COMPARATIVE STUDIES 15

INFANT AND CHILD MORTALITY

DHS Demographic and Health Surveys

MACRO INTERNATIONAL INC.

Infant and Child Mortality

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Preface

One of the most significant contributions of the DHS program is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries. The *DHS Comparative Studies* series examines these data across countries in a comparative framework, focusing on specific topics.

The objectives of the *DHS Comparative Studies* are: to describe similarities and differences between countries and regions, to highlight subgroups with specific needs, to provide information for policy formulation at the international level, and to examine individual country results in an international context. The comparative analysis of DHS data is carried out primarily by staff at the DHS headquarters in Calverton, Maryland. The topics covered in the series are selected by DHS staff in conjunction with the DHS Scientific Advisory Committee and USAID.

The reports in this series are based on a variable number of data sets that generally represent those countries for which data sets were available at the time the report was prepared. Each report provides detailed tables and graphs for countries in four regions: sub-Saharan Africa, Near East/North Africa, Asia, and Latin America/Caribbean. Survey-related issues such as questionnaire comparability, survey procedures, data quality, and methodological approaches are addressed in each report, as necessary. Where appropriate, data from previous survey programs, primarily the World Fertility Survey and the Contraceptive Prevalence Surveys, are used to evaluate trends over time.

As more surveys are conducted under the DHS program and additional data sets become available, some of the reports published early in the series will be updated.

It is hoped that the availability of comparable information for a large number of developing countries will have long-term usefulness for analysts and policymakers in the fields of international population and health.

Martin Vaessen
Project Director

Acknowledgments

1 Introduction

1.1 PURPOSE OF STUDY

The 41 surveys conducted as part of the World Fertility Survey (WFS) program between 1974 and 1982 made an enormous contribution to knowledge about childhood mortality levels, differentials, and determinants in the developing world. Major compendia of statistics from those surveys are found in the cross-national comparative reports prepared by one of the authors of this report (Rutstein, 1983; 1984). The current report provides another set of childhood mortality statistics for the 28 countries which participated in Phase I of the Demographic and Health Surveys (DHS) program.

Section 1 of this report describes the methodology used to collect mortality data in DHS surveys and to calculate mortality rates from the data. Section 2 presents statistics on the level of mortality for the period immediately preceding the surveys and on trends in mortality levels. Section 3 presents mortality differentials in terms of the demographic characteristics of children and mothers while Section 4 presents differentials in terms of the socio-economic characteristics of households. Section 5 summarizes the results of this analysis.

While the primary objective of this report is to provide a reference set of childhood mortality statistics to policymakers, program managers and researchers, it is hoped that its usefulness will extend beyond being a descriptive document. The report highlights factors that promote child survival as well as factors that are detrimental to it. Accordingly, the analysis may be helpful for identifying promising directions for health programs and for advancing the worldwide child survival effort.

1.2 SOURCES OF DATA

The data analyzed in this report were collected in 28 surveys carried out during Phase I of the DHS program. The countries surveyed and the years of data collection are as follows:

Sub-Saharan Africa

Botswana	1988
Burundi	1987
Ghana	1988
Kenya	1988/89
Liberia	1986
Mali	1987
Ondo State, Nigeria	1986/87
Senegal	1986
Sudan (North)	1989/90
Togo	1988
Uganda	1988/89
Zimbabwe	1988/89

Near East/North Africa

Egypt	1988/89
Morocco	1987
Tunisia	1988

Asia

Indonesia	1987
Sri Lanka	1987
Thailand	1987

Latin America/Caribbean

Bolivia	1989
Brazil	1986
Colombia	1986
Dominican Republic	1986
Ecuador	1987
El Salvador	1985
Guatemala	1987
Mexico	1987
Peru	1986
Trinidad and Tobago	1987

All of the surveys were national in scope with two exceptions: Sudan, where only the northern section of the country was surveyed and Ondo State, Nigeria. Northern Sudan contains about 74 percent of the national population but has cultural and demographic characteristics which differ from those of southern Sudan. Ondo State, located in southwestern Nigeria, contains approximately 5 percent of the population of Nigeria.

Summary mortality statistics for regions as well as country-specific estimates are presented in this report. The summary statistics are not fully representative of regional mortality levels, patterns, or differentials because not all countries were covered by the DHS surveys. Overall, the 28 surveys included in this report represent about 20 percent of births in the less developed countries of the world. If China and India are excluded, this figure increases to 36 percent. The 3 surveys in the Near East/North Africa region cover approximately 35 percent of the region's births while the 12 sub-Saharan surveys represent about 24 percent of that region's births. In the case of the Latin America/Caribbean region, the 10 DHS surveys represent 75 percent of the region's births. The 3 surveys in Asia represent only 9 percent of the region's births.

Since the surveys were all implemented between 1985 and 1990, the mortality statistics presented for various countries pertain to approximately the same time period.

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1.3 DESCRIPTION OF THE MORTALITY DATA

In the DHS surveys, women aged 15 to 49 are eligible to be respondents for the Individual Questionnaire. The data on infant and child mortality were collected in the reproduction section of the questionnaire. The section begins with a series of nine questions which are designed to determine the aggregate number of children ever born to a woman. The respondent is asked questions about the number of sons and the number of daughters living with her, living elsewhere and the number who have died. If the respondent reports no deceased children, she is asked if she ever had a birth which showed signs of life (breathing or crying) but survived for only a few days or hours.

Next, birth history data are collected, i.e., data specific to each live birth. Information is collected on the sex of the child, date of birth, survival status, age (for surviving children) or age at death (for deceased children).[1] Following the birth history, the interviewer checks the consistency of the aggregate data on children ever born and the birth history data. In 26 surveys, a complete birth history was obtained. In two surveys, the El Salvador and Ondo State surveys, a truncated birth history method was used and the collection of birth-specific data was limited to births in the five years preceding the survey.

The data on age at death require additional explanation. These data were collected either in days (for children dying within a month of birth), in months (for children dying after one month but before the second birthday) or in completed years (for deaths occurring after the second birthday).[2] With these data it is possible to use direct estimation procedures to calculate mortality rates by days or weeks of life for the neonatal period, by months through the first two years of life and by single year of age thereafter.

1.4 DATA QUALITY

Retrospective data of any kind are subject to errors arising from faulty respondent recall, and birth history data are particularly susceptible to several special problems. An analysis of the quality of DHS mortality data by the authors of this report is available elsewhere (Sullivan et al., 1990); thus, only the more salient aspects of data quality are reviewed here. Event omission—especially the omission of children who died, perhaps after surviving for only a few days or hours—is the data defect which can most seriously affect mortality estimates. This source of error is related to faulty respondent recall and, in some cultural settings, purposive underreporting of information associated with emotional events.

The completeness of reporting of deaths was investigated by applying an internal consistency test designed especially to detect underreporting of deaths in the neonatal period, the period in which underreporting is most likely to occur. Because internal consistency tests have limited power, about all that can be stated definitely is that evidence of *substantial* underreporting of events was not found. A comparison of DHS and WFS mortality estimates indicated underreporting of events in some DHS surveys for the period 10-15 years before the surveys. The implication is that caution is warranted when investigating trends in mortality data from DHS surveys since actual declines may be masked or understated by the observed data.

Respondent recall errors can also result in misreporting of date of birth and age at death of children. When considering the rates presented in this report, the reader should bear in mind that the effect on mortality estimates of misreporting date of birth or age at death is mitigated when rates are calculated for relatively broad age intervals and time periods. Rates for 5- or 10-year periods or for the age interval from birth to age five are little affected by misreporting errors. Rates for neonatal and infant mortality are potentially more susceptible to such error.

In addition to the problems of recall error for more distant retrospective periods, there are structural reasons for limiting mortality estimation to recent time periods. In DHS surveys, the oldest respondents are women aged 49. Thus, the birth history data for earlier and earlier time periods is restricted to births whose mothers were progressively younger and younger at the time of birth. It is known that the mother's age at birth affects a child's survival chances, so limiting the children under investigation to those born only to young mothers could bias mortality estimates. Additionally, birth history data are limited to the experience of children of surviving mothers, when, in fact, the children of nonsurviving mothers may be subject to greater than average mortality risk. The further back in time from the survey date, the greater the proportion of high-risk children who are not represented by birth history data. Accordingly, in this report, mortality rates are not presented for time periods more than 15 years prior to a survey and most rates pertain to time periods less than 10 years before a survey.

No adjustments to the observed data were made for the rates present in this report.

1.5 RATE CALCULATION

All mortality rates presented in this report except postneonatal mortality are probabilities of dying between two exact ages, e.g., between birth and exact age one year (the conventional infant mortality rate) or between exact ages one and five years (herein referred to as the child mortality rate). The rates presented are as follows:

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[1]Separate information is obtained for each live birth of a multiple birth.
[2]These procedures were followed in all countries except Mexico where children dying within a month of birth were recorded as deaths during the first month of life rather than in terms of days.

Under-five mortality	the probability of dying between birth and exact age five ($_5q_0$);
Infant mortality	the probability of dying between birth and exact age one ($_1q_0$);
Neonatal mortality	the probability of dying between birth and one month of age;
Postneonatal mortality[3]	the difference between neonatal mortality and infant mortality;
Child mortality	the probability of dying between exact ages one and five ($_4q_1$);
Early child mortality	the probability of dying between exact ages one and two ($_1q_1$);
Late child mortality	the probability of dying between exact ages two and five ($_3q_2$).

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[3]The conventional postneonatal mortality rate is not a mortality probability and is calculated by subtracting the neonatal mortality rate from the infant mortality rate. However, the rate closely approximates a probability measure.

The rates are period-specific and are based on deaths and children exposed to death at a particular age during a specific time period, e.g., the five-year period preceding the survey. However, the rates are not simple cohort rates but are synthetic cohort probabilities in which children born in somewhat different birth years contribute to the mortality experience of different subintervals of age. Thus, when calculating the child mortality rate for the five-year period preceding the survey, mortality rates for ages one, two, three and four years are based on the experience of birth cohorts of somewhat different earlier years. The overall child mortality is then estimated by multiplying together the rates for single years.

The advantage of the synthetic cohort approach is that mortality probabilities can be readily calculated for time periods close to the survey date. If the calculations were based on a simple cohort approach, child mortality rates could not be calculated for the birth cohorts born less than five years prior to the survey, because of the censoring of observations (children under age five) as of the date of data collection. A technical explanation of rate calculation is found in Appendix A.

2 Mortality Levels, Age Patterns and Time Trends

2.1 RECENT MORTALITY LEVELS

Table 2.1 presents estimated mortality rates for the five-year period preceding 28 DHS surveys.

