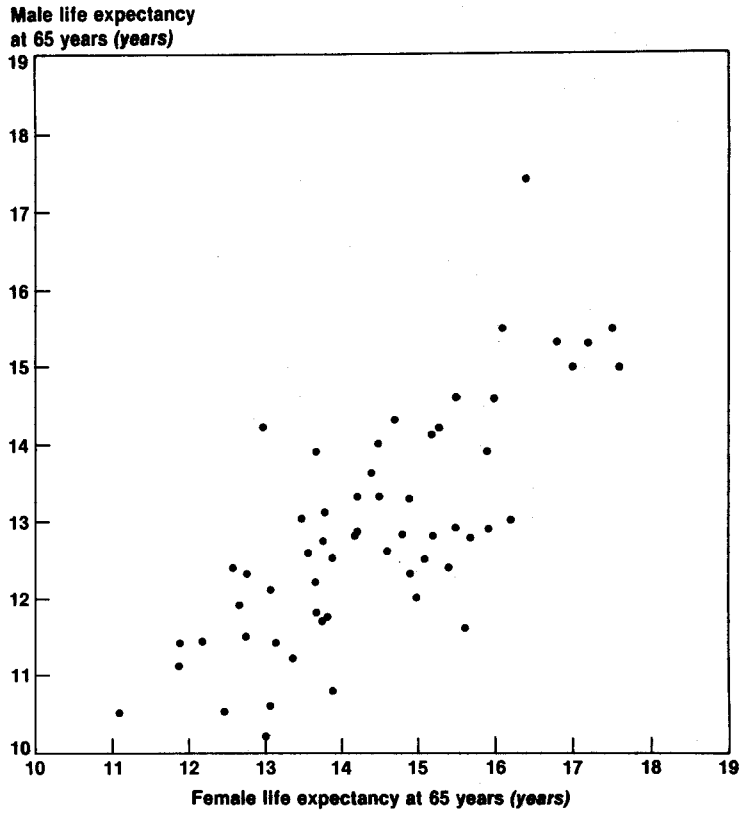
Source: Table VA.1.
NOTE: Data pertain to 28 countries, for one or more periods between 1950 and 1975.

Figure V.4. Relation between male and female life expectancy at 30 years, countries of Latin America, 1950-1975



Source: Table VA.1.
NOTE: Data pertain to 28 countries, for one or more periods between 1950 and 1975.

Figure V.5. Relation between male and female life expectancy at 65 years, countries of Latin America, 1950-1975



Source: Table VA.1.
NOTE: Data pertain to 28 countries, for one or more periods between 1950 and 1975.

dent and an independent variable. However, there is no compelling argument for selecting the male or the female life expectancy as the dependent variable. Alternatively, it is possible to apply orthogonal regression, which minimizes the perpendicular rather than vertical distances from the estimated line. This procedure, which has been followed in an analysis of sex differentials in mortality undertaken by Preston and Weed,[30] does not require an *a priori* definition of a dependent variable. The formula for the regression equation is:

$$(1) \qquad e^M_x = \bar{e}^M_x + \beta(e^F_x - \bar{e}^F_x) + \eta_x$$

where e^M_x and e^F_x are the male and female life expectancies at age x and $\bar{e}^M_x$ and $\bar{e}^F_x$ are their sample means; β is the true orthogonal regression coefficient, and η_x is an error term. The estimated orthogonal regression lines for e^M_0, e^M_5, e^M_{15} and e^M_{65} are presented below for about 60 observations in Latin America. The estimated lines are given in the form:

$$e^M_x = \beta e^F_x + \alpha$$

where $\alpha = \bar{e}^M_x - \beta \bar{e}^F_x$.

[30] Samuel H. Preston and James A. Weed, "Causes of death responsible for international and intertemporal variation in sex mortality differentials", *World Health Statistics Report*, vol. 29, No. 3 (1976).

$$(2) \qquad e^M_0 = 0.9096\, e^F_0 + 1.922, \; r^2 = 0.97$$

$$(3) \qquad e^M_5 = 0.8217\, e^F_5 + 8.330, \; r^2 = 0.86$$

$$(4) \qquad e^M_{15} = 0.8521\, e^F_{15} + 4.973, \; r^2 = 0.91$$

$$(5) \qquad e^M_{65} = 0.5159\, e^F_{65} + 5.401, \; r^2 = 0.60.$$

The estimates of β, $\hat{\beta}$, were obtained using the formula

$$\hat{\beta} = \frac{(\sigma^2_M - \sigma^2_F) + \sqrt{(\sigma^2_M - \sigma^2_F)^2 + 4\sigma^2_{MF}}}{2\sigma_{MF}}$$

where σ^2_M and σ^2_F are the sample variances of the life expectancy at age x for males and females, and σ_{MF} is the sample covariance.

The interpretation of the estimated coefficients is straightforward. When the regression coefficient ($\hat{\beta}$) is less than unity, male life expectancy increases more slowly than female life expectancy. That is, as the mortality level improves, the difference between male and female life expectancy increases (in absolute value). Thus, for instance, the difference $e^M_0 - e^F_0$ is approximately equal to -2.15 years when female life expectancy at birth is around 45 years, and about -4.41 years when female life expectancy at birth is close to 70 years. Note that the estimated regression coefficient of male on female life expectancy at age x diminishes as x increases. This regularity could be the result of a process in which the relative disadvantage of

males increases as the over-all mortality level above age x is reduced. The phenomenon of an increasing gap between male and female mortality at ages above 5 years is not new and has been examined in more developed countries.[31] It may be surmised that the emergent conditions of urban life, which may or may not be accompanied by industrialization, add new deleterious effects (related to diet, stress and occupational hazards) to males' already existing biological disadvantages.

It is possible to study the existence of characteristic departures from the average pattern of sex mortality differentials. Thus, the quantity $e^M_x - \hat{e}^M_x$, where $\hat{e}^M_x$ is the predicted value of male life expectancy at age x given the value of female life expectancy at the same age, can be taken as an indicator of the deviations from an expected pattern of sex differentials. Table V.5 displays the values $e^M_x - \hat{e}^M_x$ for $x = 0$ and 15 years. Examination of the values of $e^M_0 - \hat{e}^M_0$ reveals a sharp contrast between Temperate South America and the other regions. In fact, whereas in the former the deviations are consistently high and negative—the average is around -0.90 years in observations for the decade 1950-1960 and -2.28 years for observations for the decade 1960-1970—the rest of Latin America shows a pattern of differences which varies more erratically. Only Puerto Rico, Honduras, Mexico and Brazil approximate somewhat the pattern found in Temperate South America. All the other countries show differentials close to zero or with positive sign. Negative values for the quantity $e^M_x - \hat{e}^M_x$ indicate that male mortality is higher than would have been expected given the mortality level prevailing among females. In this light, it is worth noting that Temperate South America is the region in Latin America which is not only the most urbanized currently but also the one having a history of earliest economic development and of early and sustained urbanization. Puerto Rico, Mexico and Brazil (the last two at least for the most recent years) are likely to present industrialization and urbanization conditions similar to those found in Temperate South America. The relation between urbanization and male excess mortality is reflected in the simple correlation coefficient between the value of the differential for the most recent date and the proportion of the population living in urban areas around 1975, which attains a value of 0.57 in the sample.

Examination of the values of $e^M_{15} - \hat{e}^M_{15}$ in table V.5 reveals more or less the same features observed with respect to expectation of life at birth. As expected, however, the male disadvantage, when present, is slightly higher, i.e., the measure of differential is smaller than in the case of e_0. Again, the countries of Temperate South America, Puerto Rico and Mexico have a negative pattern of deviations. Brazil, curiously enough, shows positive values of the deviations rather than negative as would be expected.

[31] See Philip E. Enterline, "Causes of death responsible for recent increases in sex mortality differentials in the United States", *Milbank Memorial Fund Quarterly*, vol. 39, No. 2 (April 1961), pp. 312-328; Samuel H. Preston, *Mortality Patterns in National Populations: with Special Reference to Recorded Causes of Death*, Studies in Population (New York, Academic Press, 1976); George J. Stolnitz, "A century of international mortality trends: II", *Population Studies*, vol. 10, No. 1 (July 1956).

TABLE V.5. DIFFERENCES BETWEEN OBSERVED AND PREDICTED LIFE EXPECTANCY AT BIRTH AND AGE 15, MALES, COUNTRIES OF LATIN AMERICA, 1950 TO 1975

Region, country and period	*Difference between observed and predicted life expectancy at ages:* 0	15
Caribbean		
Barbados		
1950-1952	−1.04	−1.44
1959-1961	−0.41	−0.22
1969-1971	−0.81	−0.66
Cuba		
1960	0.09	0.44
1965	−0.91	1.08
1970	1.51	1.71
1974	1.33	1.45
Dominican Republic		
1950-1960	−0.49	−0.63
1960-1970	0.00	−0.12
1975	0.94	1.74
Guadeloupe		
1951-1955	−0.15	−0.54
1963-1967	−0.52	−0.63
Jamaica		
1950-1952	0.43	0.48
1959-1961	0.33	0.13
1969-1970	1.01	0.54
Martinique		
1963-1967	0.19	−0.27
Puerto Rico		
1949-1951	1.00	0.50
1954-1956	0.86	0.72
1959-1961	−0.16	−0.23
1969-1971	−1.30	−1.35
1971-1973	−2.23	−1.91
Trinidad and Tobago		
1952-1954	1.40	0.81
1955-1960	0.35	0.25
1970	0.35	−0.25
Middle America		
Costa Rica		
1949-1951	1.09	1.25
1962-1964	1.20	0.80
1972-1974	0.89	1.01
El Salvador		
1949-1951	0.80	1.89
1959-1961	0.52	0.69
1970-1972	−1.48	−1.03
Guatemala		
1950	1.00	0.93
1963-1965	1.65	1.33
1970-1972	1.14	0.68
Honduras		
1960-1962	−1.02	−0.90
1973-1974	−0.33	0.13
Mexico		
1949-1951	−0.11	−0.83
1959-1961	0.48	0.00
1969-1971	−0.16	−0.20
Nicaragua		
1963	−1.41	−0.35
Panama		
1960-1961	1.08	0.60
1969-1971	1.41	1.94
Temperate South America		
Argentina		
1946-1948	−0.50	−1.04
1959-1961	−1.35	−1.77
1969-1971	−3.33	−3.63
Chile		
1952-1953	−0.33	−0.67
1960-1961	−1.79	−1.73
1969-1970	−2.12	−2.23

TABLE V.5 (*continued*)

Region, country and period	Difference between observed and predicted life expectancy at ages: 0	15
Temperate South America (*cont.*)		
Uruguay		
1963-1964	−1.48	−1.66
1971-1976	−2.11	−2.22
Tropical South America		
Bolivia		
1975	−1.58	−0.34
Brazil		
1950-1960	−0.61	0.48
1960-1970	−0.38	0.72
Colombia		
1963-1965	1.69	0.49
1972-1974	0.08	−0.24
Ecuador		
1973-1975	2.15	1.74
Guyana		
1950-1952	0.33	−0.30
1959-1961	−0.20	−0.55
Peru		
1970-1975	−0.32	1.00
Suriname		
1963	0.00	−0.38
Venezuela		
1961-1962	0.58	0.29
1970-1972	0.90	0.71

Source: Computed from life expectancy values in table VA.1.

NOTE: The differences $(e_x^M - \hat{e}_x^M)$ were obtained by computing $\hat{e}_x^M$ from the estimated orthogonal coefficient using the observed values of female life expectancy at age x (e_x^F).

This anomaly, however, may be attributable to errors in the data and the indirect techniques used to estimate the life table.

Finally, a word should be said about the time trends in sex differentials in mortality. It appears that male life expectancy at birth falls further and further behind as time goes by, i.e., the values $e^M_0 - \hat{e}^M_0$ that were positive become smaller or even negative, and the values that were negative decline even further. There are some exceptions to this general trend, but it is difficult to determine whether they constitute true departures from a pattern or are merely the result of changing biases which affect the estimates of life expectancy. In the aggregate, the time effect can be measured by using a categorical independent variable to represent time (0 for 1950-1960, 1 otherwise) and utilizing ordinary least squares. The result of applying this procedure is that, as expected, the differential $e^M_0 - \hat{e}^M_0$ is lower (by about 0.25 year) after 1960 than before. On the other hand, however, a two-way analysis of variance of the dependent variable $(e^M_0 - \hat{e}^M_0)$ performed with two time categories and four regions reveals that while the time effects are statistically significant, they are overwhelmed by regional effects.[32]

In summary, male life expectancies at birth and at age 15 have been generally falling behind expected levels, based on female life expectancy and expected relations between the two in Latin America. This time trend, however, has been more pronounced in countries of Temperate South America, which have also experienced at all times the greatest gap between male and female mortality. Notwithstanding a more tenuous differential in the other regions, there seems to be a general movement towards an exaggeration of male mortality disadvantages in Latin America.