Under-five mortality ($_5q_0$). The estimates of under-five mortality range from a high of 247 per 1,000 live births (Mali) to a low of 32 per 1,000 (Trinidad and Tobago). This represents a more than eight-fold differential in mortality levels. The range of variation is the same as that found for the 42 surveys of the World Fertility Survey (Rutstein, 1984).

As expected, the highest levels of mortality are found in the 12 sub-Saharan countries where under-five mortality ranges from 247 per 1,000 (Mali) to 53 per 1,000 (Botswana). Rates in excess of 100 per 1,000 were estimated for 9 countries and rates between 50 and 100 per 1,000 for 3 countries.

For the remaining 16 countries of the Near East/North Africa region, Asia and Latin America and the Caribbean, under-five mortality estimates are lower and span a narrower range, i.e., from 128 per 1,000 (Bolivia) to 32 per 1,000 (Trinidad and Tobago). Moreover, there is considerable overlap in the estimates for the three regions. Estimates in excess of 100 per 1,000 were made for 2 countries in the Near East/North Africa region (Egypt and Morocco) and 3 countries in Latin America (Bolivia, Guatemala and Peru). Estimates of less than 50 per 1,000 were observed for 2 Asian countries (Sri Lanka and Thailand) and 2 countries in the Latin America/Caribbean region (Colombia and Trinidad and Tobago).

Infant Mortality ($_1q_0$). Overall, the range of estimates of infant mortality is from 144 per 1,000 births (Liberia) to 25 per 1,000 (Sri Lanka). This differential in mortality level is on the order of 6 to 1 as opposed to the differential of 8 to 1 in the case of under-five mortality.

In terms of variation by region, infant mortality is similar to under-five mortality. Infant mortality estimates tend to be higher in sub-Saharan Africa; the highest estimates there are 144 (Liberia) and 105 per 1,000 (Mali). Estimates are distinctly lower for the countries in the Near East/North Africa region, Asia, and Latin America and the Caribbean. For these regions, the estimates range from 83 (Bolivia) to 25 per 1,000 (Sri Lanka).

Child mortality ($_4q_1$). In terms of child mortality, the range of estimates is from 159 per 1,000 (Mali) to 9 per 1,000 (Colombia, Sri Lanka, and Thailand) and 4 per 1,000 (Trinidad and Tobago). Even taking the estimate for Thailand as the lower boundary, the difference in estimates is on the order of 17 to 1 as opposed to 8 to 1 for under-five mortality and 6 to 1 for infant mortality. The differential variation in the magnitude of mortality rates by age interval is a reflection of the often observed phenomena that as under-five mortality declines, child mortality declines to a greater degree than infant mortality. The reason typically cited for this is that mortality in the 1-4 year age interval is primarily due to environmental factors—which are susceptible to control—while a large component of infant mortality is due to congenital and other causes which, particularly in developing countries, are less susceptible to control.

Neonatal and postneonatal mortality. There is considerable variation in the relative magnitude of neonatal and postneonatal mortality. The only discernable pattern is that at levels of infant mortality less than 50 per 1,000, neonatal mortality rates exceed postneonatal rates (Botswana, Colombia, Mexico, Sri Lanka, Thailand, Trinidad and Tobago and Zimbabwe). At levels of infant mortality above 50 per 1,000, the relationship is less predictable.

Early child ($_1q_1$) and late child ($_3q_2$) mortality. Mortality rates for the early and late components of child mortality are also shown in Table 2.1. The relative magnitude of the rates display a consistent pattern in a number of countries. For the sub-Saharan countries in which the level of child mortality ($_4q_1$) exceeds 50 per 1,000, late child mortality is greater than early child mortality by a substantial margin, with the exception of Liberia. In almost all other countries early child mortality exceeds late child mortality, often by a considerable margin. This finding has implications for the next section of this paper where the focus is on age patterns of mortality.

2.2 MORTALITY AGE PATTERNS

This section examines the patterns of mortality in childhood by age and, in particular, the relationship between infant ($_1q_0$) and child ($_4q_1$) mortality. The mortality age patterns in model life tables are used for comparative purposes. This raises the issue of the extent to which model life tables reflect mortality conditions in ac-

Table 2.1 Infant and child mortality rates for the 5-year period preceding the survey

Infant and child mortality for the period 0-4 years preceding the survey and the child/under-five ratio, Demographic and Health Surveys, 1985-1990

Country	Year of survey	Under-five mortality $(_5q_0)$	Infant mortality $(_1q_0)$	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Child mortality $(_4q_1)$	Early child mortality $(_1q_1)$	Late child mortality/ $(_3q_2)$	$(_4q_1)/(_5q_0)$ ratio
SUB-SAHARAN AFRICA									
Mali	1987	247.0	105.1	51.1	54.0	158.6	56.2	108.5	0.64
Liberia	1986	222.5	144.3	67.9	76.4	91.4	49.1	44.5	0.41
Senegal	1986	194.6	87.8	45.8	42.0	117.0	44.7	75.8	0.60
Uganda	1988/89	176.8	98.3	43.0	55.3	87.1	38.4	50.7	0.49
Ghana	1988	154.7	77.2	43.3	33.9	84.0	29.7	56.0	0.54
Togo	1988	154.6	77.3	39.7	37.6	83.8	27.7	57.7	0.54
Burundi	1987	152.3	73.7	35.2	38.5	84.9	27.7	58.8	0.56
Sudan (North)	1989/90	123.7	70.0	43.8	26.1	57.8	25.1	33.5	0.47
Ondo State, Nigeria	1986/87	110.8	58.3	26.3	31.9	55.8	19.2	37.3	0.50
Kenya	1988	89.7	60.7	27.7	33.0	30.9	14.1	17.0	0.34
Zimbabwe	1988/89	70.6	49.1	26.6	22.5	22.7	13.1	9.7	0.32
Botswana	1988	52.6	38.4	22.5	15.9	14.7	10.2	4.6	0.28
NEAR EAST/ NORTH AFRICA									
Morocco	1987	103.0	74.2	41.5	32.7	31.1	17.2	14.1	0.30
Egypt	1988/89	101.8	73.2	38.3	34.9	30.9	15.9	15.3	0.30
Tunisia	1988	61.8	48.0	26.2	21.9	14.4	5.3	9.2	0.23
ASIA									
Indonesia	1987	98.1	67.4	27.2	40.3	32.9	13.2	20.0	0.34
Thailand	1987	44.0	35.2	20.2	15.0	9.1	4.7	4.5	0.21
Sri Lanka	1987	34.0	24.7	16.3	8.4	9.5	2.2	7.3	0.28
LATIN AMERICA/ CARIBBEAN									
Bolivia	1989	128.3	82.9	35.6	47.3	49.5	32.1	18.0	0.39
Peru	1986	110.2	75.1	34.6	40.4	38.0	20.4	17.9	0.34
Guatemala	1987	109.1	72.7	33.1	39.6	39.3	21.1	18.6	0.36
Dominican Republic	1986	88.2	67.4	39.9	27.5	22.4	12.2	10.3	0.25
El Salvador	1985	85.4	67.1	27.3	39.8	19.6	12.1	7.6	0.23
Brazil	1986	83.2	73.2	33.1	40.1	10.7	5.8	4.9	0.13
Ecuador	1987	80.9	57.2	35.4	21.8	25.1	14.1	11.2	0.31
Mexico	1987	61.4	47.4	26.9	20.6	14.7	9.4	5.4	0.24
Colombia	1986	41.2	32.3	18.9	13.4	9.2	4.7	4.6	0.22
Trinidad & Tobago	1987	31.6	28.0	22.9	5.1	3.7	2.6	1.1	0.12

Under-five mortality: the probability of dying between birth and the fifth birthday

Infant mortality: the probability of dying between birth and the first birthday

Neonatal mortality: the probability of dying between birth and one month of age

Postneonatal mortality: the difference between infant and neonatal mortality

Child mortality: the probability of dying between the first and fifth birthday

Early child mortality: the probability of dying between the first and second birthday

Late child mortality: the probability of dying between the second and fifth birthday

tual populations. The issue is important because of the extensive use of model life tables for analytic purposes (e.g., for assessing the quality of mortality data and for developing indirect techniques of mortality estimation). Only to the extent that model life tables represent actual mortality patterns is their use for analytic purposes justified.

The development of model life table systems is made possible by the fact that mortality rates follow a regular age pattern; being relatively high in infancy, declining in the early childhood years through age 10 or so and then taking on increasing values with increasing age. This general pattern is observed in all populations, although there are differences in the precise configuration of mortality schedules depending on the level and the cause structure of mortality.

The Regional Model Life Tables (Coale and Demeny, 1966) are used as the standard against which the mortality rates in DHS surveys are compared. The Regional Model Life Tables consist of four single-parameter model life table systems: one system with an average or general mortality pattern (the West model) and three systems with distinctive mortality patterns (the North, East, and South models).[4]

The relationship between infant and child mortality can be indexed in a number ways. We have chosen the ratio $_4q_1$ to $_5q_0$, which has the property of approximating the proportion of under-five deaths which occur between exact ages one and five. Figure 2.1 shows values for this ratio for the Regional Model Life Tables. Values of the ratio are least for the East mortality pattern, intermediate for the West pattern, and greatest for the North pattern. Values of the ratio for the South pattern are relatively low at low levels of mortality and relatively high at high levels of mortality. The greatest value of the ratio is .51 at a level of under-five mortality of 300 per 1,000.

The question of interest here is: How well do the Regional Model Life Tables represent observed values of $_4q_1/_5q_0$? Panel A of Figure 2.2 shows the values of $_4q_1/_5q_0$ observed for 16 countries in the Near East/North Africa region, Asia, and Latin America and the Caribbean. The country-specific values for all but two of the surveys (Brazil and Sri Lanka) fall within the boundary values of the Regional Model Life Tables. For the majority of these countries a model system can be selected which fits the observed age pattern.

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[4]In a study of the relationship between infant and child mortality rates (United Nations, 1990), two sets of model life tables, those for the Regional Model Life Tables and those from the Model Life Tables for Developing Countries (United Nations, 1982), were used. For reasons of economy, only the Regional Model Life Tables are used here. However, the principal conclusion would be the same if comparison with the United Nations Model Tables had been included. The reason for this is that the variation in the age pattern of mortality under age five is about the same for the Coale and Demeny tables and the United Nations tables. The similarity between the two sets of model life tables is described elsewhere (United Nations, 1990; 1992).

Figure 2.1 Values of the ratio $_4q_1/_5q_0$ for the Regional Model Life Tables, Demographic and Health Surveys, 1985-1990
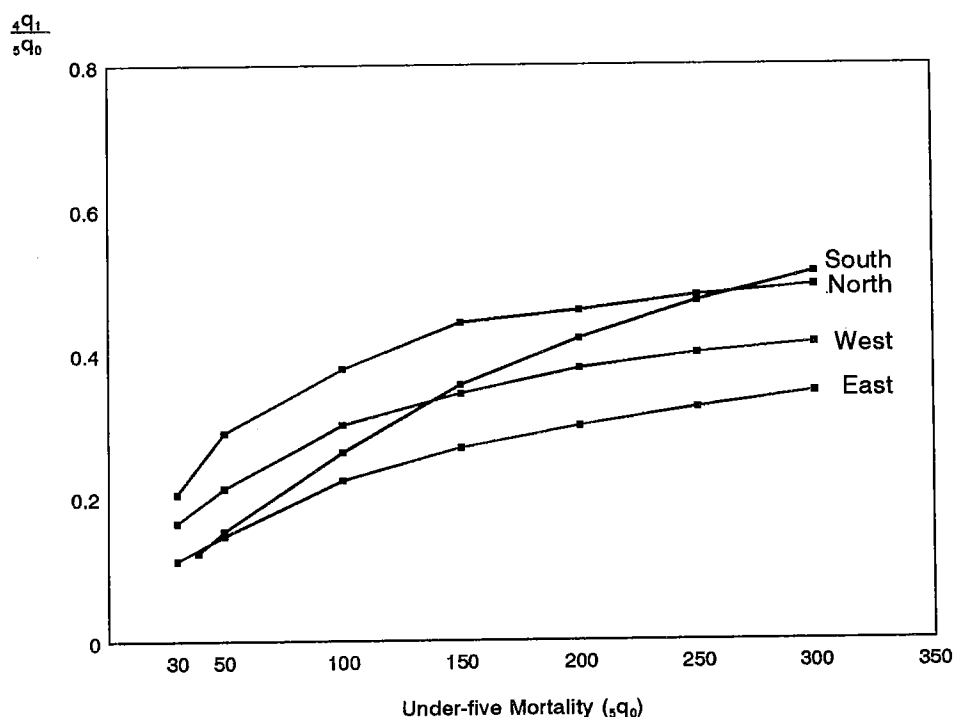
Figure 2.2 Comparison of $_4q_1/_5q_0$ values from DHS-I surveys with the range of values from Regional Model Life Tables, Demographic and Health Surveys, 1985-1990

PANEL A
Countries outside Sub-Saharan Africa

$\frac{_4q_1}{_5q_0}$

Under-five Mortality ($_5q_0$)

PANEL B
Countries of Sub-Saharan Africa

$\frac{_4q_1}{_5q_0}$

Under-five Mortality ($_5q_0$)
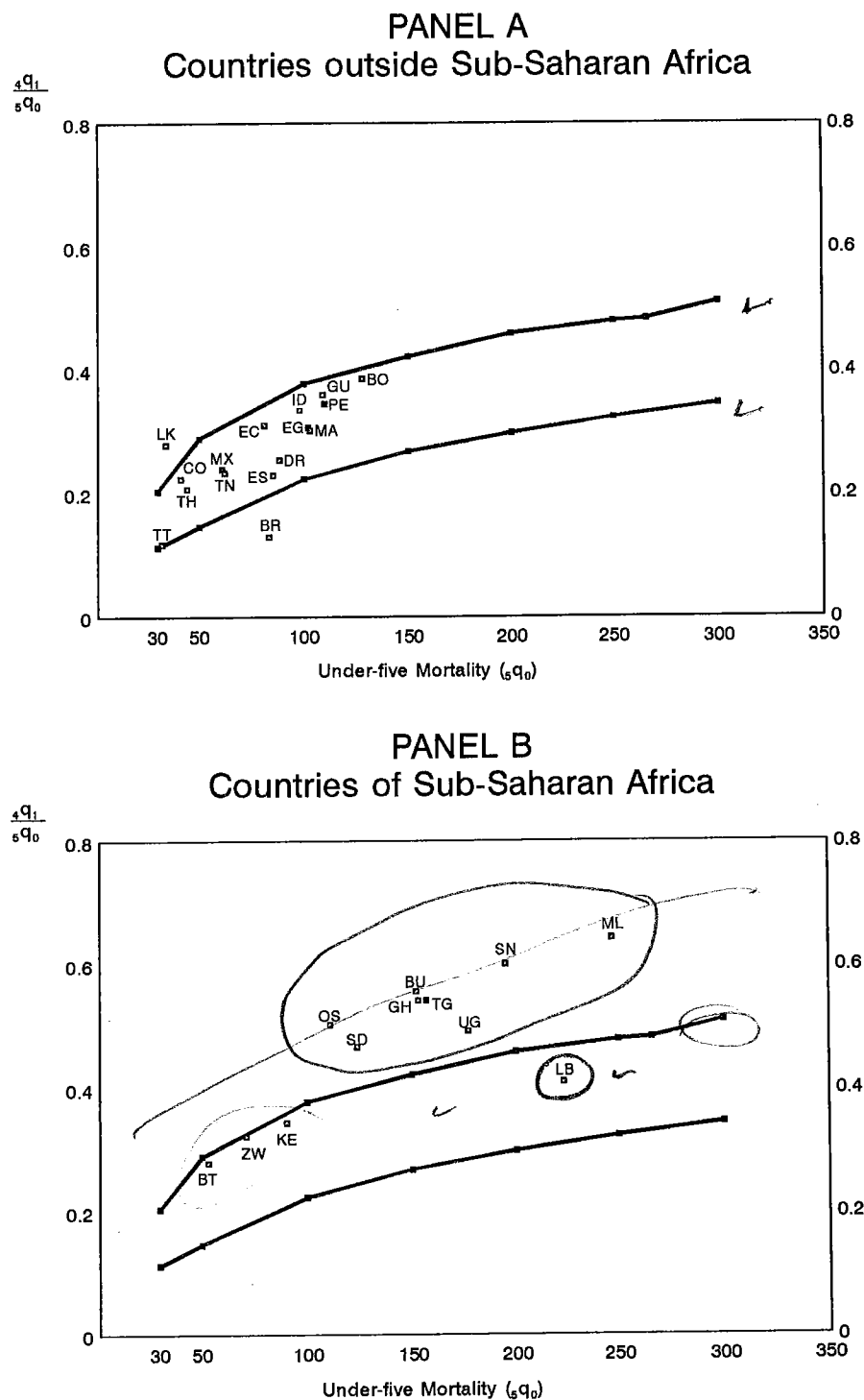
SYMBOLS: **Panel A** - BO (Bolivia), BR (Brazil), CO (Colombia), DR (Dominican Republic), EC (Ecuador), EG (Egypt), ES (El Salvador), GU (Guatemala), ID (Indonesia), LK (Sri Lanka), MA (Morocco), MX (Mexico), PE (Peru), TH (Thailand), TN (Tunisia), TT (Trinidad and Tobado); **Panel B** - BT (Botswana), BU (Burundi), GH (Ghana), KE (Kenya), LB (Liberia), ML (Mali), OS (Ondo State, Nigeria), SD (Sudan [North]), SN (Senegal), TG (Togo), UG (Uganda), ZW (Zimbabwe).

For the 12 countries of sub-Saharan Africa, the situation is quite different. Panel B of Figure 2.2 shows that for the three countries with relatively low mortality (Botswana, Kenya and Zimbabwe), the observed values of the ratio lie within the boundary values of the Regional Model Life Tables. But for eight of the nine remaining countries—all high mortality countries—values of the ratio lie above the upper boundary value of the Regional Model Life Tables.

The finding of high concentrations of deaths in the age interval 1-4 in sub-Saharan Africa is not new. Relatively high child mortality has been documented in multiround surveys conducted at the national level in Senegal in 1970-71 and 1978-79. In those surveys, at levels of under-five mortality of around 275 per 1,000, values for the ratio $_4q_1/_5q_0$ were found to be .67 and .62 (Cantrelle et al., 1986). These results are supported by in-depth studies in the Ngayokheme area of Senegal where, at levels of under-five mortality in excess of 350 per 1,000, values of .72 and .68, were found (Cantrelle et al., 1986). Additionally, the WFS surveys of the 1970s and early 1980s found high values for this ratio in sub-Saharan countries. In all but one of nine WFS surveys, the ratio $_4q_1/_5q_0$ exceeds the comparable value from the North Model Tables.[5] Finally, similar results have been found for surveys conducted in Phase II of the DHS program. Currently, DHS data are published for nine such surveys and, in all but two, the ratio of $_4q_1/_5q_0$ exceeds the comparable values from the North Model Life Tables.[6]

It is very unlikely that high concentrations of deaths between the ages of 1 and 5 reported earlier are the result of data defects. Underreporting of neonatal deaths and misreporting of late infant deaths as deaths at age one would erroneously inflate the index $_4q_1/_5q_0$. While such errors no doubt occurred, there are several reasons for believing that the observed age patterns are not primarily the result of such errors. First, in the case of Senegal, this pattern has been found in studies employing very different data collection methodologies (multiround surveys, retrospective birth histories,

and in-depth panel studies). Second, as shown in Table 2.1, for many of the countries of sub-Saharan Africa relatively high mortality extends into the late child age interval ($_3q_2$) rather than being limited to age one ($_1q_1$) as would result from the misreporting of late infant deaths as death at age one. Appendix B pursues this issue by investigating the degree to which misreporting age at death could be responsible for the high values of the ratio $_4q_1/_5q_0$ and concludes that it can not. Third, a detailed analysis of the reported symptoms of deceased children for the Ngayokheme area of Senegal substantiates the validity of the observed age pattern. In particular, Garenne has shown that the high mortality rates which were observed in the age interval 6-17 months were associated with fever and malaria and that the high rates in the age interval 18-35 months were associated with diarrhea and measles. The latter symptoms are consistent with an increased exposure to environment risks following weaning, an event which occurred on average at the age of 24 months in the area under study (Cantrelle et al., 1986).

An important aspect of the finding that many countries of sub-Saharan African are not represented by the Regional Model Life Tables is that those countries are not marginal outliers. In the case of four countries (Burundi, Mali, Ondo State and Senegal), the observed values of $_4q_1/_5q_0$ exceed comparable values from the North Model Life Tables by more than 30 percent. For the countries of the sub-Saharan region, this assessment of the coverage of model life table systems is considerably less optimistic than an earlier assessment conducted by the United Nations (United Nations, 1990). This is particularly unfortunate since sub-Saharan Africa is the region of the world where demographic data are most lacking and where analytic tools such as model life tables are most needed.