[32] The unequal number of cases in each cell prevented the choice of disaggregated analysis of variance. Instead, the mean for each cell had to be used.

C. MORTALITY DIFFERENTIALS

The study of mortality differentials by subnational aggregates, whether they be regions delineated by administrative boundaries, population agglomerations determined on the basis of size, or non-geographic population groups which share certain socio-economic characteristics, requires considerably more information than is currently available in most Latin American countries. However, since an understanding of the factors determining mortality levels cannot be accomplished without studying mortality differentials, subnational data have been assembled for regions or other population aggregates within countries having either good vital statistics or demographic estimates derived from reliable indirect techniques. While some of these data undoubtedly contain biases, the gains derived from disaggregation of the mortality data will probably more than compensate for these. The present section contains two parts. The first briefly reviews regional mortality differentials in countries having an array of mortality measures (for infancy, childhood and adulthood). The second focuses on regional and socio-economic differentials in mortality below age 2.

1. *Mortality differentials by regions*

Data for 13 regions in Chile for 1969-1970 are presented in table V.6. The regions are arranged in a North-South axis (except for the Area Metropolitana which is located in the centre of the country) and their geographic boundaries roughly coincide with the prevalence of certain economic activities. Most of the industrial sector and services activity is concentrated in the centre (Area Metropolitana and region V) although some heavy industry is also located in region VIII. Regions I, II, III and part of region VI are predominantly mining areas, whereas agricultural production is concentrated mainly in regions IV, VII, VIII, IX, XI and XII. The variability among the regions in infant mortality rates $({}_1q_0)$ and life expectancy at birth is rather substantial, the coefficient of variation for the latter mortality estimator being 0.04. The levels of life expectancy and infant mortality among the regions are closely related to their urban character or their degree of economic development. Thus, the Area Metropolitana and region V, which concentrate most of the industry, services and governmental bureaucracy, have among the highest life expectancy. The poor rural areas represented by regions VIII, IX and X show the lowest life expectancy. It is surprising to find regions I and XII among those with the highest life expectancy at birth, given the nature of their economic activities. However, these apparently deviant cases are not the result of faulty vital registration. Estimates of infant mortality for 1975-1976, calculated using

TABLE V.6. SELECTED MORTALITY PARAMETERS, REGIONS OF CHILE, 1969-1970

Region and provinces	Probability of dying between ages: 0 and 1 ($1{,}000\ {}_1q_0$)	1 and 5 ($1{,}000\ {}_4q_1$)	Life expectancy (years) at ages: 0	5	15	30	65
I. Tarapacá	58.1	11.9	64.5	64.3	54.6	40.9	13.6
II. Antofagasta	86.4	16.9	60.4	62.1	52.7	39.9	12.3
III. Atacama	92.7	13.2	61.7	63.9	54.2	40.5	13.4
IV. Coquimbo	84.9	14.9	63.5	65.3	55.7	42.0	14.3
V. Aconcagua, Valparaíso, Dept. San Antonio	59.1	7.9	64.0	63.5	53.1	40.0	13.1
VI. O'Higgins, Colchagua	80.1	11.9	61.8	62.9	53.4	39.9	13.3
VII. Curicó, Talca, Maule, Linares	101.5	20.9	59.5	62.5	53.1	39.6	13.3
VIII. Nuble, Concepción, Arauco, Bío-Bío	107.9	19.6	58.3	61.6	52.2	38.9	13.4
IX. Cautin, Malleco	107.6	24.4	58.9	62.5	53.2	40.2	13.9
X. Valdivia, Osorno, Llanquihue, Chiloé	117.4	22.5	58.9	63.2	53.9	40.8	14.2
XI. Aysén	85.6	16.1	62.2	64.1	54.8	41.1	14.7
XII. Magallanes	58.5	9.9	64.5	64.2	54.6	40.7	13.8
XIII. Metropolitana	57.5	8.8	64.3	63.8	54.2	40.3	13.4

Source: José M. Pujol, *Chile: Tablas Abreviadas de Mortalidad a Nivel Nacional y Regional, 1969-1970*, Publicaciones de CELADE, Serie A, No. 141 (Santiago, Centro Latinoamericano de Demografía, 1976).

indirect techniques on data from Enquesta Demográfica y Socioeconomica (EDESEC)[33] confirm that regions I and XII rank among the lowest in infant mortality (table V.8). Moreover, according to the socio-economic indicators presented for regions in table V.7, regions I and XII rank among those having the lowest proportions of illiterate population and population without access to piped water, two rough indicators of the levels of living. Thus, their mortality levels could be expected to be among the lowest. The relation between mortality levels and these two socio-economic indicators can be better gauged by calculating the values of the corresponding simple correlation coefficients. Using data for 12 of the regions (the number remaining after excluding region XI, for which no socio-economic data are available), correlation coefficients above 0.68 are obtained if infant mortality is taken as the dependent variable and above 0.60 if, instead, life expectancy is taken as the dependent variable. The better predictor of infant mortality is the proportion of the population without piped water ($r = 0.78$); this compares with $r = 0.73$ for illiteracy. These figures, although valid only on an aggregate level, illustrate quite convincingly the importance of the indicators used in explaining the total variability in mortality levels in the Chilean regions.

An interesting feature of table V.6 is that the regional heterogeneity in the levels of life expectancy at all ages above zero is, with the exception of age 65, less than the heterogeneity for life expectancy at birth. Thus, the coefficients of variation for life expectancy at ages 5, 15 and 30 years are about half the size of the coefficients of variation for life expectancy at birth. Moreover, the ranking of the regions according to levels of infant mortality or life expectancy at birth is by no means preserved when life expectancy at other ages is examined. This suggests that some of the regions with manifest disadvantages in the

TABLE V.7. SOCIO-ECONOMIC INDICATORS FOR REGIONS OF CHILE, 1965-1966

Region	Proportion of population illiterate	Proportion of population economically active in agriculture	Proportion of population without piped water
I.	0.06	0.12	0.20
II.	0.05	0.03	0.14
III.	0.10	0.09	0.37
IV.	0.17	0.27	0.56
V.	0.08	0.14	0.30
VI.	0.18	0.42	0.57
VII.	0.21	0.49	0.58
VIII.	0.16	0.30	0.52
IX.	0.21	0.49	0.66
X.	0.16	0.45	0.63
XI.	...	...	...
XII.	0.05	0.17	0.23
XIII.	0.07	0.06	0.21

Source: Hugo Behm and Mónica Correa, *La Mortalidad en los Primeros Años de Vida en paises de la América Latina: Chile, 1965-1966*, CELADE Publicaciones, Serie A, No. 1030 (San José, Centro Latinoamericano de Demografía, 1977).

TABLE V.8. ESTIMATED PROBABILITIES OF DYING BEFORE THE FIRST BIRTHDAY ($1{,}000\ {}_1q_0$), REGIONS OF CHILE, 1975-1976

Region	$1{,}000\ {}_1q_0$
I.	49.8
II.	54.7
III.	62.6
IV.	56.0
V.	47.1
VI.	65.6
VII.	70.1
VIII.	79.6
IX.	68.4
X.	81.6
XI.	62.0
XII.	37.8
XIII.	44.4

Source: Carmen Arretx, "Informe preliminar sobre diferencias en el nivel de vida entre regiones, medido a través de indicadores demográficos" (draft) (Santiago de Chile, Centro Latinoamericano de Demografía, 1977).

NOTE: Data are indirect estimates based on child survivorship statistics.

[33] Carmen Arretx, "Informe preliminar sobre diferencias en el nivel de vida entre regiones, medido a través de indicadores demográficos" (draft) (Santiago de Chile, Centro Latinoamericano de Demografía, 1977).

care and services offered to the newborn may be able to provide better standards of living or of health services to the adult population or, alternatively, that regions relatively favoured by lower infant mortality may offer a less satisfactory environment for the adult population.

Mortality trend data by region are available for Argentina for the period 1946-1948 and 1969-1971, for regions containing approximately 80 per cent of the total population. Table V.9, panel A, presents the values of life expectancy at various ages and the probabilities of dying within the first year of life and between ages 1 and 5 years. As in the case of Chile, the heterogeneity of mortality levels in Argentina, although quite striking during the past, has diminished substantially. As measured by the coefficient of variation of life expectancy at birth (computed from unweighted means and standard deviations), such heterogeneity was reduced by about 45 per cent during the interval 1946-1948 to 1969-1971. The convergence of mortality levels among regions between 1959-1961 and 1969-1971 seems to have been due more to the sharp deterioration in the region of Buenos Aires than to the acceleration of the decline in the other regions. According to the data in table V.9, mortality in the Buenos Aires region has increased for virtually all ages, since there are reductions in life expectancies at ages other than zero as well. Accinelli and Müller have argued that these increases in mortality are due to a real deterioration in living conditions for large sectors of the population of Buenos Aires.[34] This does not mean, however, that other factors are not operating also. In the other regions, mortality levels above age zero have stagnated or changed only slightly.[35] An additional feature of the mortality reversal in the region of Buenos Aires is that it appears to be mainly attributable to an increase in mortality among males. Thus, from panel B of table V.9 it can be calculated that about 74 per cent of the total decrease in life expectancy at birth was due to higher mortality among males, whereas 87 per cent of the total decrease in life expectancy at age 5 was due to worsening of male mortality conditions. (Although there are no

[34] M. Accinelli and M. Müller, "Un hecho inquietante: la evolución reciente de la mortalidad en la Argentina", *Notas de Población*, vol. 6, No. 17 (August 1978), pp. 9-18.

[35] However, the probability of dying between ages 1 and 5 years had continued to decline in all regions with the exception of Buenos Aires, which shows stable levels rather than reversal of past trends.

TABLE V.9. SELECTED MORTALITY PARAMETERS FOR REGIONS OF ARGENTINA, 1947-1970

Panel A. Mortality levels for regions of Argentina, 1947-1970

Region	Period	$1000\ {}_1q_0$	$1000\ {}_4q_1$	Life expectancy (years) at ages: 0	5	15	30	65
Buenos Aires	1946-1948	48.2	10.3	63.8	62.7	53.2	39.7	12.7
	1959-1961	45.6	6.8	68.2	66.9	37.2	43.2	14.4
	1969-1971	56.0	6.7	66.2	65.6	55.9	41.9	13.5
Centro Litoral	1946-1948	65.6	18.2	61.4	61.9	52.5	39.3	12.8
	1959-1961	50.6	9.0	66.8	66.0	56.3	42.3	13.9
	1969-1971	50.5	7.4	66.9	65.9	56.3	42.3	13.9
Cuyo	1946-1948	91.6	30.7	58.0	60.7	51.4	38.3	12.5
	1959-1961	55.8	14.4	64.8	64.6	55.0	41.1	13.1
	1969-1971	62.5	9.6	65.1	65.1	55.4	41.5	13.1
Noroeste	1946-1948	118.9	53.9	51.1	56.1	47.3	35.8	12.0
	1959-1961	98.6	41.2	57.7	61.6	52.3	39.2	12.6
	1969-1971	98.0	26.2	59.5	62.2	52.7	39.4	12.7

Panel B. Mortality levels for Buenos Aires (by sex), 1959-1970

	Males						Females					
			Life expectancy (years) at ages:						Life expectancy (years) at ages:			
Period	$1{,}000\ {}_1q_0$	$1{,}000\ {}_4q_1$	0	5	15	30	$1{,}000\ {}_1q_0$	$1{,}000\ {}_4q_1$	0	5	15	30
1959-1961	49.6	7.0	65.1	63.9	54.3	40.4	41.3	6.6	71.7	70.2	60.5	46.3
1969-1970	61.9	7.1	62.2	61.7	52.1	38.3	49.9	5.6	70.7	69.8	60.1	45.9

Panel C. Socio-economic indicators for regions of Argentina, 1970

Region	Proportion of population illiterate	Proportion of rural population	Index of living conditions[a]
Buenos Aires	0.037	0.00	0.029
Centro Litoral	0.063	0.25	0.138
Cuyo	0.086	0.36	0.240
Noroeste	0.128	0.42	0.429

Sources: Jorge L. Somoza, *La Mortalidad en la Argentina entre 1869 y 1960*, Instituto Torcuato di Tella, Centro de Investigaciones Sociales, and Centro Latinoamericano de Demografía, Serie Naranja: *Sociología* (Buenos Aires, 1971); Maria S. Müller, *La Mortalidad en la Argentina: Evolución Historica y Situación en 1970* (Santiago de Chile, Centro Latinoamericano de Demografía, 1978); Hugo Behm and A. Maguid, *La Mortalidad en los Primeros Años de Vida en Paises de America Latina: Argentina*, CELADE Publicaciones, Serie A, No. 1039 (San José, Centro Latinoamericano de Demografía, 1978).

[a] Average of the proportions of population living in precarious housing with no access to sewage system nor to piped water.

more than national data to confirm it, a similar phenomenon—i.e., increasing mortality in some parts of the country—has probably occurred in Uruguay in the interval 1963-1964 to 1974-1975.)[36] Neither Argentina as a whole nor the most favoured among its regions (i.e., Buenos Aires) had attained sufficiently high levels of life expectancy by 1960 or 1970 to make the inception of unfavourable mortality trends more understandable.

Mortality levels in the regions of Argentina around 1970 are closely associated with the levels of certain socio-economic indicators. In panel C of table V.9, values for three indicators are presented: the proportions of illiterate population, the proportions living in rural areas, and the proportions of the population living under unsanitary conditions. Although in general the regions that are better off according to these indices also tend to show lower levels of mortality, and vice versa, the relationship is by no means perfect. This can be seen from a comparison of Buenos Aires and Centro Litoral. Although Buenos Aires has more favourable values of the indicators of socio-economic conditions than Centro Litoral, it experienced worse mortality at all ages except 1-5 years. Unfortunately, time trend data for the three socio-economic indicators are not available; it would be of interest to see to what extent changes in their values are associated with changes in mortality levels.

Data of much poorer quality are available for Brazil by regions and municipalities. Table V.10 presents the values of the available estimates. Panel A gives the estimated life expectancies at birth that were obtained by assuming an underlying pattern of mortality and utilizing estimates of the probabilities of dying before ages 2, 3 and 5 years. The latter were obtained from statistics on survivorship of children calculated from data of census samples of women in the age-groups 20-24, 25-29 and 30-34 years.[37] With the exception of the West, the poorest regions (Amazônia, North, North-east and Bahia) systematically show the lowest levels of life expectancy in the three periods covered in table V.10. The level of heterogeneity in life expectancy, although increasing from 1940-1950 to 1950-1960, declined thereafter, reflecting a relatively closer clustering around similar levels of life expectancy in the more recent period. Examination of the table V.10 columns showing relative changes in life expectancy per year also reveals that, in general, the gains in life expectancy were greater in most regions in the period 1940-1950 to 1960-1970 than in 1930-1940 to 1940-1950. The poorest regions (with the exception of the West), which had experienced lower than average relative gains from 1930-1940 to 1940-1950, had higher than average relative gains in the more recent period, whereas the more prosperous regions (South and São Paulo) showed below-average gains in the more recent pe-

[36] This is suggested by the stagnation in life expectancy at birth among males (65.5 years in 1963-1964 compared with 65.7 years in 1974-1976), as well as increased mortality among male children under 5 years (table VA.1).

[37] The resulting estimates should be viewed cautiously, as they are quite vulnerable to minor departures of the underlying from the assumed mortality pattern.

TABLE V.10. ESTIMATED LIFE EXPECTANCY AT BIRTH, REGIONS OF BRAZIL, 1930-1970

(Years)

Panel A. Regions of Brazil

				Average annual percentage change	
	1930-1940	*1940-1950*	*1960-1970*	*1930-1940 to 1940-1950*	*1940-1950 to 1960-1970*
Amazônia	39.8	42.7	54.8	0.728	1.417
North	40.0	43.7	53.4	0.898	1.110
North-east	34.7	34.0	43.8	−0.202	1.441
Bahia	38.3	39.2	52.0	0.235	1.633
Minas	43.0	46.1	59.4	0.721	1.443
Rio	44.5	48.7	62.4	0.943	1.407
São Paulo	42.7	49.4	62.9	1.569	1.366
Paraná	43.9	45.9	61.9	0.455	1.743
South	51.0	55.3	68.1	0.843	1.157
West	46.9	49.8	54.4	0.618	0.462

Panel B. São Paulo

	Life expectancy at birth	*Probability of dying before 5th birthday ($_1,000_5q_0$)*
1949-1951	58.4	132.0
1959-1961	64.7	85.7
1969-1971	64.0	92.8

Sources: Panel A: J. A. M. Carvalho, "Regional trends in fertility and mortality in Brazil", *Population Studies*, vol. 28, No. 3 (November 1974), p. 419. Life expectancies for 1930-1940 were estimated using the values of $q(2)$ and $q(3)$ and the 1940 Mexican Life Tables as standards in a logit system. For 1940-1950 and 1960-1970 life expectancies were estimated using the Mexican Life Tables of 1940 and 1960, respectively. Panel B: Luis Armando de Madeiros Frias, "Avaliaçao histórica das alterções introduzidas nas tábuas de mortalidad do municipio de São Paulo pelo fenêmano da importação de obitos", *Revista Brasileira de Estadística*, vol. 35, No. 140 (October-December 1974).

riod. São Paulo and the West are the only regions for which the relative gains appear to have decreased. Further evidence for São Paulo reveals that there may actually have been a decline in life expectancy in the 1960s. Panel B of table V.10 shows that the level of life expectancy calculated from registered data fell from 64.7 years in 1959-1961 to 64.0 in 1969-1971.[38] Infant and childhood mortality (as measured by ${}_5q_0$) appear to have increased from 85.7 per 1,000 live births to about 93 per 1,000 in the same interval. It is difficult to say whether the data for São Paulo are accurate enough to support an interpretation similar to that given with respect to Argentina. By the same token, even if the decline in life expectancy were a real one, it would be difficult to determine if it reflected a more general phenomenon experienced by other urban areas in Brazil. Evidence for the latter possibility is given in a 1974 study by Yunes and Ronchezel,[39] whereas Carvalho and Wood have provided a rationale for the apparent increase in mortality in São Paulo.[40]

Finally, to complete this brief description of mortality levels by regions within a country, table V.11 has been prepared. Panel A displays several mortality indicators for regions of Peru, and panel B presents mortality data for females in regions of the Dominican Republic. In both cases, the mortality indicators were estimated by applying various indirect techniques to retrospective data collected in special surveys. The areas which are the most economically backward as well as geographically removed from the centres of concentration of population and services show the highest levels of mortality at the young ages (Sierra and Selva in Peru, the rural interior included in region IV in the Dominican Republic.) The very large contrasts in infancy and early childhood give way to near uniformity for the values of life expectancy at 15 years. In Peru, the level of e_{15} in the Lima Metropolitan region is close to that in the Selva (Jungle) region (50.1 years and 50.8 years, respectively), while in the Dominican Republic the region containing the capital, Santo Domingo, and the most backward of the regions (region IV) also have similar values of e_{15} for females. These regional convergences in adult mortality levels may result from the survival to adulthood of the healthiest members of a cohort, the frailer lives having succumbed early on; from a relative lack of sensitivity of adult mortality to regional disparities in socio-economic conditions; and from relatively unfavourable trends in adult mortality in the more advanced regions due to changes in life style that are associated with affluence.

The following are the most important findings of this brief examination of regional differences in mortality:

TABLE V.11 ESTIMATES OF SELECTED MORTALITY PARAMETERS BY REGIONS, PERU AND THE DOMINICAN REPUBLIC

Region	Probability of dying between ages: 0 and 1 ($1{,}000\ {}_1q_0$)	1 and 5 ($1{,}000\ {}_4q_1$)	Life expectancy (years) at ages: 0	15
Panel A. Peru, 1974-1976				
Costa	58.6	42.2	58.3	50.6
Resto Costa	74.9	47.4	57.1	50.6
Sierra	154.9	78.0	48.0	48.2
Selva	115.5	50.0	53.6	50.8
Lima Metropolitana	41.0	35.2	59.4	50.1
Panel B. Dominican Republic, 1975				
I. Santo Domingo	82.3	57.3	58.3	53.4
II.	84.2	53.1	59.9	55.0
III.	91.1	53.9	59.8	54.4
IV.	108.8	64.0	56.6	54.0
V.	86.0	56.0	58.8	54.2
TOTAL	85.5	55.8	58.9	54.2

Sources: Panel A, Peru: Peru, Instituto Nacional de Estadística, *Encuesta Demográfica Nacional del Perú, Fascículo 2, La Mortalidad en el Perú* (Lima, 1978). Panel B, Dominican Republic: José M. Guzman, *Republica Dominicana: Estimación de la Mortalidad Basada en la Encuesta Nacional de Fecundidad, 1975*, CELADE Publicaciones, Serie C, No. 1007 (San José, Centro Latinoamericano de Demografía, 1978).

1. The same lack of uniformity in mortality levels observed among countries also becomes evident when mortality indicators for subnational areas are examined. This suggests that the sources of variability in mortality levels should be sought through the study of differential mortality within countries, by seeking to identify population groups which share certain characteristics believed to affect their mortality levels;

2. The variability in adult mortality appears to be less than that of infants and young children;

3. Although only data for Brazil and Argentina can be used to support the contention, it would seem that the regions experiencing stagnation or declines in life expectancy are not the most backward, but rather the most urbanized and developed regions within a country. While such regions are centres of urban and economic development, large numbers of their inhabitants are poor, unemployed and live under unsanitary conditons.

2. *Mortality differentials by rural/urban categories and levels of education*

A detailed analysis of mortality levels at various ages by socio-economic categories or rural/urban residence is virtually impossible for all but a handful of Latin American countries. However, this is less of a drawback for the study of the impact of socio-economic factors on mortality than would be thought. Differences in the living standards, levels of nutrition, access to medical services and a host of other factors influencing mortality produce the sharpest contrasts in the risks of dying during the first year of life. Fortunately, relatively accurate measures are available of the probabilities of dying before age 2 (${}_2q_0$) by area of residence as well as by educational levels of mothers. These estimates were obtained by Behm and his collabora-

[38] This apparent decline in life expectancy may, of course, be due to changing completeness of death registration. However, it should be noted that the data for São Paulo in the second panel of table V.10 are not incompatible with the estimates in the first panel.

[39] Jão Yunes and Vera Ronchezel, "Evolução da mortalidade geral, infantil e proporcional no Brazil', in *A Evolução da População Brasileira*, Supplement to *Revista de Saúde Pública* (June 1974).

[40] Some authors have indicated that recent mortality trends in several Brazilian regions do reflect a deterioration in the real purchasing power of large segments of the population. See José A. M. Carvalho and Charles H. Wood, "Mortality, income distribution and rural-urban residence in Brazil", *Population and Development Review*, vol. 4, No. 3 (September 1978).

tors[41] from samples of census records containing information on survivorship of children by age of mothers. The proportions of children dead were converted into probabilities of dying before certain ages according to the well known Brass technique and the modifications introduced to it by Sullivan.[42] The value of the probability of dying before age 2 was selected as the most robust of all the resulting estimates and will be utilized here as an indicator of mortality level.

It should be borne in mind, however, that estimates based on these techniques may contain certain errors. The most important among them are the following: (*a*) Since mortality has been declining, the estimate of the probability of dying before age 2 refers to a period of time before the census or, equivalently, applies to a cohort of children born sometime before the census. The exact difference between the date of the census and the reference period to which the estimates pertain depends mainly on the time distribution of births, and, consequently, will vary among population groups whose patterns of childbearing differ. As a result, the estimates of mortality differentials will be partially contaminated by a component which is, strictly speaking, unrelated to mortality conditions. Conversely, if there were no differentials in childbearing patterns, the estimated mortality differentials, although accurate, would pertain only to a certain time period before the date of the census; (*b*) The number of children reported by mothers as having died is especially sensitive to errors of recall or outright concealment, resulting in under-reporting of deaths, and often of births as well. This downward bias is likely to be larger among women in the lower socio-economic categories, where both fertility and mortality are relatively high. As a consequence, the measure of mortality differentials could also be downwardly biased. The errors in the estimates of mortality differentials arising from source (*a*) will be somewhat compensated by those arising from source (*b*) only if there are differentials in the time distribution of births, as is likely to be the case. Although the net errors will be smaller than if (*a*) or (*b*) were operating alone, the estimates will still be somewhat biased. The magnitude of the error is, of course, unknown.