2.3 TIME TRENDS IN MORTALITY

In this section rates are presented for three 5-year periods preceding the surveys. Since all fieldwork for the surveys was conducted between 1985 and 1990, the 5-year rates pertain to the period from about the mid-1970s (10-14 years preceding the surveys) to about the mid-1980s (0-4 years preceding the surveys).

There are several limitations to using the DHS data for documenting trends in mortality. The first concerns the quality of the data for the various time periods preceding the surveys. In general, data for the earlier time periods are likely to be of lower quality because of the longer periods over which respondents must recall events. Event omission and misreporting of date of birth and age at death for deceased children are all more likely for longer recall periods. Analysis of the quality of DHS mortality data for the period 10-14 years before the surveys has found evidence of event underreporting for the surveys in Colombia, Indonesia, Kenya, Sri Lanka, and Thailand (Brass and Jolly, 1993; Sullivan et al., 1990).

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[5]As part of the World Fertility Survey program, surveys were conducted in Benin, Cameroon, Cote d'Iviore, Ghana, Kenya, Mauritania, Nigeria, Senegal, and Sudan. Only in Cote d'Ivoire was the concentration of deaths in the child ages less than is predicted by the North mortality pattern (Rutstein, 1984).

[6]DHS Phase II survey results are now available for Burkina Faso, Cameroon, Malawi, Namibia, Niger, Nigeria, Rwanda, Tanzania and Zambia. The concentration of deaths in the child ages was greater than is predicted by the North Model Life Tables except for Namibia and Tanzania. The case of Niger is particularly noteworthy. At a level of under-five mortality of 318 per 1,000, the value of the ratio of child deaths to deaths under age five was .70 (i.e., about the same value as was found for Senegal in studies which first called attention to the extraordinarily high concentration of under-five deaths between the ages of 1 and 5).

For those countries, estimates of the decline in mortality based on DHS data are considered minimum estimates.

Mortality declines 10-14 to 0-4 years before the survey. Table 2.2 shows mortality rates for 26 countries for three 5-year periods preceding the survey; i.e., for the periods 10-14, 5-9, and 0-4 years before each survey.[7] The average percentage decline in mortality between the periods 10-14 and 0-4 years preceding the survey by region and for all countries combined is presented in the table below:

Region	No. of countries	Under-five mortality	Infant mortality	Child mortality
Sub-Saharan Africa	11	-22%	-20%	-27%
Near East/North Africa	3	-43%	-35%	-59%
Asia	3	-33%	-29%	-40%
Latin America/Caribbean	9	-31%	-27%	-43%
All countries combined	26	-29%	-25%	-38%

For all 26 countries combined, the average mortality decline was 29 percent for under-five mortality, 25 percent for infant mortality and 38 percent for child mortality. These declines are quite substantial and equate to average declines during the period under consideration of approximately 3.0, 2.5, and 3.8 percent per annum.

Mortality declines were also found in each region, although important differences exist between regions. In terms of under-five mortality, the decline was greatest for the countries of the Near East/North Africa region (43 percent), somewhat less for Asia and the Latin America/Caribbean region (33 and 31 percent,

respectively) and distinctly less for sub-Saharan Africa (22 percent). In terms of infant and child mortality, the regional pattern is the same, with the largest declines in the Near East and North Africa and the smallest declines in sub-Saharan Africa. So, at least for the countries under consideration, the region in which mortality was highest in the earlier time period was also the region in which there was least success in reducing mortality during the 15-year period.

It is worth noting that, as expected, for all countries combined percentage decline of child mortality (38 percent) was greater than that of infant mortality (25 percent). The same pattern holds for the declines in each region.

In two countries, Egypt and Colombia, the decline in under-five mortality was on the order of 50 percent. The experience of Egypt is also notable because of the absolute magnitude of the decline; i.e., from 204 to 102 per 1,000. Other countries with declines on the order of 40 percent were Ecuador, Morocco, Sri Lanka, Trinidad and Tobago and Tunisia. In all of these countries, child mortality declines were greater than those of infant mortality. Child mortality declines were 60 percent or greater in Brazil, Colombia and Egypt and 50 percent or greater in Morocco, Sri Lanka, Trinidad and Tobago and Tunisia.

Mortality changes in successive five-year periods. In general the mortality estimates for the three 5-year periods preceding the survey show a consistent trend. In the case of under-five mortality the only departure from a declining trend between the periods 10-14 and 5-9 years preceding the survey occurs in Uganda, Zimbabwe and Sudan. For infant and child mortality, the trend across the three periods is also quite consistent. The only increases of note are for Uganda and Zimbabwe (infant mortality increases of about 10 points between 10-14 and 5-9 years before the surveys) and Ghana (child mortality increases by 10 points between the periods 5-9 and 0-4 years before the survey). In the case of Uganda, the high mortality rates for the period 5-9 years before the survey (1978-82) result from the deterioration of the health infrastructure during the period of civil unrest (1973-82) and, no doubt, reflect setbacks in child survival efforts (Kaijuka et al., 1989).

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[7]Rates for Ondo State and El Salvador are not shown because the data necessary for calculating the rates for the two earlier time periods were not collected.

Table 2.2 Infant and child mortality rates for the 15 years preceding the survey

Infant and child mortality for three 5-year periods preceding the survey, and the percent of change, Demographic and Health Surveys, 1986-1990

Country	Under-five mortality (deaths per 1,000 births)				Infant mortality (deaths per 1,000 births)				Child mortality (deaths per 1,000)			
	Years before survey			Percent change	Years before survey			Percent change	Years before survey			Percent change
	10-14	5-9	0-4		10-14	5-9	0-4		10-14	5-9	0-4	
SUB-SAHARAN AFRICA												
Mali	355.6	310.4	247.0	-31	168.6	156.3	105.1	-38	225.0	182.7	158.6	-30
Liberia	266.4	240.6	222.5	-16	186.0	161.9	144.3	-22	98.7	93.9	91.4	-7
Senegal	279.9	230.5	194.6	-30	113.1	94.3	87.8	-22	188.1	150.4	117.0	-38
Uganda	186.5	199.8	176.8	-5	96.2	115.5	98.3	2	99.9	95.3	87.1	-13
Ghana	183.0	152.5	154.7	-15	98.5	85.3	77.2	-22	93.7	73.5	84.0	-10
Togo	197.7	165.1	154.6	-22	101.7	91.3	77.3	-24	106.9	81.3	83.8	-22
Burundi	232.9	223.5	152.3	-35	104.4	99.8	73.7	-29	143.5	137.4	84.9	-41
Sudan (North)	143.8	146.1	123.7	-14	80.1	84.0	70.0	-13	69.3	67.7	57.8	-17
Kenya	105.5	92.9	89.7	-15	64.4	56.6	60.7	-6	44.0	38.4	30.9	-30
Zimbabwe	91.8	101.0	70.6	-23	54.7	64.4	49.1	-10	39.2	39.1	22.7	-42
Botswana	83.3	58.3	52.6	-37	56.2	38.8	38.4	-32	28.7	20.3	14.7	-49
Average				-22				-20				-27
NEAR EAST/ NORTH AFRICA												
Morocco	167.8	130.7	103.0	-39	106.4	89.1	74.2	-30	68.7	45.8	31.1	-55
Egypt	204.9	164.0	101.8	-50	125.5	114.7	73.2	-42	90.8	55.7	30.9	-66
Tunisia	101.0	85.4	61.8	-39	71.0	63.4	48.0	-32	32.3	23.5	14.4	-55
Average				-43				-35				-59
ASIA												
Indonesia	129.5	121.8	98.1	-24	81.4	80.4	67.4	-17	52.4	45.0	32.9	-37
Thailand	66.2	53.6	44.0	-33	53.5	41.3	35.2	-34	13.4	12.8	9.1	-32
Sri Lanka	57.3	50.4	34.0	-41	38.4	39.9	24.7	-36	19.7	11.0	9.5	-52
Average				-33				-29				-40
LATIN AMERICA/ CARIBBEAN												
Bolivia	159.3	152.9	128.3	-19	96.2	99.3	82.9	-14	69.8	59.5	49.5	-29
Peru	133.2	119.4	110.2	-17	86.6	83.2	75.1	-13	51.0	39.5	38.0	-26
Guatemala	149.0	132.8	109.1	-27	88.8	86.3	72.7	-18	66.1	50.9	39.3	-41
Dominican Republic	114.3	96.4	88.2	-23	77.9	73.2	67.4	-14	39.4	25.1	22.4	-43
Brazil	128.0	110.8	83.2	-35	104.0	95.8	73.2	-30	26.7	16.6	10.7	-60
Ecuador	132.5	98.7	80.9	-39	93.1	73.3	57.2	-39	43.4	27.5	25.1	-42
Mexico	88.5	81.4	61.4	-31	68.5	65.9	47.4	-31	21.4	16.7	14.7	-31
Colombia	85.4	59.2	41.2	-52	57.8	45.2	32.3	-44	29.3	14.6	9.2	-68
Trinidad & Tobago	52.8	36.3	31.6	-40	45.7	33.4	28.0	-39	7.4	3.1	3.7	-50
Average				-31				-27				-43
All countries				-29				-25				-38

3 Demographic Differentials

Previous demographic studies have shown the important influence of certain demographic factors on rates of childhood mortality. This section examines the role of five such variables on differential mortality: sex of the child, multiplicity of birth (singleton or twin), order of birth, age of the mother at birth, and length of preceding interbirth interval. It is generally accepted that the demonstrated associations between each of these factors and mortality risk operate through both behavioral and biological mechanisms. Further, it is also well established that the behavioral factors take on a more significant role and biological factors (at birth) take on a less significant role with increasing age of the child. The interpretation of these associations is thus facilitated by examination of the relative strength of the associations across age groups.

In addition to under-five and infant mortality, this analysis examines differences in covariate effects across three key under-five age segments: the *neonatal period,* when the effects of the demographic variable on pregnancy outcome per se (low birth weight, birth trauma, complications at birth, and heritable factors) are expected to be demonstrated; the *postneonatal period,* when children are becoming increasingly sensitive to changing nutritional inputs and environmental exposure to disease agents; and the *12-59 month period,* when environmental conditions and preventive and curative health interventions play predominant roles in the maintenance of good health and survival.

It should be emphasized that the following comparative analysis focuses only on bivariate relationships. The aim is to evaluate the relative strength and consistency of associations between commonly available demographic variables and childhood mortality. It does leave unanswered important questions concerning the causal nature of observed associations, which is beyond the scope of this report.

In order to examine results based on as many births as possible while minimizing problems of truncation bias, this analysis considers only children exposed during the 0-9 years before the interview. Even following this procedure, for certain covariate categories the number of observations for individual surveys is still very small; rates based on less than 500 cases are flagged. In addition to rates, risk ratios are presented. A risk ratio (or relative risk) is defined here simply as the ratio of the mortality rate in one risk category to the rate in a specified reference category.