Table V.12 presents the probabilities of dying before age 2 (per 1,000 live births) for urban and rural areas in 12 Latin American countries. The table shows that urban areas have considerably lower levels of mortality than have rural areas. The exact magnitude of the differentials is, however, disputable. Column 4 contains the ratios of the value of $q(2)$ in rural areas to those in urban areas. The greatest differentials are shown equally by countries with low mortality levels (Costa Rica) and those with high mortality (Ecuador and Peru). There is, of course, no compelling reason for believing that there should be some relation between the total level of mortality and the size of the rural/urban differential as measured by the calculated ratios. In the first place, the total level of mortality is a weighted average of the levels prevailing in rural and urban areas. With a fixed differential, say, favouring urban over rural areas, the relation between total levels and the measure of the differential will depend on the proportional distribution of the population. Thus, given the above assumption of better conditions in urban areas, a country with a predominantly urban population will have the same differential as a country with a heavily rural population despite the fact that the former's total level of mortality will be lower than the latter's. Furthermore, the proportional distribution of the population by urban and rural residence depends strongly on the different criteria selected in each country to define "urban" as opposed to "rural". It is likely, for instance, that in densely populated countries (such as El Salvador or Honduras) the urban category might include a large fraction of population which could have been classified as rural following slightly different criteria. In this case, the mortality differential between urban and rural areas will be smaller than it would be otherwise. Conversely, countries more sparsely populated,with strong geographic contrasts imposing formidable barriers for communication (which, at the same time, contribute towards increasing the variability of living conditions) will show greater differentials (the case of Peru may serve as an example.) In the second place, the measure of differential being used may lead to confusion, for as mortality declines, smaller absolute differences between rural and urban mortality produce proportionately higher changes in the ratios than if the levels of mortality had been higher. Using the difference in the $q(2)$ values, however, does not clarify matters much further (see column 5 of table V.12). Lastly, it should be remembered that smaller differentials can be observed merely as a product of differential omission of children ever born who have died. If the tendency towards concealment or omission is higher among rural mothers, the observed differentials will underestimate the true ones and may even reverse the expected pattern (e.g., higher mortality in rural areas).

Regardless of the relation between the total mortality level and the size of the differential, it is clear from table V.12 that mortality in rural areas exceeds mortality in urban areas by a substantial margin in most of the countries for which data were available. This phenomenon is generally expected to occur as the process of mortality decline advances for the following reasons:

(*a*) The urban population, regardless of internal composition, has better access to medical services, enjoys advantages in the process of distribution of goods and services and is, on the average, better provided with basic community amenities such as a clean water supply, sanitary housing, waste disposal and sewage systems. Theoretically, the contrasts between rural and urban areas arising from these sources should increase, reach a maximum, then decline steadily as the countryside undergoes the process of social transformation that follows the industrialization take-off. Two issues should be kept in mind at this point. First, the pattern of mortality differentials in Western Europe followed a different course in which city mortality exceeded the mortality levels in the countryside until medical innovations reduced the impact of the infectious

[41] See sources to table V.12.

[42] William Brass and Ansley J. Coale, "Methods of analysis and estimation", chap. 3 in William Brass and others, eds., *The Demography of Tropical Africa* (Princeton, N.J., Princeton University Press, 1968); J. Sullivan, "Models for the estimation of the probability of dying between birth and exact ages of childhood", *Population Studies*, vol. 26, No. 1 (March 1972), pp. 79-97.

TABLE V.12. RURAL/URBAN DIFFERENCES IN THE PROBABILITIES OF DYING DURING THE FIRST TWO YEARS OF LIFE ($1{,}000\ {}_2q_0$), COUNTRIES OF LATIN AMERICA

Country and year	$1{,}000\ {}_2q_0$			Rural to urban ratios (2)÷(3) (4)	Excess of rural rate (2)−(3) (5)
	Total (1)	Rural areas (2)	Urban areas (3)		
Bolivia (1975)	202	224	166	1.35	58
Chile (1970)	91	112	84	1.33	28
Colombia (1973)	88	109	75	1.45	34
Costa Rica (1973)	81	92	60	1.53	32
Dominican Republic (1975)	123	130	115	1.13	15
Ecuador (1974)	127	145	98	1.48	47
El Salvador (1971)	145	148	139	1.06	9
Guatemala (1973)	149	161	120	1.34	41
Honduras (1970)	140	150	113	1.33	37
Nicaragua (1971)	149	152	143	1.06	9
Paraguay (1972)	75	77	69	1.12	8
Peru (1972)	169	213	132	1.61	81

Sources: Individual volumes for each country, as shown below, published by the Centro Latinoamericano de Demografía:

A/1024: Hugo Behm, *La Mortalidad en los Primeros Años de Vida en los Países de América Latina. Costa Rica, 1968-1969.*

A/1025: Hugo Behm, Kenneth Hill and Augusto Soliz, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina. Bolivia, 1971-1972.*

A/1026: Hugo Behm and Ana E. Escalante, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina. El Salvador, 1966-1967.*

A/1027: Hugo Behm and Fulvia Brizuela, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina. Paraguay, 1967-1968.*

A/1028: Hugo Behm and Francisco De Moya, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina. República Dominicana, 1970-1971.*

A/1029: Hugo Behm and Alfredo Ledesma, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina. Perú, 1967-1968.*

A/1030: Hugo Behm and Mónica Correa, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina, Chile, 1965-1966.*

A/1031: Hugo Behm and Luis Rosero, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina, Ecuador, 1969-1970.*

A/1032: Hugo Behm and José Olinto Rueda, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina, Colombia, 1968-1969.*

A/1036: Hugo Behm and Domingo Primante, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina, Nicaragua, 1966-1967.*

A/1037: Hugo Behm and Ernesco Vargas, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina, Guatemala, 1968-1969.*

A/1038: Hugo Behm and Domingo Primante, *La Mortalidad en los Primeros Años de Vida en Países de la América Latina, Honduras, 1969-1970.*

diseases that contributed to the cities' excess mortality. A new process of convergence between cities and countryside took place after the Second World War. Today, the mortality differentials are slight and they not rarely favour the countryside over the city.[43] Secondly, while urban areas in Latin America appear to have many advantages over rural areas, living conditions for some sectors of the urban population (e.g., those living in squatter settlements on the fringes of the cities, by and large migrants from the rural areas) are sometimes worse than those to which rural inhabitants are exposed. As unchecked population growth in the cities continues, unaccompanied by profound economic transformations, mortality in rural and urban areas may tend to converge. The convergence of urban and rural mortality levels in Latin America follows a reversed European pattern: the dominating force is more the deterioration of mortality conditions in the urban areas than improvements in the countryside.

(*b*) Urban and rural mortality differentials are also due to the fact that their populations differ in composition. Urban populations not only have a more favourable distribution of income but are, on the average, better educated than rural dwellers. At the individual level, the negative relation between mother's level of education and infant and childhood mortality has been consistently confirmed by various researchers under rather disparate conditions.[44]

[43] Kingsley Davis, "Cities and mortality", in International Union for the Scientific Study of Population, *Proceedings of the International Population Conference, Liège, 1973* (Liège, 1973).

[44] D. Chao, "Income, human capital and life expectancy", paper presented at the Annual Meetings of the Population Associaton of America, 26-28 April 1979, Philadelphia, Pa. (Washington, D.C., 1979); T. Paul Schultz, "Interpretation of relations among mortality, economics of the household, and the health environment", in *Proceedings of the Meeting on Socioeconomic Determinants and Consequences of Mortality, El Colégio de Mexico, Mexico City, 19-25 June 1979* (New York and Geneva, United Nations and World Health Organization, [1980]), pp. 382-422; John C. Caldwell, "Education as a factor in mortality decline; an examination of Nigerian data", in *ibid.*, pp. 172-192; Samuel H. Preston, "Causes and consequences of mortality decline in less developed countries during the twentieth century", in Richard A. Easterlin, ed., *Population and Economic Change in Developing Countries* (Chicago, Ill., University of Chicago Press, 1980); Alberto Palloni, "Mortality decline in Latin America", paper presented at the Annual Meetings of the Population Association of America, 26-28 April 1979, Philadelphia, Pa. (Washington, D.C., 1979); "Some generalizations on mortality changes in Latin America", Population Studies Center, University of Michigan, Ann Arbor, Mich., 1980.

Apparently, a higher level of education not only equips the mother with the knowledge to provide better care for her children but also, and more importantly in the context of developing societies, it provides her with the power to neutralize the authority of elders who, within traditional family settings, have uncontested control of children's care and education.[45] The relation between levels of infant mortality and mother's education is, however, contaminated by the influence that parity has on mortality levels. Females with higher education have fewer children which, in turn, implies lower mortality rates for a recently born child. Further research is needed to confirm that the negative association between mortality of children and mother's educational level is maintained regardless of parity.[46]

At the aggregate level the relation between a country's educational level (frequently measured by the proportion of literate population) and the over-all level of mortality (measured by life expectancy at birth or a death rate) has also consistently been revealed as highly negative and significant.[47] However, a slightly different approach renders results that are contradictory with the traditional ones: for some countries an increase in the proportion literate would produce an increase (not a decrease) in mortality.[48] This testifies to the difficulty of correctly and unequivocally interpreting the aggregate relation. In this section, the focus is on the individual level, and only tangentially is the aggregate level relationship examined.

Table V.13 presents the estimates of $q(2)$ by levels of mother's education for some Latin American countries. The last column gives the average difference in $q(2)$ which results from comparisons of adjacent educational categories. The contrasts are quite striking: thus, in Bolivia, the mortality level for the lowest educational group is about twice the level for the highest educational group. On the average, the passage from one educational group to a higher one decreases the risk of dying before age 2 by the equivalent of 25 deaths per 1,000 births. Mortality levels are least sensitive to mother's educational levels in Cuba. In fact, there is scarcely any difference between the first two levels, although the contrast is more marked between these and the last two educational categories. As was mentioned before (in section A of this chapter), Cuba has been involved in the past two decades in an effort to reduce the differential access of various sectors of the population to food and basic services. Apparently nowhere has this effort been more rewarded than in matters of health.[49]

It can be seen from table V.13 that the level of mortality in a given educational category is a function of both the over-all level of mortality in the country and the distances between educational categories. If one takes Cuba as a standard and lets the category 4-6 years of education represent the over-all level of mortality, it is possible to calculate how much of the other countries' mortality differen-

[45] J. C. Caldwell, *op. cit.*

[46] In her research on Chilean mortality, Taucher introduced a control for parity which attenuated the relation between mortality and education, but did not eliminate it. See Erica Taucher, "La mortalidad infantil en Chile", *Notas de Población*, vol. 7, No. 20 (Santiago de Chile, Centro Latinoamericano de Demografía, 1979).

[47] C. Chao, "Income, human capital and life expectancy", paper presented at the Annual Meetings of the Population Association of America, 26-28 April, 1979, Philadelphia, Pa. (Washington, D.C., 1979).

[48] Alberto Palloni, "Some generalizations on mortality changes in Latin America", Population Studies Center, University of Michigan, Ann Arbor, Mich., 1980.

[49] Sergio Diaz-Briquets, "Income redistribution and mortality change: the Cuban case", paper presented at the Annual Meetings of the Population Association of America, 13-15 April 1978, Atlanta, Ga. (Washington, D.C., 1978).