In order to examine the relationship between the mortality level of a country and the strength of bivariate relationships, countries are listed within region by descending order of under-five mortality. For sub-Saharan Africa and the Latin America/Car-

ibbean region, the analysis includes sufficient countries to support regional generalizations. This is not true for Asia and the Near East/North Africa region. Therefore, a summary of regional effects, by way of median relative risks, is presented graphically for these two regions (see Figures 3.1-3.5) and in tabular format for the two regions and for all 28 countries combined (see Table 3.6).

3.1 SEX OF THE CHILD

In general, males have higher mortality at all ages of childhood than females. Exceptions to this apparent genetically-determined pattern are seen when behavioral factors favor the health and survival of male children.

Table 3.1 shows this pattern as captured in the DHS data. Taking all countries together, under-five mortality is 11 percent higher among males than females (i.e., median of 11 percent excess risk). Excess male mortality is most pronounced in the first month of life (31 percent), diminishes during the postneonatal period (6 percent), and disappears altogether during the 12-59 month period.

No clear regional patterns exists, but the countries of the Latin America/Caribbean and Near East/North Africa regions tend to have a slight excess of female mortality after the first birthday. Egypt is notable in this regard; after the neonatal period, female deaths exceed male deaths by some 20 percent. For most of these countries, however, the size of the excess female risk is small and, in the case of the Latin America/Caribbean region (where postneonatal male risk is higher), could be explained by differential age at death misreporting (i.e., greater heaping at 12 months of age for female deaths).

Figure 3.1 shows only small differences between sub-Saharan Africa and Latin America and the Caribbean in gender-related mortality. The higher excess male risk during the neonatal period in sub-Saharan Africa may be associated with the generally poorer access to high quality maternity services in that region.

3.2 MULTIPLICITY OF BIRTH

Children from multiple births—twins, triplets, etc.—experience much higher mortality than single births (Pison, van de Walle, and Sala-Diakanda, 1989). Mortality is especially high for children from multiple births during the neonatal period. Important mediating factors include low birth weight, complications before and at birth, and competition for time and material resources

Table 3.1 Childhood mortality rates and the relative risk of dying by sex of child

Childhood mortality and the relative risk of dying by sex of the child, Demographic and Health Surveys, 1985-1990

Country	Sex of child	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five-mortality ($_5q_0$)	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
SUB-SAHARAN AFRICA											
Mali	M	78.7	57.9	136.7	166.9	280.7	1.33	0.87	1.09	0.97	1.02
	F	59.0	66.5	125.5	172.0	275.9	1.00	1.00	1.00	1.00	1.00
Liberia	M	77.3	91.6	168.9	90.9	244.5	1.21	1.28	1.25	0.97	1.13
	F	63.7	71.7	135.4	93.9	216.6	1.00	1.00	1.00	1.00	1.00
Senegal	M	53.7	45.0	98.6	132.0	217.6	1.26	1.11	1.19	1.01	1.07
	F	42.4	40.5	82.9	131.1	203.1	1.00	1.00	1.00	1.00	1.00
Uganda	M	54.0	57.3	111.3	95.8	196.4	1.24	1.00	1.11	1.12	1.11
	F	43.5	57.2	100.6	85.7	177.7	1.00	1.00	1.00	1.00	1.00
Ghana	M	55.4	33.4	88.9	79.2	161.0	1.45	0.98	1.23	1.00	1.10
	F	38.3	34.3	72.5	79.4	146.2	1.00	1.00	1.00	1.00	1.00
Togo	M	50.9	37.6	88.5	74.5	156.4	1.29	0.94	1.12	0.82	0.96
	F	39.3	39.9	79.3	91.2	163.3	1.00	1.00	1.00	1.00	1.00
Burundi	M	45.3	51.9	97.1	101.7	189.0	1.43	1.22	1.31	0.91	1.06
	F	31.6	42.7	74.3	111.9	177.8	1.00	1.00	1.00	1.00	1.00
Sudan (North)	M	50.1	33.5	83.7	62.3	140.7	1.42	0.96	1.19	0.99	1.09
	F	35.3	35.0	70.3	63.0	128.9	1.00	1.00	1.00	1.00	1.00
Ondo State, Nigeria	M	33.2	29.5	62.8	55.4	114.7	1.41	0.95	1.15	1.08	1.11
	F	23.5	31.0	54.5	51.4	103.1	1.00	1.00	1.00	1.00	1.00
Kenya	M	28.9	34.5	63.4	35.5	96.6	1.35	1.06	1.17	1.07	1.13
	F	21.4	32.6	54.1	33.2	85.5	1.00	1.00	1.00	1.00	1.00
Zimbabwe	M	34.9	28.3	63.3	29.2	90.6	1.36	1.19	1.28	0.95	1.15
	F	25.6	23.9	49.5	30.8	78.8	1.00	1.00	1.00	1.00	1.00
Botswana	M	29.9	16.5	46.4	18.4	63.9	2.07	0.99	1.49	1.14	1.37
	F	14.4	16.6	31.0	16.2	46.8	1.00	1.00	1.00	1.00	1.00
NEAR EAST/ NORTH AFRICA											
Morocco	M	46.4	36.3	82.8	38.0	117.6	1.06	0.99	1.03	0.99	1.02
	F	43.8	36.7	80.6	38.2	115.7	1.00	1.00	1.00	1.00	1.00
Egypt	M	51.4	42.4	93.7	38.2	128.4	1.24	0.83	1.01	0.82	0.95
	F	41.4	51.0	92.4	46.8	135.0	1.00	1.00	1.00	1.00	1.00
Tunisia	M	31.6	24.7	56.3	18.1	73.3	1.22	0.86	1.03	0.94	1.01
	F	26.0	28.8	54.7	19.3	73.0	1.00	1.00	1.00	1.00	1.00

Table 3.1—*Continued*

Country	Sex of child	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
ASIA											
Indonesia	M	39.9	44.2	84.1	36.6	117.7	1.38	1.27	1.32	0.89	1.15
	F	28.9	34.8	63.8	41.3	102.4	1.00	1.00	1.00	1.00	1.00
Thailand	M	28.4	17.2	45.6	10.5	55.6	1.48	1.46	1.47	0.92	1.32
	F	19.2	11.7	30.9	11.5	42.1	1.00	1.00	1.00	1.00	1.00
Sri Lanka	M	26.1	13.5	39.6	10.4	49.5	1.74	1.36	1.59	1.03	1.43
	F	15.0	9.9	24.9	10.1	34.7	1.00	1.00	1.00	1.00	1.00
LATIN AMERICA/ CARIBBEAN											
Bolivia	M	45.5	54.6	100.1	53.9	148.6	1.26	1.19	1.22	0.98	1.12
	F	36.0	45.8	81.8	55.1	132.4	1.00	1.00	1.00	1.00	1.00
Peru	M	37.4	45.8	83.2	36.4	116.6	1.19	1.06	1.11	0.89	1.03
	F	31.5	43.3	74.8	41.0	112.8	1.00	1.00	1.00	1.00	1.00
Guatemala	M	42.4	47.1	89.5	43.5	129.1	1.41	1.22	1.31	0.96	1.16
	F	30.1	38.5	68.5	45.5	110.9	1.00	1.00	1.00	1.00	1.00
Dominican Republic	M	45.0	34.1	79.0	22.4	99.7	1.29	1.30	1.30	0.90	1.18
	F	34.8	26.2	61.0	24.9	84.4	1.00	1.00	1.00	1.00	1.00
El Salvador	M	43.7	37.4	81.1	16.6	96.3	1.60	1.15	1.36	0.89	1.25
	F	27.3	32.5	59.7	18.7	77.4	1.00	1.00	1.00	1.00	1.00
Brazil	M	41.2	56.1	97.3	13.3	109.2	1.35	1.42	1.39	0.99	1.32
	F	30.5	39.6	70.1	13.4	82.6	1.00	1.00	1.00	1.00	1.00
Ecuador	M	43.4	27.1	70.4	25.4	94.0	1.38	0.96	1.18	0.94	1.10
	F	31.4	28.3	59.7	27.1	85.2	1.00	1.00	1.00	1.00	1.00
Mexico	M	32.7	27.7	60.4	14.6	74.2	1.24	1.07	1.15	0.88	1.09
	F	26.4	26.0	52.4	16.7	68.2	1.00	1.00	1.00	1.00	1.00
Colombia	M	22.2	18.7	40.8	13.0	53.3	1.19	1.05	1.12	1.24	1.15
	F	18.6	17.9	36.4	10.5	46.5	1.00	1.00	1.00	1.00	1.00
Trinidad & Tobago	M	22.8	5.6	28.4	3.2	31.5	0.98	0.59	0.87	0.91	0.87
	F	23.2	9.6	32.8	3.6	36.2	1.00	1.00	1.00	1.00	1.00

after birth. Twinning is a relatively rare event—about 2 percent of births in the last 10 years among all countries studied here were twin births. Consequently, only one survey (Egypt) yielded as many as 500 twins born during this time frame, making country-specific analysis of mortality differentials problematic. Nonetheless, the strength and consistency of the relationship are compelling enough to warrant cautious interpretation of the findings.

Table 3.2 presents age-specific rates of mortality for single births and twins. Among all countries, twins are five times as likely to die during the neonatal period as singletons; 2.5 times as likely during the postneonatal period, and 1.5 times as likely during the 12-59 month age period. Rutstein (1984) found a relative risk of infant death (twin to single birth) of 3.95 using WFS data from 41 countries, compared with 3.74 for the 28 countries examined here (data not shown).