TABLE V.13. PROBABILITIES OF DYING DURING THE FIRST TWO YEARS OF LIFE ($1{,}000\ {}_2q_0$) BY EDUCATIONAL LEVEL OF MOTHER, COUNTRIES OF LATIN AMERICA

Country and year of census or survey	*Total*	*Years of instruction of mother*					*Average slope*[a]
		0	*1-3*	*4-6*	*7-9*	*10 and over*	
Cuba[b] (1974)	41	46	45	34	29	...	5.67
Paraguay (1972)	75	104	80	61	45	27	19.25
Costa Rica (1973)	81	125	98	70	51	33	23.00
Colombia[c] (1973)	88	126	95	63	42	32	23.50
Chile (1970)	91	131	108	92	66	46	21.25
Dominican Republic (1975)	123	172	130	106	81	54	29.50
Ecuador (1974)	127	176	134	101	61	46	32.50
Honduras (1974)	140	171	129	99	60	35	34.00
El Salvador (1971)	145	158	142	111	58	30	32.00
Guatemala (1973)	149	169	135	85	58	44	31.25
Nicaragua (1971)	149	168	142	115	73	48	30.00
Peru[d] (1972)	169	207	136	102	77	70	34.30
Bolivia (1975)	202	245	209	176	110[e]	...	45.00
Argentina (1970)	58	96	75	59	39	26	16.80

Source: Hugo Behm and Domingo Primante, "Mortalidad en los primeros años de vida en la America Latina", *Notas de Población*, vol. 6, No. 16 (1978).

[a] Calculated by averaging the differences in values of $1{,}000\ {}_2q_0$ between successive educational categories.

[b] Provisional figures based on the Encuesta Nacional de Ingresos y Engresos de la Población, 1974. Years of instruction are 0, 1-5, 6 and 7 years and over.

[c] Years of instruction are 0, 1-3, 4-5, 6-8 and 9 and over.

[d] Years of instruction are 0-2, 3-4, 5, 6-9 and 10 and over.

[e] For 7 years and over.

tials could be eliminated if they approached the Cuban standard. As an illustration, the calculations for the first and third educational categories indicate that on the average close to 50 per cent of the present variability in the levels of $q(2)$ associated with these educational categories could be eliminated if the mortality differentials resembled those found in Cuba.

If the argument presented in (*a*) above has any validity, the differentials between rural and urban mortality should persist even after taking into account the differential composition of the population by educational levels. However, table V.14 shows that in most countries the advantages that the urban population seems to enjoy are considerably attenuated when the comparison is carried out within each educational group. The size of the urban/rural ratios within educational categories—with all the reservations that such measures warrant—is reduced well below the ratios observed in table V.12 and in some cases, notably the Dominican Republic, the ratios drop below 1. This implies that the effect of mother's education on mortality accounts for a significant amount of the previously observed rural/urban differentials. These effects, operating through the disparate educational composition of the rural and urban populations, sharpen their mortality differentials. A less significant fraction of the mortality differentials is accounted for by other factors, both unrelated to population composition and related to it (e.g., compositional heterogeneity by income categories net of the effects of education). The last column of table V.13 gives the average change in $q(2)$ by educational groups in rural and urban areas. With the exception of Peru and Costa Rica, the educational differentials are at least as sharp in urban as in rural areas. If rural areas are in fact disadvantaged (above and beyond considerations of population composition), then mortality levels for each educational category would be expected to exceed those for the corresponding category in urban areas. Moreover, the disparities between educational categories in rural areas may be attenuated due to lesser availability of community resources which improve mortality conditions, or to higher exposure to deleterious factors. Both lesser availability of resources and increased exposure to environments conducive to higher mortality moderate the advantages to be gained from additional education.

Even though the educational level of the population is important enough to account for most of the rural/urban mortality differential within countries, its influence is not sufficiently strong to account for international variations in mortality for a given educational category. This can be shown by a two-way analysis of variance on the data of table V.14. Two categories for area (urban and rural) and four for years of education (0, 1-3, 4-6 and 7 years and over) were used. The results are disappointing: neither the area of residence nor the degree of education explains a significant amount of the variation encountered in the table, as indicated by the corresponding F-ratios. Most of the variation is within cell variation (and thus unrelated to education or area of residence) or due to interaction effects. Thus, the mortality differentials among countries during the first two years of life depend not only on mother's education and, secondarily, on area of residence, but also and mainly on factors affecting conditions within each country. This is illustrated by the table which follows.

PROBABILITY OF DYING BEFORE AGE 2 ($1000\ {}_2q_0$)

Area of residence	*Years of instruction of mother*			
	0	*1-3*	*4-6*	*7 and over*
Rural				
Country range	103-255	78-223	62-181	35-144
Average	161	134	109	69
Urban				
Country range	92-212	83-176	57-166	42-100
Average	154	125	92	64

Source: Table V.14

It can be seen that for each educational category, the urban and rural averages are close. In addition, however, for both the urban and rural areas, the range of country values within an educational category may be as wide as, or wider than, the differential between the country averages for the lowest and highest educational categories. Thus, for example, whereas increasing the educational level of urban mothers from 0 to 7 years and over implies an average reduction in the probability of dying before the age of 2 years of about 60 per cent, an even greater differential (some 65 per cent) is found between the countries with the lowest and highest values of $q(2)$ for urban women with 4 to 6 years of schooling.

The striking size of the country mortality differentials observed within educational categories is less for urban areas and the higher educational categories. The reason for this may be that highly educated groups within each country manage to get better access to resources which improve their living conditions, regardless of the differential distribution by countries of such resources. The result is to reduce the mortality differentials in the highest educational categories.

Without additional information it is difficult to determine all of the factors that may be responsible for observed international variations in mortality. A few are presented below as hypotheses to be tested:

(*a*) Errors in census coverage and/or a differential degree of omission of children dead. The direction of the effects of these errors is difficult to gauge. However, one would intuitively expect countries with higher mortality to be those also with the highest rates of omission. If this were the case, then the ranges (after corrections) in the text table above would increase further;

(*b*) Lack of comparability with respect to the educational categories. Clearly, the number of years of education may signify different things in different countries and contexts, resulting in increased heterogeneity of mortality levels within educational categories;

(*c*) Contextual factors affecting the aggregate levels of living in a country may result in different risks of mortality within the same educational category in different countries. In recent papers several researchers have found that the average income, the degree of income inequality and, more importantly, the over-all level of education in the country (as measured by the proportion of the population that is literate) explain close to 90 per cent of the total var-

TABLE V.14. PROBABILITIES OF DYING DURING THE FIRST TWO YEARS OF LIFE ($1{,}000\ {}_2q_0$) BY RURAL/URBAN RESIDENCE AND EDUCATIONAL LEVEL OF MOTHER, COUNTRIES OF LATIN AMERICA

Country, year of census or survey and area of residence	Mother's educational level (years of instruction)						Average slope[a]
	0	1-3	4-6	7-9	10 or more	12 or more	
Bolivia, 1975							
Total	245	209	176	110[b]	...	...	45.0
Urban	212	205	166	100[b]	...	...	37.3
Rural	255	208	181	144[b]	...	...	37.0
Ratio (rural ÷ urban)	1.20	1.01	1.09	1.44	...	...	
Chile, 1970							
Total	131	108	92	66	46	...	21.2
Urban	125	104	89	65	47	...	19.5
Rural	136	113	105	79	...[c]	...	19.0
Ratio (rural ÷ urban)	1.09	1.09	1.18	1.22	...	...	
Colombia, 1973							
Total	126	95	63[d]	42[e]	32[f]	31	19.0
Urban	122	86	57[d]	42[e]	30[f]	29	23.0
Rural	129	104	85[d]	46[e]	65[f]	...[c]	16.0
Ratio (rural ÷ urban)	1.06	1.21	1.49	1.10	2.17	...	
Costa Rica, 1973							
Total	125	93	70	51	33	...	23.0
Urban	92	83	58	54	32	...	15.0
Rural	123	96	79	40	37	...	21.5
Ratio (rural ÷ urban)	1.34	1.16	1.36	0.74	1.16	...	
Ecuador, 1974							
Total	176	134	101	61	46	...	32.5
Urban	173	125	89	58	44	...	32.3
Rural	176	138	113	75	61	...	28.8
Ratio (rural ÷ urban)	1.02	1.10	1.27	1.20	1.39	...	
El Salvador, 1971							
Total	158	142	111	58	30	...	32.0
Urban[g]	184	136	98	37[b]	...	...	49.0
Rural[h]	156	144	118	60[b]	...	...	32.0
Ratio (rural ÷ urban)	0.85	1.06	1.29	1.62	...	...	
Honduras, 1974							
Total	171	129	99	60	35	...	34.0
Urban	167	121	84	50	33	...	33.5
Rural	171	132	114	85	...[c]	...	28.7
Ratio (rural ÷ urban)	1.02	1.09	1.36	1.36	...	...	
Nicaragua, 1971							
Total	168	142	115	73	48	...	30.0
Urban	185	145	114	69	50	...	33.8
Rural	163	138	120	...[c]	...[c]	...	21.5
Ratio (rural ÷ urban)	0.88	0.95	1.05	...	...	...	
Paraguay, 1972							
Total	104	80	61	45	27	...	19.3
Urban	106	89	58	45	24	...	20.5
Rural	103	78	62	41	...[c]	...	20.6
Ratio (rural ÷ urban)	0.97	0.88	1.07	0.95	...	...	
Peru, 1972							
Total	...	207[i]	136[j]	102[k]	77[l]	70[m]	34.3
Urban	...	176[i]	127[j]	99[k]	76[l]	69[m]	26.8
Rural	...	223[i]	156[j]	120[k]	97[l]	101[m]	30.5[n]
Ratio (rural ÷ urban)	...	1.27	1.23	1.21	1.28	1.46	

Sources: See table V.12.

[a] Calculated by averaging the differences in values of $1{,}000\ {}_2q_0$ between successive educational categories.

[b] For 7 or more years of instruction.

[c] Not calculated because the women in the group had fewer than 100 children.

[d] For 4-5 years of instruction.

[e] For 6-8 years of instruction.

[f] For 9-11 years of instruction.

[g] Urban San Salvador.

[h] Remainder of El Salvador.

[i] Less than 3 years of instruction.

[j] Did not complete primary education.

[k] Primary level completed.

[l] Secondary education not completed.

[m] Secondary or higher education completed.

[n] Estimate based on sample of women who had fewer than 100 children.

iation in over-all mortality[50] or in infant and childhood mortality.[51] It may seem odd that the contextual effects of a country's educational level may explain the variation in mortality risks that was left unexplained by the educational levels of mothers. Not, however, if it is understood that

[50] D. Chao, "Income, human capital and life expectancy", paper presented at the Annual Meetings of the Population Association of America, 26-28 April 1979, Philadelphia, Pa. (Washington, D.C., 1979).

[51] Alberto Palloni, "Some generalizations on mortality changes in Latin America", Population Studies Center, University of Michigan, Ann Arbor, Mich., 1980.

the effects of the aggregate educational level (keeping constant the effects of related variables such as income) include the contribution of factors associated with levels of living which influence the individual choices left to members of different educational or income backgrounds.

To summarize, most of the rural/urban differentials in mortality under the age of 2 years seem to originate in the different educational composition of both sectors although some residual variation remains which could be attributable to other compositional contrasts or to an unequal allocation of resources between rural and urban areas. The level of mother's education seems to explain much of the variation in mortality levels within a population. Since the necessary data are not available, it is difficult to say whether or not the importance of education reflects also associated factors such as income and occupation. In other contexts, however, it has been shown that the net effects of education, after controlling for other factors, remain important in explaining mortality differentials. With respect to international variations in mortality levels, however, these are unaccounted for by educational level of the mothers. Most of the variation in $q(2)$ observed in our sample is probably associated with contextual factors which affect entire populations regardless of educational categories.

3. *Mortality differentials by ethnic groups*

Table V.15 presents the only available information on mortality by ethnic groups that could be obtained from the tabulations prepared by Behm and his collaborators. Although it is difficult to generalize from the findings for three countries, it is illustrative to note certain regularities. First, regardless of region of residence, Indian groups (speaking Indian dialects rather than Spanish) show higher mortality than non-Indians. Thus, for instance, in the Bolivian altiplanes, where Spanish-speaking groups enjoy the lowest levels of mortality, the Indian groups experienced levels of $q(2)$ that were twice as high. Similarly, in Guatemala, Indian mortality was much higher than non-Indian mortality in both rural and urban areas. The differentials appear to be stronger in urban areas, where Indian mortality was 61 per cent higher than non-Indian mortality compared with an excess mortality of 21 per cent in rural areas. Finally, mortality inequalities between Indian and non-Indian groups persist even when educational composition is taken into account. Thus, in Guatemala, approximately the same differentials that are observed between urban and rural areas are maintained within educational groups. In Ecuador the inequalities in mortality levels which prevail within the lowest educational group are attenuated in the other two categories. Thus, it would appear that the Indian population experiences higher mortality than the non-Indian population even when area of residence and educational levels are controlled. This suggests that membership in groups that are bounded by language, culture and physical attributes also imposes a way of life which has repercussions on mortality levels.