Figure 3.1 Relative risk of dying associated with sex of child, by age of child; medians for 12 sub-Saharan countries and 10 Latin American and Caribbean countries, Demographic and Health Surveys, 1985-1990

Table 3.2 Childhood mortality rates and the relative risk of dying by whether multiple or single birth

Childhood mortality and the relative risk of dying by whether multiple (M) or single (S) birth, Demographic and Health Surveys, 1985-1990

Country	Multiple or single birth	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$
SUB-SAHARAN AFRICA											
Mali	M	260.2	166.1	426.3	199.4	540.7	4.05	2.79	3.44	1.18	1.99
	S	64.3	59.6	123.9	168.9	271.9	1.00	1.00	1.00	1.00	1.00
Liberia	M	195.6	180.7	376.3	134.0	459.9	3.00	2.33	2.64	1.47	2.08
	S	65.1	77.6	142.7	91.1	220.8	1.00	1.00	1.00	1.00	1.00
Senegal	M	278.1	104.2	382.3	211.4	512.9	6.48	2.52	4.54	1.62	2.52
	S	42.9	41.3	84.2	130.3	203.5	1.00	1.00	1.00	1.00	1.00
Uganda	M	177.4	126.3	303.6	81.4	360.3	4.01	2.30	3.06	0.89	1.99
	S	44.2	54.9	99.1	91.0	181.0	1.00	1.00	1.00	1.00	1.00
Ghana	M	192.0	66.2	258.2	109.1	339.1	4.60	2.02	3.47	1.39	2.31
	S	41.7	32.7	74.4	78.5	147.0	1.00	1.00	1.00	1.00	1.00
Togo	M	212.7	77.5	290.2	132.7	384.4	5.91	2.12	4.00	1.65	2.61
	S	36.0	36.6	72.6	80.6	147.4	1.00	1.00	1.00	1.00	1.00
Burundi	M	213.8	112.3	326.0	205.7	464.6	5.99	2.43	3.98	1.95	2.60
	S	35.7	46.3	81.9	105.7	178.9	1.00	1.00	1.00	1.00	1.00
Sudan (North)	M	164.1	84.1	248.2	87.9	314.3	4.20	2.57	3.46	1.42	2.43
	S	39.1	32.7	71.8	62.0	129.3	1.00	1.00	1.00	1.00	1.00
Ondo State, Nigeria	M	155.3	47.1	202.3	59.3	249.7	6.61	1.60	3.82	1.11	2.41
	S	23.5	29.5	53.0	53.2	103.4	1.00	1.00	1.00	1.00	1.00
Kenya	M	112.8	73.3	186.1	46.3	223.8	4.88	2.25	3.35	1.36	2.55
	S	23.1	32.6	55.6	34.1	87.9	1.00	1.00	1.00	1.00	1.00
Zimbabwe	M	72.0	63.4	135.4	39.3	169.4	2.50	2.57	2.53	1.32	2.08
	S	28.8	24.7	53.5	29.7	81.5	1.00	1.00	1.00	1.00	1.00
Botswana	M	99.2	74.2	173.4	0.0	173.4	4.82	4.79	4.80	0.00	3.27
	S	20.6	15.5	36.1	17.6	53.1	1.00	1.00	1.00	1.00	1.00

Table 3.2—*Continued*

Country	Multiple or single birth	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five-mortality $(_5q_0)$	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$
NEAR EAST/ NORTH AFRICA											
Morocco	M	270.2	62.8	333.0	60.1	373.2	6.96	1.75	4.47	1.60	3.41
	S	38.8	35.8	74.5	37.6	109.4	1.00	1.00	1.00	1.00	1.00
Egypt	M	179.3	126.5	305.8	57.8	345.9	4.25	2.88	3.55	1.37	2.78
	S	42.2	44.0	86.2	42.1	124.6	1.00	1.00	1.00	1.00	1.00
Tunisia	M	132.5	68.4	200.9	27.2	222.7	5.14	2.68	3.92	1.47	3.24
	S	25.8	25.5	51.3	18.5	68.8	1.00	1.00	1.00	1.00	1.00
ASIA											
Indonesia	M	124.4	66.2	190.6	62.2	241.0	3.71	1.68	2.61	1.61	2.22
	S	33.5	39.4	72.9	38.7	108.7	1.00	1.00	1.00	1.00	1.00
Thailand	M	146.0	47.2	193.1	14.6	204.8	6.49	3.35	5.28	1.33	4.35
	S	22.5	14.1	36.6	11.0	47.1	1.00	1.00	1.00	1.00	1.00
Sri Lanka	M	59.9	56.1	116.0	14.5	128.8	3.00	5.15	3.75	1.42	3.16
	S	20.0	10.9	30.9	10.2	40.7	1.00	1.00	1.00	1.00	1.00
LATIN AMERICA/ CARIBBEAN											
Bolivia	M	195.0	102.5	297.6	43.0	327.8	5.00	2.06	3.36	0.79	2.37
	S	39.0	49.7	88.6	54.6	138.4	1.00	1.00	1.00	1.00	1.00
Peru	M	172.4	115.6	288.0	29.2	308.8	5.29	2.65	3.77	0.75	2.75
	S	32.6	43.6	76.3	38.8	112.1	1.00	1.00	1.00	1.00	1.00
Guatemala	M	110.1	122.8	232.9	66.6	284.0	3.11	2.93	3.01	1.51	2.40
	S	35.4	41.9	77.3	44.2	118.1	1.00	1.00	1.00	1.00	1.00
Dominican Republic	M	267.2	94.8	362.0	76.3	410.6	7.91	3.33	5.81	3.35	4.91
	S	33.8	28.5	62.3	22.8	83.6	1.00	1.00	1.00	1.00	1.00
El Salvador	M	180.7	126.9	307.6	51.5	343.3	5.21	3.70	4.46	2.94	4.03
	S	34.7	34.3	68.9	17.5	85.2	1.00	1.00	1.00	1.00	1.00
Brazil	M	210.4	87.6	297.9	53.2	335.2	6.43	1.85	3.72	4.16	3.66
	S	32.7	47.3	80.0	12.8	91.7	1.00	1.00	1.00	1.00	1.00
Ecuador	M	134.5	67.2	201.6	59.2	248.9	3.77	2.50	3.23	2.30	2.87
	S	35.7	26.9	62.5	25.7	86.6	1.00	1.00	1.00	1.00	1.00
Mexico	M	136.2	69.5	205.7	13.0	216.1	5.01	2.69	3.88	0.83	3.19
	S	27.2	25.8	53.0	15.7	67.8	1.00	1.00	1.00	1.00	1.00
Colombia	M	146.2	44.3	190.4	50.7	231.4	8.12	2.49	5.32	4.53	4.97
	S	18.0	17.8	35.8	11.2	46.6	1.00	1.00	1.00	1.00	1.00
Trinidad & Tobago	M	220.3	66.7	287.0	22.2	302.9	11.07	10.11	10.87	6.94	10.27
	S	19.9	6.6	26.4	3.2	29.5	1.00	1.00	1.00	1.00	1.00

Twin mortality varies across regions less than singleton mortality, resulting in larger differentials in the countries of Latin America and the Caribbean—especially after infancy. Thus, whereas in Africa excess twin risk diminishes sharply after 12 months of age to about 40 percent over singleton risk, excess risk to twins seen in the Latin American/Caribbean surveys is maintained at about 160 percent over mortality for single births (see Figure 3.2). One possible interpretation of this finding is that in countries with a mortality transition well underway (i.e., now at lower levels), improvements in survival among the congenitally frail lag behind gains made in general child health and survival. This explanation is supported (with a few exceptions) by looking within regions; the high mortality countries generally have lower risk ratios than the lower mortality countries, which tend to exhibit higher twin to single birth risk ratios.

3.3 BIRTH ORDER OF THE CHILD

Survival chances have been shown to be associated with the birth order or rank of the child. Generally speaking, first births and births of very high rank carry higher than average mortality risk. The factors that combine to produce this effect in the developing country setting are not well understood, nor does the typical U-shaped pattern occur in all studies. Certainly, there is a biological rationale that may explain high mortality among first births—namely, that many first births occur before a woman has reached full physical and reproductive maturity, leading to perinatal risks. Also, first-time mothers will often be ill-prepared to handle new roles in her life. Operating to mitigate this effect, however, is that first-time, young mothers tend to be better educated than older, high parity women in developing countries, and in many settings are more likely to use modern health services.

The causal mechanisms explaining the heightened risk among high order births is even less well understood than for first births. While older, high parity women are at increased risk of complications during childbirth and for delivery of a genetically impaired child, it appears that, in many developing country settings, social and economic conditions play a more significant role than biological factors in risk elevation among high birth order children. That the strength and consistency of the high birth order effect seems to vary considerably from study to study and country to country, lends support to this notion.

Table 3.3 presents age-specific rates of mortality for children of birth order 1, 2-3, 4-6, and 7+. The reference category used for calculation of relative risks is birth orders 2-3. When looking at the overall median influence of birth order on under-five mortality, the impression is one of rather minimal effects. Relative to births orders 2-3, under-five mortality is 6, 10, and 30 percent higher to children of birth orders 1, 4-6, and 7+, respectively. This aggregate statistic, however, "averages-away" notable regional patterns and masks underlying and offsetting age-varying effects.

Figure 3.2 Relative risk of dying associated with multiplicity of birth, by age of the child; medians for 12 sub-Saharan countries and 10 Latin American and Caribbean countries, Demographic and Health Surveys, 1985-1993
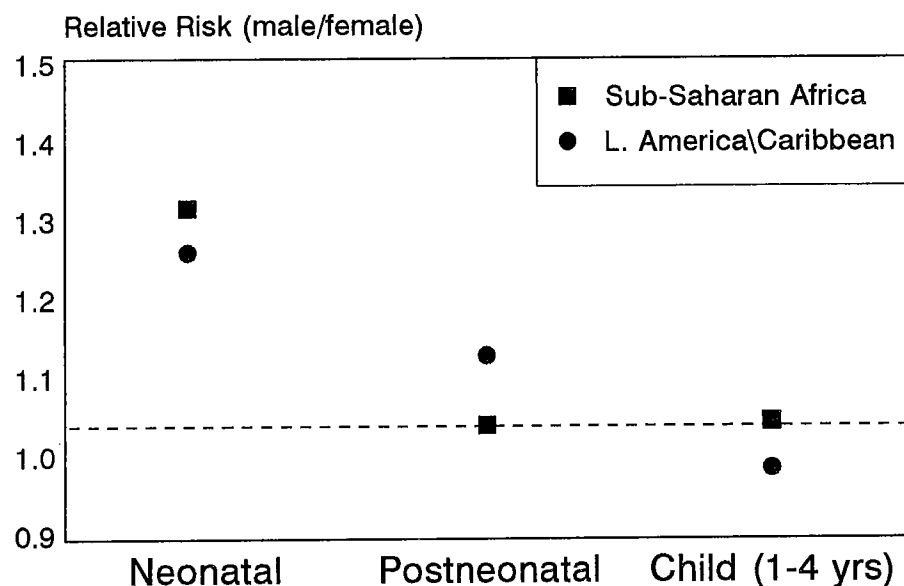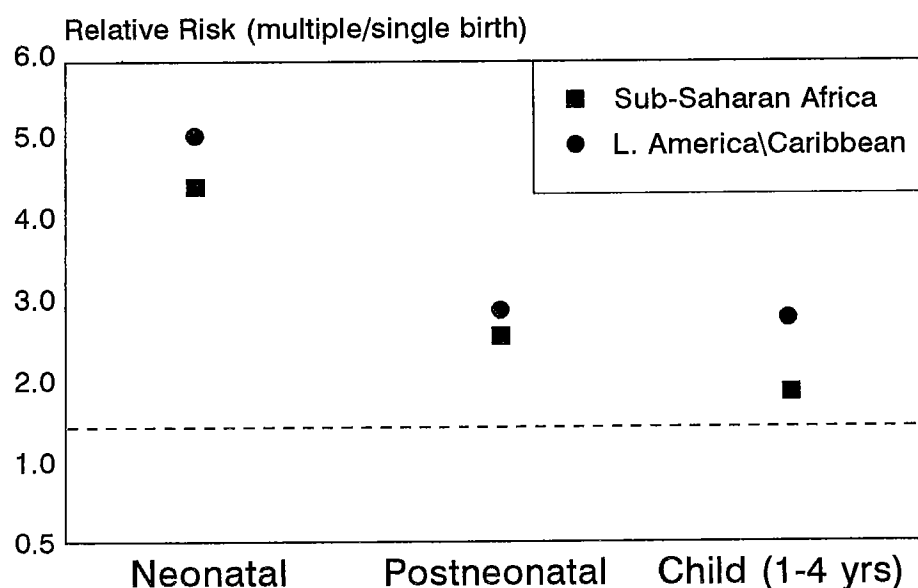
Table 3.3 Childhood mortality rates and the relative risk of dying by birth order