TABLE V.15. PROBABILITIES OF DYING DURING THE FIRST TWO YEARS OF LIFE ($1{,}000\ {}_2q_0$) BY ETHNIC GROUPS IN THREE LATIN AMERICAN COUNTRIES

Bolivia, 1975

Ethnic group[a]	*Region*			
	Total	*Altiplano*	*Valle*	*Trópico*
Indian	258	268	220[b]	...
Indian-Spanish	208	214	194	...
Spanish	149	137[b]	161	145
TOTAL	202	218	196	145

Ecuador,[c] *1974*

Composition of political divisions[a]	*Educational level of mother (years of instruction)*			
	0	*1-3*	*4 and over*	*Total*
Predominantly Indian	230	168	109	197
Predominantly non-Indian	178	147	107	143

Guatemala, 1973

Educational level of mother (years of instruction)	*Indian*		*Non-Indian*	
	Urban	*Rural*	*Urban*	*Rural*
0	171	175	154	161
1-3	133	161	109	126
4-6	122	[b]	73	98
7 and over	[b]	[b]	43	37
TOTAL	164	175	102	145

Sources: As for table V.12.

[a] Ethnic groups determined by language spoken.

[b] Mothers had a total of less than 100 births.

[c] For the Sierra region only.

D. CAUSES OF DEATH

A review of mortality levels and trends is not complete without an analysis by causes of death. While the statistics on causes of death for Latin American countries are far better, both in terms of quality and quantity, than those of most Asian and African countries, they still present many problems which serve as constraints on the types of analyses that can be successfully undertaken.

During the past decade or so, statistics on causes of death, grouped according to some standard classification system, have been published for countries of Latin America by the Pan American Health Organization and the World Health Organization.[52] Unfortunately, however, there are gaps in the series for individual countries, and some countries are not represented at all. For example, there are no country-wide data on deaths by cause for Brazil, which is by far the most populous country in Latin America. There are also a number of problems with the data that do exist. One is lack of consistency over time in the classification scheme as a result of changes introduced in the periodic revisions of the International Classification of Diseases. Also affecting the accuracy of time trend

[52] See Pan American Health Organization, *Health Conditions in the Americas 1965-1968*, Scientific Publication No. 207 (Washington, D. C., 1970); *Health Conditions in the Americas 1969-1972*, Scientific Publication No. 287 (Washington, D.C., 1974); World Health Organization, *World Health Statistics Annual*, various issues (Geneva).

analyses is the highly variable quality of the data over time. With respect to the cross-sectional data, there are, too, serious defects in these statistics for many countries. These include the under-registration of deaths, which in some countries is substantial, and the sizable percentage of deaths assigned to ill defined causes. The latter problem arises because, in many parts of Latin America, deaths are often not attended by a physician or other reliable medical personnel who could certify the cause of death. In both instances, it cannot be assumed that the unregistered deaths or those of ill defined cause have the same distribution as the ones which have been reported and the cause of death determined.

In the present analysis, cross-sectional data on the structure of causes of death in Latin American countries are examined. In order to assess the quality of the available data, two types of indicators were examined by country—the relative completeness factors for death registration (i.e., the proportion of total deaths registered) and the proportion of all deaths classified as due to ill defined causes (table V.16). The relative completeness factors were estimated through the application of several indirect techniques, different techniques being appropriate for different age segments of the population. The base data used for this assessment included statistics on the survivorship of children as reported in censuses taken around 1970. These statistics were used to estimate under-registration of infant and early childhood deaths. Estimates of under-registration for the population aged 5 years and over were based on the distribution of registered deaths by age and sex, and the population by age and sex as enumerated at the above-mentioned censuses. (References to sources describing these techniques can be found in the note to table V.16.) The results of this assessment revealed that in all countries but Barbados, Trinidad and Tobago and Uruguay, there was some degree of under-registration of deaths. Death registration was particularly incomplete in the Dominican Republic, Honduras, Nicaragua, Paraguay and Peru. In these countries the relative completeness factors for the population aged 5 years and above ranged from only 0.53 to 0.77, and the completeness factors for the two younger age-groups tended to be even lower. The second indicator of the quality of cause-of-death statistics—the proportion of deaths assigned to ill defined causes—is also shown for each country in table V.16, and for a number of countries this proportion is substantial—around 0.20 or higher in eight of 18 countries. The countries with high proportions of deaths in the ill defined category tend also to be those with substantial under-registration of deaths (e.g., between 27 and 42 per cent of all deaths were in the ill defined category in the Dominican Republic, El Salvador, Honduras and Nicaragua).

The countries appearing in table V.17, which presents the percentages of total deaths from selected causes, have been chosen in part on the basis of the quality of their statistics as reflected by the indicators in table V.16. As a result, they represent, on average, a biased sample, with lower mortality and a different mortality structure by causes of death than the countries omitted because of seriously defective data. The data in table V.17 are more recent than those in table V.16, pertaining mostly to 1976 or 1977. For most of the countries, the quality of data has improved since 1970. This is suggested from a comparison between the percentages of all deaths in the "symptoms and ill defined" category around 1970 (table V.16) and the mid 1970s (table V.17). In most countries this percentage has declined moderately. It is likely that the degree of under-registration has also declined, but it is not possible to determine the relative completeness factors for these data, as the techniques employed can only be applied to years surrounding censuses or sample surveys, which produce statistics on the enumerated population by age and sex.

In addition to the 12 countries of Latin America included in table V.17, data are also presented for a more developed country, England and Wales, for purposes of comparison, as there are sharp contrasts in the structure of

TABLE V.16. COMPLETENESS FACTORS FOR DEATH REGISTRATION (REGISTERED DEATHS RELATIVE TO ENUMERATED POPULATION AT RISK) AND PROPORTION OF ALL DEATHS ASSIGNED TO SYMPTOMS AND ILL DEFINED CONDITIONS, COUNTRIES OF LATIN AMERICA, EARLY 1970s

Country and year	Relative completeness factors within age segments			Proportion symptoms and ill defined conditions
	0-1 year (1)	1-5 years (2)	5 years and over (3)	(4)
Argentina, 1970	[a]	[a]	[a]	0.07
Barbados, 1970	1.00	1.00	1.00	0.04
Chile, 1970	[b]	[b]	[b]	0.06
Colombia, 1972	1.27	1.04	0.87	0.10
Costa Rica, 1973	0.96	0.99	0.96	0.08
Dominican Republic, 1970	0.41	0.63	0.60	0.42
Ecuador, 1973	0.71	1.08	0.95	0.19
El Salvador, 1971	0.61	0.53	0.97	0.34
Guatemala, 1970	0.87	1.11	0.92	0.16
Honduras, 1971	0.30	0.56	0.66	0.38
Mexico, 1970	0.98	1.00	1.00	0.14
Nicaragua, 1973	0.43	0.52	0.53	0.27
Panama, 1970	0.87	0.93	0.85	0.19
Paraguay, 1972	0.50	0.61	0.63	0.21
Peru, 1971	0.44	0.45	0.75	0.09
Trinidad and Tobago, 1970	1.00	1.00	1.00	0.05
Uruguay, 1974	1.00	1.00	1.00	0.06
Venezuela, 1971	0.97	0.97	0.97	0.22

Sources: Data on population and registered deaths by age and sex used to calculate death rates and proportions of all deaths in ill defined category are from various issues of World Health Organization, *World Health Statistics Annual* (Geneva).

NOTE: To evaluate the completeness of death registration in the age intervals 0-1 year and 1-5 years, the age-specific death rates calculated from registered data were compared with those estimated indirectly from data on children surviving, as reported in censuses and sample surveys.

The completeness of death registration at ages 5 years and above was evaluated by means of a technique developed by William Brass. See his *Methods for Estimating Fertility and Mortality from Limited and Defective Data* (Chapel Hill, N.C., University of North Carolina, 1975). In addition, a technique based on a slightly different set of assumptions, developed by Samuel H. Preston, was also used. See Samuel Preston and Kenneth Hill, "Estimating the completeness of death registration", *Population Studies*, vol. 34, No. 2 (July 1980).

Ratios larger than 1.0 indicate that the relative under-enumeration of population at risk exceeds the relative under-registration of deaths.

[a] Completeness factors were not estimated; instead, the values derived by Maria S. Müller were used. See her *La Mortalidad en la Argentina: Evolución Historica y Situación en 1970* (Santiago, Centro Latinoamericano de Demografía, 1978).

[b] Completeness factors were not estimated; instead, the values derived by José Pujol were used. See his *Chile: Tablas Abreviadas de Mortalidad a Nivel Nacional y Regional, 1969-1970*, Publicaciones de CELADE, Serie A, No. 141 (Santiago, Centro Latinoamericano de Demografía, 1976).

TABLE V.17. PERCENTAGES OF TOTAL DEATHS FROM SELECTED CAUSES, SELECTED COUNTRIES OF LATIN AMERICA AND ENGLAND AND WALES, MID 1970s

Country and year	Infectious and parasitic diseases		Influenza and pneumonia (A90-A92)	Avitaminosis and other nutritional deficiencies (A65)	Complications of pregnancy, childbirth, abortion (A112-A118)	Diseases of the circulatory system (A80-A88)	Neoplasms (A45-A61)	Diabetes (A64)	Cirrhosis of liver (A102)	Accidents and violence (AE138-AE150)	Symptoms and ill defined conditions (A136-A137)
	Total (A1-A44)	Enteritis and other diarrhoeal diseases (A5)									
Argentina (1977)	5.6	1.7	3.0	1.0	0.3	41.3	16.5	2.1	1.9	7.8	4.8
Chile (1977)	7.8	2.6	8.4	0.9	0.3	22.2	14.7	1.6	4.4	10.7	10.1
Colombia (1975)	14.4	7.7	7.2	3.4	0.7	21.7	8.6	1.1	0.5	10.8	9.4
Costa Rica (1977)	6.8	3.3	5.3	1.1	0.4	22.0	16.2	2.6	1.3	12.1	7.8
Cuba (1977)	2.9	1.1	7.6	0.2	0.1	42.4	18.3	2.0	1.0	10.9	0.3
Ecuador (1972)	26.7	13.5	8.6	1.5	0.7	8.1	3.5	0.5	0.5	5.9	19.9
Guatemala (1976)	29.9	14.4	13.9	3.1	0.5	3.6	2.1	0.4	0.6	19.9	14.1
Mexico (1974)	18.4	11.7	13.1	1.3	0.7	14.5	5.0	1.9	2.6	11.3	11.7
Panama (1974)	14.0	5.5	7.3	1.1	0.5	21.3	8.2	1.7	0.6	9.8	16.3
Trinidad and Tobago (1976)	5.8	4.1	4.9	1.1	0.4	39.7	9.1	8.3	1.7	7.6	4.2
Uruguay (1976)	3.0	1.3	3.1	1.2	0.1	41.1	20.5	2.3	0.8	5.3	6.6
Venezuela (1977)	11.6	6.2	6.5	0.8	0.5	20.5	9.4	1.9	1.2	12.8	16.4
England and Wales (1977)	0.4	0.1	9.2	0.0	0.0	50.8	22.0	0.9	0.3	3.5	0.5

Source: Calculated from various issues of World Health Organization, *World Health Statistics Annual* (Geneva).

NOTE: The causes of death are classified according to the "A" list of the International Classification of Diseases, 8th Revision (1965).

causes of death between the more and less developed countries. In the more developed countries, mortality from neoplasms and diseases of the circulatory system constitutes a high proportion of all deaths, while mortality from the infectious and parasitic diseases is extremely low—only about 1 per cent of all deaths, on the average. In the developing countries, mortality from neoplasms and circulatory diseases, while representing a sizable proportion of all deaths, is still substantially below that of the more developed countries, relatively speaking. However, the infectious and parasitic diseases, and particularly the diarrhoeal diseases, are very prominent as causes of death.

The differences among the countries in the percentages of deaths due to the various causes arise from two sources. The first is differences from country to country in mortality levels by causes of death, that is to say, differences in age-specific death rates. The second source of differences in percentages is differences in age structure. Certain diseases are important at the younger ages, while others predominate at middle and old age. Countries with a youthful population age structure will therefore be characterized by relatively large proportions of deaths from the infectious and parasitic diseases, which tend to afflict the young, while those with an old age structure will have sizable proportions of total deaths from the degenerative diseases, mainly neoplasms and diseases of the circulatory system. Because the data in table V.17 have not been adjusted for differences in age structure, they reflect such differences among countries, as well as differences in age-specific mortality, and should be viewed as suggestive of the types of health problems which the countries of Latin America face, rather than as precise measures of levels and differences in levels of mortality by cause.

It is clear that there are very large differences in over-all mortality structure by cause among the Latin American countries. The percentage of total deaths due to the infectious diseases ranges from about 3 per cent to 7 per cent in a group of countries with relatively low mortality (Argentina, Costa Rica, Cuba, Trinidad and Tobago and Uruguay) to about 27 per cent and 30 per cent in Ecuador and Guatemala, respectively. While the percentages in the first group of countries are low compared with those of the remaining countries of Latin America, they are still several times as high as that of England and Wales (with 0.4 per cent).

The diarrhoeal diseases, a subgroup of the infectious and parasitic diseases, are among the major causes of death in several Latin American countries, particularly among infants and young children. In Ecuador, Guatemala and Mexico, they accounted for between 12 and 14 per cent of all deaths. Even in the countries where these diseases are relatively much less prominent, they still assume a far greater importance than in the more developed countries (in England and Wales, only 0.1 per cent of deaths were from this disease category).

The percentages of total deaths from nutritional deficiencies shown in table V.17 are relatively low, but the importance of this group of causes of death is much greater than indicated by the statistics, as these conditions are often associated with infectious diseases as a contributing cause of death.[53]

The range of percentages for mortality due to circulatory diseases is extremely wide—from under 10 per cent in Ecuador and Guatemala (these may be considerably understated because of the large proportions of "ill defined" deaths) to over 40 per cent in Argentina. Cuba and Uruguay. However, these latter percentages are still substantially below that of England and Wales (50.8 per cent). The proportion of deaths attributable to neoplasms also varies widely, from under 5 per cent in Ecuador and Guatemala (with the same qualification noted above) to between 15 and 20 per cent in Argentina, Costa Rica, Cuba and Uruguay. These compare with 22 per cent in England and Wales. The lesser relative importance of deaths from neoplasms and the circulatory diseases in the countries of Latin America, in comparison with the more developed countries, appears to be due not to their favourable age structure alone but also (with a few exceptions) to lower age-specific mortality from these causes. A ranking of 20 Latin American countries and Canada and the United States in descending order of their age-adjusted death rates from malignant neoplasms and diseases of the heart in 1972 gave the following results:[54]

Malignant neoplasms	*Heart diseases*
Uruguay	Trinidad and Tobago
Argentina	United States
Chile	Argentina
Canada	Canada
United States	Remaining 18 countries
Remaining 17 countries	of Latin America
of Latin America	

The figures on diabetes and cirrhosis of the liver are interesting, as these diseases are often said to be associated with affluence. Yet, despite the age advantage of the Latin American countries, in most cases the percentage of deaths due to these diseases substantially exceeds that of England and Wales.

It is clear from the foregoing data that the infectious diseases are still an important cause of mortality in the countries of Latin America, after 20 years of accelerated mortality decline. It will be recalled that the countries selected for table V.17 were among those with the best statistics, and, had accurate data for the remaining countries been available, they would have been even less favourable. A recent study on mortality in Latin America, which included also countries with poor data, compared age-standardized death rates in Latin American countries around 1970 for three groups of diseases (all infectious and parasitic diseases; the diarrhoeal diseases; and influenza, pneumonia and bronchitis) with the corresponding rates in a group of European countries in the past at equivalent mortality levels, as measured by the standardized death rate for all causes.[55] Two sets of standardized death rates

[53] See Ruth R. Puffer and Carlos V. Serrano, *Patterns of Mortality in Childhood; Report of the Inter-American Investigations of Mortality in Childhood*, Scientific Publication No. 262 (Washington, D.C., Pan American Health Organization, 1973), pp. 180-185.

[54] Pan American Health Organization, *Health Conditions in the Americas 1969-1972*, Scientific Publication No. 287 (Washington, D.C., 1974), pp. 21 and 23.

[55] Alberto Palloni, "A procedure that allocates the deaths attributed to ill defined conditions". Population Studies Center, University of Michigan, Ann Arbor, Mich. 1980.

by cause were calculated for the Latin American countries. In the first set, the deaths in the ill defined category were not included with any of the specific causes, whereas in the second, such deaths were distributed according to a technique developed by the author of the study. Two sets of ratios were then calculated of the observed to the "expected" standardized death rates by country for each of the three cause-of-death groups, the "expected" rate being that observed in the more developed countries in the past at equivalent mortality levels. The standardized death rates for the European countries used in calculating both sets of ratios were not corrected for ill defined deaths, but the proportions which such deaths represented of total deaths were, on the average, substantially below those in Latin America. The unweighted averages of the two sets of ratios for the 18 countries included in the study were as follows:

	Uncorrected for ill defined causes	*Corrected for ill defined causes*
Infectious and parasitic diseases	1.13	1.45
Diarrhoeal diseases	2.56	3.31
Influenza, pneumonia, bronchitis	0.94	1.07

The ratios computed on rates uncorrected for ill defined deaths in Latin American countries understate the excess mortality due to the selected causes of death, while the ratios computed on the corrected rates overstate it. The true values lie somewhere in between. However, there is a further problem which cannot be quantified. Because of a change in the International Classification of Diseases, infant deaths from diarrhoeal diseases, which had been included with "diseases of infancy" prior to the 8th Revision (1965) were classified with the diarrhoeal diseases beginning with the 8th Revision. Because of the importance of this class of diseases during infancy, the change in classification has the effect of biasing upwards the ratios for diarrhoeal diseases, and to a lesser extent, those for the infectious diseases.

In order to eliminate this source of bias, death rates from diarrhoea at ages 1-4 years (this age-group was not affected by the change in the International Classification of Diseases) were compared between countries of Latin America in recent years and countries of Northern and Western Europe in the past when their death rates from all causes in this age-group were as high as those in Latin America around 1970 (table V.18). The excess mortality from this disease group is very high. In most cases the rates of Latin American countries are at least twice as high, and in five countries they are over four times as high. Mortality in this age-group appears to be particularly sensitive to the levels of such indicators of economic development as nutritional status, sanitary conditions and the availability and quality of medical care. It is at these ages that the greatest contrasts in death rates are found between the developed and developing countries. The fact that the cause-of-death structure in Latin American countries shows a much higher incidence of the infectious and diarrhoeal diseases than in European countries at similar mortality levels in the past indicates not only that the diffusion of medical technology has not reached all sectors of the population but that basic improvements in living conditions have not occurred. The morbid conditions leading to

TABLE V.18. RATIOS OF OBSERVED TO EXPECTED DEATH RATES FOR DIARRHOEAL DISEASES AT AGES 1-4 YEARS, COUNTRIES OF LATIN AMERICA, EARLY 1970s

Country and year	*Death rates from diarrhoeal diseases[a] (per 100,000 population)*		*Ratios of observed to expected rates*
	Observed	*Expected*	
Argentina, 1970	23.6	13.7	1.72
Barbados, 1970	1.1	1.8	0.61
Chile, 1970	35.4	22.0	1.61
Colombia, 1972	240.1	72.6	3.17
Costa Rica, 1973	77.4	35.7	2.17
Dominican Republic, 1970	206.8	88.5	2.33
Ecuador, 1973	355.9	107.8	3.30
El Salvador, 1971	576.2	139.1	4.14
Guatemala, 1970	744.5	179.5	4.15
Honduras, 1971	405.2	134.7	3.01
Mexico, 1970	264.3	67.5	3.92
Nicaragua, 1973	386.1	85.3	4.52
Panama, 1970	127.8	57.0	2.24
Paraguay, 1972	200.0	48.8	4.10
Peru, 1971	370.2	77.1	4.73
Trinidad and Tobago, 1970	38.7	13.1	2.95
Uruguay, 1974	9.1	9.9	0.92
Venezuela, 1971	89.7	37.3	2.40

Sources: Alberto Palloni, "A procedure that allocates the deaths attributed to ill defined conditions". Population Studies Center, University of Michigan, Ann Arbor, Mich., 1980. Observed death rates are from various issues of World Health Organization, *World Health Statistics Annual* (Geneva). "Expected" death rates have been calculated by matching death rates from all causes at ages 1-4 years in the Latin American countries with those in selected countries of Northern and Western Europe. The observed death rates from diarrhoeal diseases in the latter countries with equivalent mortality levels from all causes at ages 1-4 years were taken as the "expected" death rates. The latter are based on data in Samuel H. Preston, Nathan Keyfitz and Robert Schoen, *Causes of Death; Life Tables for National Populations* (New York, Seminar Press, 1972).

NOTE: Because deaths from ill defined causes have not been allocated to specific diseases, and because the proportion of such deaths is generally greater in Latin American countries than in the countries with which they have been matched, the death rates from diarrhoeal diseases in the former countries are probably understated to a greater extent than in the latter countries. The ratios should therefore be considered as lower limits of excess mortality from diarrhoeal diseases.

[a] Item A5 of the International Classification of Diseases, 8th Revision.

the development of diarrhoeal diseases are inextricably linked with the onset of infections, on the one hand, and the pre-existing weakness of the host, on the other. Satisfactory nutritional levels are not only a barrier against the contraction of infectious diseases but an important factor in recovery. In about 60 per cent of the deaths to children under 5 years of age having diarrhoea as the main cause, nutritional deficiencies were found to be an associated cause.[56]

The data reviewed in this chapter indicate that although mortality in Latin American countries has declined sharply since the end of the Second World War, it has also preserved a rather "traditional" character, with the persistence of relatively high levels of death rates from preventable and curable diseases. This resistance to change in the pattern of causes of death may be explained, *inter alia*, by the disappointing pace of improvement in levels of living, poor access of the population to medical services and the inefficiency of public health programmes.

[56] Ruth R. Puffer and Carlos V. Serrano, *Patterns of Mortality in Childhood: Report of the Inter-American Investigation of Mortality in Childhood*, Scientific Publication No. 262 (Washington, D.C., Pan American Health Organization, 1973), p. 183.