Childhood mortality and the relative risk of dying by birth order of child, Demographic and Health Surveys 1985-1990

Country	Birth order	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five-mortality ($_5q_0$)	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
SUB-SAHARAN AFRICA											
Mali	1	87.6	84.5	172.0	156.0	301.2	1.58	1.38	1.47	0.90	1.11
	2-3	55.6	61.2	116.7	173.9	270.4	1.00	1.00	1.00	1.00	1.00
	4-6	56.8	55.1	111.9	173.7	266.2	1.02	0.90	0.96	1.00	0.98
	7+	93.1	55.8	148.9	166.1	290.3	1.68	0.91	1.28	0.96	1.07
Liberia	1	77.9	77.7	155.6	99.1	239.2	1.22	0.93	1.06	1.06	1.05
	2-3	63.8	83.6	147.4	93.3	226.9	1.00	1.00	1.00	1.00	1.00
	4-6	64.2	82.8	147.0	87.9	222.0	1.01	0.99	1.00	0.94	0.98
	7+	87.9	82.3	170.2	88.9	243.9	1.38	0.98	1.15	0.95	1.08
Senegal	1	65.3	48.3	113.6	121.4	221.2	1.43	1.21	1.33	0.93	1.08
	2-3	45.5	39.9	85.4	130.7	205.0	1.00	1.00	1.00	1.00	1.00
	4-6	36.4	46.3	82.7	142.2	213.1	0.80	1.16	0.97	1.09	1.04
	7+	55.3	35.6	90.9	126.1	205.5	1.21	0.89	1.06	0.97	1.00
Uganda	1	58.6	61.1	119.8	106.1	213.1	1.25	1.10	1.17	0.99	1.07
	2-3	46.8	55.7	102.4	106.9	198.3	1.00	1.00	1.00	1.00	1.00
	4-6	43.4	61.9	105.2	82.1	178.7	0.93	1.11	1.03	0.77	0.90
	7+	50.6	49.1	99.7	64.5	157.7	1.08	0.88	0.97	0.60	0.80
Ghana	1	53.4	31.0	84.4	82.6	160.1	1.40	1.04	1.24	0.97	1.09
	2-3	38.2	29.9	68.1	85.2	147.5	1.00	1.00	1.00	1.00	1.00
	4-6	43.1	38.5	81.6	79.7	154.8	1.13	1.29	1.20	0.94	1.05
	7+	66.2	36.8	103.0	58.8	155.7	1.73	1.23	1.51	0.69	1.06
Togo	1	50.2	30.5	80.7	82.1	156.2	1.15	0.75	0.96	0.92	0.94
	2-3	43.5	40.9	84.4	89.3	166.1	1.00	1.00	1.00	1.00	1.00
	4-6	43.4	36.9	80.4	79.8	153.8	1.00	0.90	0.95	0.89	0.93
	7+	46.7	47.4	94.1	75.3	162.3	1.07	1.16	1.12	0.84	0.98
Burundi	1	53.2	44.7	97.8	106.7	194.1	1.49	0.97	1.20	0.96	1.06
	2-3	35.7	46.1	81.8	110.6	183.4	1.00	1.00	1.00	1.00	1.00
	4-6	32.9	47.2	80.2	103.4	175.3	0.92	1.02	0.98	0.93	0.96
	7+	39.2	54.0	93.2	105.7	189.0	1.10	1.17	1.14	0.96	1.03
Sudan (North)	1	63.6	33.9	97.4	64.7	155.9	1.86	1.06	1.48	0.98	1.22
	2-3	34.2	31.8	65.9	66.1	127.6	1.00	1.00	1.00	1.00	1.00
	4-6	37.0	33.9	70.8	58.1	124.8	1.08	1.07	1.07	0.88	0.98
	7+	45.5	38.1	83.6	63.1	141.4	1.33	1.20	1.27	0.95	1.11
Ondo State, Nigeria	1	36.5	37.1	73.6	54.1	123.7	1.46	1.40	1.43	1.18	1.30
	2-3	25.1	26.4	51.5	45.7	94.9	1.00	1.00	1.00	1.00	1.00
	4-6	27.8	27.9	55.7	57.7	110.1	1.11	1.06	1.08	1.26	1.16
	7+	28.9	34.8	63.7	54.5	114.7	1.15	1.32	1.24	1.19	1.21
Kenya	1	34.9	30.2	65.1	37.8	100.5	1.49	0.95	1.18	1.16	1.17
	2-3	23.5	31.8	55.2	32.5	85.9	1.00	1.00	1.00	1.00	1.00
	4-6	18.7	30.9	49.6	33.5	81.4	0.80	0.97	0.90	1.03	0.95
	7+	29.5	42.7	72.2	36.0	105.6	1.26	1.34	1.31	1.11	1.23
Zimbabwe	1	31.6	29.8	61.3	31.5	90.9	1.13	1.21	1.17	1.06	1.13
	2-3	27.9	24.6	52.5	29.7	80.6	1.00	1.00	1.00	1.00	1.00
	4-6	25.1	22.7	47.8	27.0	73.5	0.90	0.92	0.91	0.91	0.91
	7+	43.7	31.3	75.0	35.0	107.4	1.57	1.27	1.43	1.18	1.33
Botswana	1	19.7	12.9	32.6	15.1	47.2	0.82	0.63	0.73	0.82	0.76
	2-3	24.1	20.6	44.7	18.4	62.2	1.00	1.00	1.00	1.00	1.00
	4-6	20.3	13.7	34.0	20.2	53.5	0.84	0.66	0.76	1.10	0.86
	7+	25.5	19.2	44.7	10.5	54.7	1.06	0.93	1.00	0.57	0.88

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Table 3.3—*Continued*

Country	Birth order	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
NEAR EAST/ NORTH AFRICA											
Morocco	1	54.4	34.7	89.1	35.6	121.5	1.30	0.92	1.12	1.02	1.09
	2-3	41.9	37.8	79.6	35.0	111.8	1.00	1.00	1.00	1.00	1.00
	4-6	41.8	35.9	77.7	40.5	115.1	1.00	0.95	0.98	1.16	1.03
	7+	47.0	37.2	84.2	41.1	121.9	1.12	0.99	1.06	1.18	1.09
Egypt	1	44.2	44.2	88.4	29.8	115.5	1.15	1.02	1.08	0.80	1.00
	2-3	38.4	43.4	81.8	37.3	116.0	1.00	1.00	1.00	1.00	1.00
	4-6	45.1	46.9	92.0	49.1	136.6	1.18	1.08	1.13	1.32	1.18
	7+	69.1	55.8	124.9	57.1	174.9	1.80	1.29	1.53	1.53	1.51
Tunisia	1	30.2	29.0	59.3	6.4	65.2	1.32	1.34	1.33	0.36	1.07
	2-3	22.9	21.6	44.5	17.6	61.2	1.00	1.00	1.00	1.00	1.00
	4-6	31.2	26.8	58.0	24.8	81.3	1.36	1.24	1.30	1.41	1.33
	7+	36.7	36.4	73.0	27.4	98.5	1.60	1.68	1.64	1.56	1.61
ASIA											
Indonesia	1	38.6	38.5	77.1	25.4	100.5	1.13	1.10	1.12	0.64	0.95
	2-3	34.0	35.0	69.0	39.7	106.0	1.00	1.00	1.00	1.00	1.00
	4-6	29.9	40.3	70.2	39.6	107.1	0.88	1.15	1.02	1.00	1.01
	7+	38.5	54.5	93.0	60.9	148.2	1.13	1.56	1.35	1.53	1.40
Thailand	1	23.2	6.9	30.0	8.3	38.1	1.06	0.46	0.82	0.86	0.83
	2-3	21.9	14.8	36.7	9.7	46.0	1.00	1.00	1.00	1.00	1.00
	4-6	27.7	20.9	48.6	13.5	61.3	1.26	1.41	1.32	1.39	1.33
	7+	(32.0)	(37.5)	(69.5)	(25.0)	(92.7)	1.46	2.54	1.89	2.59	2.01
Sri Lanka	1	23.0	7.9	30.9	9.2	39.8	1.34	0.64	1.05	1.07	1.05
	2-3	17.1	12.4	29.5	8.6	37.9	1.00	1.00	1.00	1.00	1.00
	4-6	23.3	14.6	37.9	12.9	50.3	1.36	1.18	1.29	1.50	1.33
	7+	(30.5)	(16.8)	(47.3)	(16.7)	(63.3)	1.78	1.36	1.61	1.94	1.67
LATIN AMERICA/ CARIBBEAN											
Bolivia	1	34.0	45.4	79.4	33.2	110.0	0.94	0.93	0.94	0.60	0.81
	2-3	36.1	48.7	84.8	55.2	135.3	1.00	1.00	1.00	1.00	1.00
	4-6	44.3	51.5	95.8	64.1	153.8	1.23	1.06	1.13	1.16	1.14
	7+	54.6	59.1	113.7	65.7	171.9	1.51	1.21	1.34	1.19	1.27
Peru	1	26.5	34.6	61.1	21.8	81.5	1.01	0.97	0.99	0.66	0.88
	2-3	26.1	35.8	61.9	32.9	92.8	1.00	1.00	1.00	1.00	1.00
	4-6	43.7	44.7	88.3	50.1	134.0	1.67	1.25	1.43	1.52	1.44
	7+	45.5	72.1	117.6	52.6	164.0	1.74	2.01	1.90	1.60	1.77
Guatemala	1	40.4	40.8	81.1	46.1	123.5	1.24	1.00	1.11	1.07	1.09
	2-3	32.5	40.6	73.0	43.3	113.2	1.00	1.00	1.00	1.00	1.00
	4-6	32.1	44.6	76.8	45.9	119.2	0.99	1.10	1.05	1.06	1.05
	7+	50.2	48.1	98.3	41.6	135.7	1.55	1.18	1.35	0.96	1.20
Dominican Republic	1	39.7	30.7	70.3	14.3	83.6	1.19	0.99	1.10	0.63	0.98
	2-3	33.3	30.9	64.2	22.6	85.4	1.00	1.00	1.00	1.00	1.00
	4-6	44.5	22.6	67.2	32.8	97.7	1.34	0.73	1.05	1.45	1.14
	7+	50.3	40.1	90.4	25.7	113.8	1.51	1.30	1.41	1.14	1.33
El Salvador	1	41.0	29.7	70.7	13.5	83.3	1.50	1.00	1.24	1.36	1.25
	2-3	27.4	29.8	57.2	9.9	66.5	1.00	1.00	1.00	1.00	1.00
	4-6	38.9	36.0	74.9	25.1	98.1	1.42	1.21	1.31	2.53	1.48
	7+	44.4	55.2	99.6	30.4	126.9	1.62	1.85	1.74	3.06	1.91
Brazil	1	35.3	26.5	61.8	6.5	67.9	1.30	0.64	0.90	0.58	0.86
	2-3	27.2	41.8	69.0	11.2	79.4	1.00	1.00	1.00	1.00	1.00
	4-6	34.6	64.3	98.9	15.1	112.5	1.27	1.54	1.43	1.35	1.42
	7+	68.1	88.8	156.9	36.1	187.3	2.50	2.12	2.27	3.23	2.36