ANNEX

TABLE VA.1. TRENDS IN SELECTED MORTALITY INDICATORS, COUNTRIES OF LATIN AMERICA, 1950-1975

Region, country and period	Crude death rates[a] (both sexes)	Sex	Probability of dying ($1,000\ {}_nq_x$) between ages: 0 and 1 year	1 and 4 years	Life expectancy at ages: 0	5	15	30	65	Sources
Caribbean										
Barbados										
1950-1952	13.2	M	143.1	...	53.4	59.8	50.2	36.5	10.6	1, 2
		F	129.3	...	58.0	64.4	54.8	41.5	14.1	
1959-1961	9.9	M	77.8	17.2	62.7	64.2	54.6	40.5	12.4	1, 2
		F	65.6	14.6	67.4	68.2	58.5	44.4	15.4	
1969-1971	8.3	M	49.9	6.5	65.8	64.7	55.1	41.1	12.8	2, 3
		F	37.7	6.0	71.2	69.4	59.6	45.3	15.4	
Cuba										
1950	11.0	M	109.6	62.5	53.6	58.2	49.5	37.3	12.0	4, 5
		F	85.5	46.4	57.9	61.2	52.5	40.1	13.2	
1960	8.4	M	70.2	21.4	62.0	63.1	53.8	40.5	12.5	6, 5
		F	53.9	19.7	66.1	66.2	56.8	43.2	13.9	
1965	7.7	M	55.5	16.8	65.4	65.3	55.9	42.3	13.3	6, 5
		F	41.5	15.5	68.9	68.0	58.5	44.7	14.5	
1970	6.8	M	43.6	13.1	68.4	67.5	57.9	44.1	14.1	6, 5
		F	31.9	12.1	71.5	69.7	60.1	46.1	15.2	
1974	6.4	M	51.2	...	68.5	67.6	57.9	44.0	14.0	7, 5
		F	39.7	...	71.8	70.1	60.4	46.3	15.7	
Dominican Republic										
1950-1960	19.0	M	155.4	...	45.1	53.0	45.0	33.8	12.2	8, 5
		F	131.7	...	48.4	55.5	47.8	36.8	13.7	
1960-1970	13.6	M	111.4	...	52.6	57.2	48.6	36.6	12.8	8, 5
		F	93.4	...	56.0	59.9	51.4	39.4	14.2	
1975	10.7	M	108.7	50.0	57.5	62.7	53.9	41.6	14.3	5, 9
		F	92.7	43.0	60.3	64.3	55.4	42.8	14.7	
Guadeloupe										
1951-1955[b]	12.8[c]	M	63.5	42.9	55.4	56.7	47.5	34.2	11.2	1, 2
		F	51.9	40.0	59.2	59.9	50.6	37.9	13.4	
1963-1967	8.1[c]	M	53.1	17.5	62.5	62.1	52.9	38.7	12.3	1, 2
		F	43.4	18.0	67.3	66.6	57.0	43.1	14.9	
1970-1975	7.3	M	...	...	...	...	...	...	...	2
Haiti										
1971	17.4	M,F	161.9	79.2	47.6	52.8	44.7	33.8	10.9	10
Jamaica										
1950-1952	12.3	M	84.5	46.8	55.7	58.7	49.8	36.9	11.4	1, 2
		F	71.7	40.3	58.9	61.0	52.1	39.7	13.2	
1959-1961	10.3	M	59.8	27.9	62.7	63.5	54.0	40.2	12.8	2
		F	51.6	24.3	66.6	66.9	57.4	43.4	14.8	
1969-1970[d]	7.7	M	36.5	...	66.7	65.3	55.7	41.8	13.9	11, 2
		F	33.3	...	70.2	68.6	58.9	44.7	15.9	
Martinique										
1963-1967	7.3	M	47.9	17.9	63.3	62.5	53.0	39.2	12.8	1, 2, 12
		F	38.8	17.9	67.4	66.4	56.7	42.6	15.2	
Puerto Rico										
1949-1951	10.6	M	70.5	...	59.5	61.4	52.4	39.9	17.4	1, 13
		F	58.5	...	62.4	64.2	55.1	42.8	16.4	
1954-1956	7.2	M	58.3	...	66.0	66.4	57.0	43.5	15.0	1, 13
		F	48.5	...	69.6	69.6	60.2	46.3	17.0	
1959-1961	6.7	M	48.8	...	67.1	66.4	56.9	43.2	15.3	1, 13
		F	39.6	...	71.9	70.8	61.2	47.0	17.2	
1969-1971	6.7	M	32.9	3.6	69.0	66.6	56.9	43.3	15.5	2
		F	24.1	3.5	75.2	72.3	62.5	48.1	17.5	
1971-1973	6.6	M	30.3	3.3	68.9	66.3	56.6	43.0	15.0	2
		F	23.5	2.8	76.1	73.1	62.8	48.4	17.6	
Trinidad and Tobago										
1952-1954	10.9	M	75.9	...	56.3	57.8	48.5	35.4	10.5	14
		F	67.6	...	58.5	59.5	50.2	37.7	12.5	

TABLE VA.1 (*continued*)

Region, country and period	Crude death rates[a] (both sexes)	Sex	Probability of dying ($1,000\ {}_nq_x$) between ages: 0 and 1 year	Probability of dying ($1,000\ {}_nq_x$) between ages: 1 and 4 years	Life expectancy at ages: 0	5	15	30	65	Sources
Carribbean (*cont.*)										
Trinidad and Tobago (*cont.*)										
1955-1960	9.3	M	65.5	. . .	60.6	61.4	51.2	37.4	10.6	14
		F	53.2	. . .	64.3	63.5	54.0	40.2	13.1	
1970	6.8	M	34.5	8.1	64.1	62.1	52.5	38.6	10.2	14
		F	28.2	7.6	68.1	65.8	56.1	41.9	13.0	
Middle America										
Costa Rica										
1949-1951	12.7	M	104.6	60.7	54.7	59.8	51.0	38.0	11.9	15, 1
		F	89.1	59.9	57.1	61.4	52.6	39.4	12.7	
1962-1964	9.1	M	94.7	29.4	60.9	64.2	55.1	41.5	13.6	5, 16
		F	77.6	30.9	63.7	66.1	57.9	43.1	14.4	
1972-1974	5.8	M	56.3	12.0	67.5	67.3	57.8	44.0	15.3	5, 16
		F	45.2	12.0	71.2	70.5	60.8	46.5	16.8	
El Salvador										
1949-1951	20.4	M	151.7	67.4	46.2	53.1	45.8	34.6	11.1	17, 5
		F	133.5	65.6	48.2	54.4	47.3	36.3	11.9	
1959-1961	18.1	M	113.4	42.7	54.5	59.1	50.7	38.2	12.1	17, 5
		F	96.3	39.8	57.5	61.2	52.9	40.4	13.1	
1970-1972	11.1	M	114.2	77.4	54.9	61.9	53.1	40.4	14.6	5, 16
		F	96.1	73.8	60.1	66.6	57.7	43.9	16.0	
Guatemala										
1950	22.0	M	171.7	132.4	39.6	49.6	43.2	32.7	11.4	18, 5
		F	154.0	137.6	40.9	50.5	44.4	34.4	12.2	
1963-1965	17.3	M	116.6	97.7	47.7	53.7	46.7	35.0	11.9	5, 16
		F	101.7	105.7	48.9	54.4	47.5	36.8	11.9	
1970-1972	13.0	M	91.3	86.9	51.8	57.2	49.4	37.0	12.3	19
		F	79.2	90.0	53.9	59.1	51.4	38.8	12.8	
Honduras										
1960-1962	17.8	M	173.4	114.9	40.6	50.1	42.5	31.9	10.5	5, 16
		F	158.6	114.3	44.1	52.8	45.2	33.7	11.1	
1973-1974	14.2	M	136.5	64.0	50.7	57.6	49.2	37.5	14.2	16, 20
		F	117.5	58.0	54.3	60.2	51.8	38.8	13.0	
Mexico										
1949-1951	15.0	M	107.5	100.4	48.1	54.6	46.6	34.9	12.4	1, 21
		F	94.7	107.9	51.0	57.9	49.9	37.8	12.6	
1959-1961	11.6	M	82.8	54.2	56.4	59.8	51.1	38.6	14.0	17, 5
		F	72.4	56.3	59.6	62.9	54.2	41.2	14.5	
1969-1971	9.7	M	88.6	37.8	58.8	61.9	52.9	40.2	14.6	5, 16
		F	74.6	39.0	62.9	65.7	56.5	43.0	15.5	
1969-1971	10.0	M	79.6	42.7	58.4	60.9	51.9	39.0	13.3	22
		F	67.1	41.0	62.3	64.5	55.4	41.9	14.2	
Nicaragua										
1963	. . .	M	140.4	58.8	48.6	54.9	46.4	35.3	12.5	16
		F	122.4	55.5	53.2	59.0	50.4	38.1	15.1	
1971	14.8	F	113.9	65.8	54.9	61.1	52.5	40.1	14.4	23
Panama										
1960-1961	9.3	M	63.9	. . .	60.5	62.1	53.1	40.5	12.9	24, 5
		F	59.8	. . .	63.4	64.8	55.8	43.1	15.9	
1969-1971	7.5	M	56.7	33.4	63.5	64.6	55.6	42.1	13.3	25, 5
		F	45.0	32.2	66.3	66.6	57.5	43.8	14.9	
Temperate South America										
Argentina										
1946-1948	9.2	M	72.2	20.3	59.1	59.9	50.6	37.4	11.7	26, 5
		F	63.0	20.0	63.6	64.2	54.8	41.7	13.8	
1959-1961	8.7	M	59.2	12.6	63.7	63.5	53.9	40.2	12.9	26, 5
		F	51.0	12.8	69.5	69.2	59.5	45.5	15.5	
1969-1971		M	64.8	9.6	61.9	61.8	52.3	38.5	11.6	27, 5
		F	54.4	9.3	69.7	69.4	59.8	45.6	15.6	
Chile										
1952-1953	13.6	M	128.0	35.4	53.0	58.0	49.0	36.5	11.8	28, 5
		F	112.4	37.4	56.8	61.6	52.5	39.9	13.7	
1960-1961	12.4	M	122.2	29.2	54.4	59.2	50.0	37.1	11.7	28, 5
		F	107.2	29.5	59.9	64.2	54.9	41.6	13.8	
1969-1970	9.2	M	82.8	15.3	58.5	60.2	50.7	37.4	12.6	29, 5
		F	71.2	13.7	64.7	65.9	56.3	42.4	14.6	

TABLE VA.1 (*continued*)

Region, country and period	Crude death rates[a] (both sexes)	Sex	Probability of dying (1,000 $_nq_x$) between ages: 0 and 1 year	1 and 4 years	Life expectancy at ages: 0	5	15	30	65	Sources
Temperate South America (*cont.*)										
Uruguay										
1963-1964	9.1	M	50.6	5.7	65.5	64.4	54.7	40.7	12.8	2, 5
		F	41.7	5.2	71.6	70.1	60.3	46.0	15.7	
1974-1976	9.3	M	52.3	5.8	65.7	64.7	55.0	41.0	13.0	5, 30
		F	41.3	5.9	72.5	71.0	61.3	48.9	16.2	
Tropical South America										
Bolivia										
1975	17.2	M	169.0	94.0	46.5	56.5	48.3	37.3	12.7	31, 5
		F	156.0	68.0	51.1	59.7	51.3	39.7	13.8	
Brazil										
1950-1960	11.7	M	106.0	55.4	51.8	57.0	48.6	37.2	13.0	5, 32
		F	55.6	54.0	55.8	59.3	50.7	38.8	13.5	
1960-1970	9.9	M	79.1	50.1	57.1	60.2	51.5	39.4	13.7	5, 32
		F	59.7	38.3	61.3	62.7	53.8	41.1	13.9	
Colombia										
1963-1965	12.9	M	81.2	38.6	57.7	59.9	51.1	38.5	12.6	5, 16
		F	76.2	50.3	59.7	62.6	53.6	40.2	13.6	
1972-1974	13.0	M	82.6	41.1	57.1	59.8	50.8	38.0	11.5	33
		F	71.4	42.7	60.8	63.3	54.1	40.0	12.8	
Ecuador										
1973-1975	12.1	M	105.9	57.3	58.9	64.5	55.7	42.6	15.3	16
		F	97.3	62.2	60.5	66.2	57.5	44.3	16.1	
Guyana[e]										
1950-1952	13.5	M	90.4	. . .	53.2	55.3	46.1	33.0	9.2	1, 2
		F	75.3	. . .	56.3	57.9	48.7	36.2	11.7	
1959-1961	6.9	M	61.0	23.5	59.5	59.9	50.4	36.9	10.8	2
		F	53.2	20.6	63.7	63.6	54.0	40.6	13.9	
Paraguay										
1971-1972	. . .	M,F	66.1	30.8	63.5	65.1	55.9	42.7	16.1	16
Peru										
1970-1975	13.0	M	125.7	61.2	53.2	59.6	51.1	39.3	13.1	34
		F	102.9	50.7	57.0	61.8	53.0	40.8	13.8	
Suriname										
1963	7.8[f]	M	. . .	. . .	62.5	61.6	52.2	38.6	12.0	1, 12
		F	. . .	. . .	66.7	65.6	55.9	41.9	15.0	
Venezuela										
1961-1962	9.5	M	60.6	27.4	61.2	61.8	52.7	39.3	12.8	17, 5
		F	51.1	27.3	64.7	65.0	55.7	42.0	14.2	
1970-1972	7.1	M	56.0	. . .	64.9	65.1	55.7	41.7	14.2	35, 5
		F	46.0	. . .	68.4	68.2	58.7	44.5	15.3	

Sources:

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[a] Deaths per 1,000 population.

[b] Including also mortality experience of Martinique for which no separate life table values for 1951-1955 were calculated.

[c] Excluding deaths of infants dying before registration of birth.

[d] Life expectancy at birth for 1970 in life tables prepared by the United States Bureau of the Census is about one year lower.

[e] Excluding Amerindians.

[f] Deaths of Indian and Negro population living in tribes excluded but rates computed on total population.

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