Table 3.3—*Continued*

		Mortality rates (deaths per 1,000)					Relative risk of dying				
Country	Birth order	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five-mortality $(_5q_0)$	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$
Ecuador	1	34.0	25.1	59.1	14.6	72.8	1.25	1.01	1.13	0.58	0.96
	2-3	27.2	24.9	52.1	25.3	76.1	1.00	1.00	1.00	1.00	1.00
	4-6	43.1	25.3	68.4	32.2	98.4	1.59	1.02	1.31	1.27	1.29
	7+	61.0	43.7	104.8	37.3	138.1	2.25	1.76	2.01	1.47	1.82
Mexico	1	19.0	22.5	41.5	6.0	47.2	0.78	0.87	0.82	0.56	0.78
	2-3	24.5	25.8	50.4	10.7	60.5	1.00	1.00	1.00	1.00	1.00
	4-6	31.2	29.2	60.3	25.6	84.4	1.27	1.13	1.20	2.39	1.40
	7+	57.3	32.1	89.4	25.4	112.6	2.34	1.24	1.77	2.37	1.86
Colombia	1	16.4	10.8	27.2	9.0	36.0	0.89	0.49	0.67	1.25	0.75
	2-3	18.4	22.3	40.8	7.3	47.7	1.00	1.00	1.00	1.00	1.00
	4-6	23.2	19.0	42.3	17.4	59.0	1.26	0.85	1.04	2.40	1.24
	7+	32.8	21.8	54.6	21.5	75.0	1.78	0.98	1.34	2.96	1.57
Trinidad & Tobago	1	21.1	6.7	27.8	3.9	31.5	1.38	0.72	1.13	1.80	1.18
	2-3	15.3	9.2	24.5	2.1	26.6	1.00	1.00	1.00	1.00	1.00
	4-6	28.1	6.4	34.5	4.2	38.6	1.84	0.69	1.41	1.95	1.45
	7+	*	*	*	*	*	4.41	0.46	2.92	3.25	2.93

Note: Figures in parentheses are based on 250-500 births.
* Less than 250 births

While first births are generally at greater risk of dying during the neonatal period, in four surveys first births are at lower risk (Bolivia, Botswana, Colombia, and Mexico) and in another nine surveys the excess risk is less than 25 percent. After the first month of life, the findings are more variable; indeed, for the majority of countries first births are at lower risk during the postneonatal and 1-4 year periods than births of order 2-3. For all countries, the median excess risk associated with first birth order is 25 percent during the neonatal period; after the neonatal period, essentially no excess risk among first births is observed.

In the aggregate, first births in sub-Saharan Africa are at greater absolute and relative risk than first births in other surveyed countries, especially so in the first month of life. This may again be an indication of the relatively low access to good maternity services in these countries. Figure 3.3 shows that at every age, first births in the Latin American/Caribbean countries fare relatively better than first births in sub-Saharan Africa. Also, after the neonatal period, first births are at lowest risk and a clear incremental increase in mortality with increasing birth order is observed, being especially pronounced during ages 1-4 years.
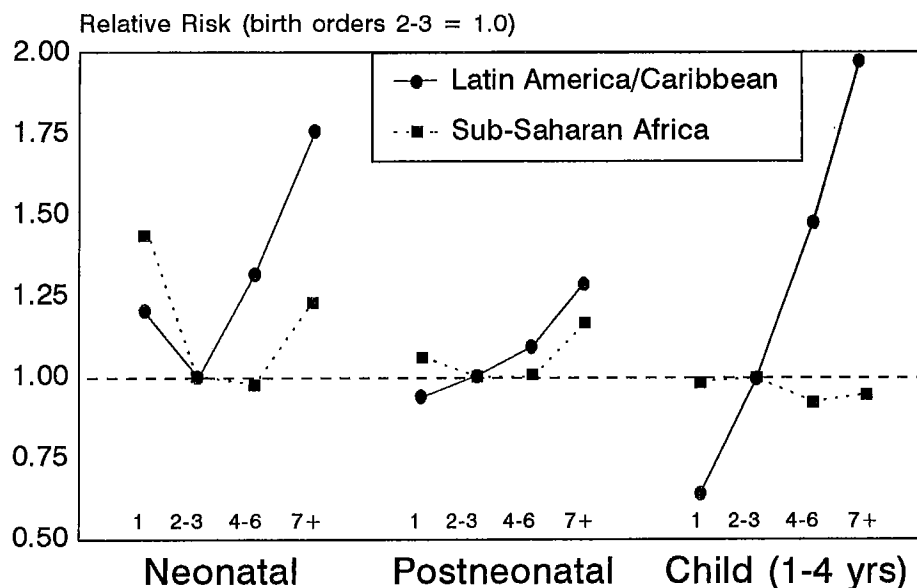
The association between high birth order and childhood mortality varies substantially among countries. For all countries combined, under-five mortality is 30 percent higher among very high order births (7+), and just 10 percent higher among high order births (4-6) than among second and third order births. The most pronounced high birth order effects occur in Latin America (see Figure 3.3), where under-five risk associated with birth orders 7+

is 80 percent higher than risk among birth orders 2-3. This almost certainly is related to the closer relationship in Latin America between high fertility and lower socioeconomic status than in higher fertility countries, e.g. sub-Saharan Africa where excess under-five risk is only 7 percent.

In most countries, the excess risk associated with high birth order is most pronounced during the neonatal age period. The median excess risk related to very high birth order (7+) is 53 percent during the neonatal period, 24 percent during the postneonatal period (1-11 months), and 19 percent during ages 1-4 years. In sub-Saharan Africa, the median high birth order effect is even weak during the neonatal period (23 percent) and does not persist after the first birthday. In several of these countries, high birth order is associated with lower rather than higher risk during ages 1-4 years.

In many countries outside sub-Saharan Africa, the age period most sensitive to harmful high birth order effects is the age period 1-4 years. In Latin America, high order births (7+) are twice as likely to die between ages 1 and 5 as children of birth orders 2-3; these findings underscore the primacy of underlying socioeconomic factors—as opposed to biomedical circumstances (pregnancy outcome, delivery complications, etc.)—in explaining excess risk in these settings. The social systems that continue to support and foster high fertility behavior in much of sub-Saharan Africa do not (or no longer) exist in most of Latin America and the Caribbean.

Figure 3.3 Relative risk of dying associated with birth order, by age of child; medians for 12 sub-Saharan countries and 10 Latin American and Caribbean countries, Demographic and Health Surveys

## 3.4 MATERNAL AGE AT BIRTH

Birth order and maternal age at birth are highly related. The relationship will however vary across sociocultural settings depending on levels and age patterns of fertility. Where age at marriage is rising, first births will often be delayed to a later, generally less risky age, especially among that segment of the society in transition. Further, under a lower, later fertility regime, older maternal age at birth becomes decreasingly associated with grand multiparity, again varying over social strata; so that while very young maternal age at birth and older maternal age at birth will continue to be associated with heightened risk of childhood mortality, the relationship will be expected to vary considerably among countries. The age groups used here are: less than 20 years, 20-24, 25-34 (reference group), and 35 or more years at birth.

Table 3.4 shows childhood mortality rates by maternal age at birth. The median excess under-five risk associated with young maternal age at birth (<20 years) for all countries combined is 31 percent. In 22 of 28 countries surveyed, births to young mothers have a 10 to 50 percent greater chance of dying before age 5 than children born to mothers aged 25-34 years. There is a slight decrease in excess risk associated with young maternal age at birth with increasing age of the child; births to women under 20 years of age are at 40, 28, and 23 percent increased risk of dying during the neonatal, postneonatal, and 1-4 year age segments, respectively. The corresponding median estimates for the Latin America/Caribbean region are 17, 46, and 4 percent, respectively, and 45, 23, and 34 percent, respectively, for sub-Saharan Africa (see Figure 3.4).

Older maternal age at birth (35 years or more) is less strongly linked with mortality than young age at birth. The median excess risk (all countries) associated with older age at birth is 15 percent. In sub-Saharan Africa, the effect is quite pronounced during the neonatal period (43 percent), but afterwards is negligible; whereas in Latin America, the effect drops off more gradually with increasing age and mortality risk is still significantly elevated for births to older mothers during the 1-4 year age period (20 percent excess risk).

Apart from the neonatal period, older age at birth presents a greater risk in Latin America than in Africa where births to older women are on average at slightly lower relative risk that lower age births. Not surprisingly, this finding parallels that from the analysis of high birth order, and again, emphasizes the influence of social context on the relationship between biodemographic variables and child mortality. High fertility and late childbearing in the African context, while presenting clear perinatal risk (and, as other studies have shown, maternal risk), occurs against a supportive cultural backdrop and is, thus, likely to be associated with behaviors and household conditions that enhance survival after the perilous neonatal period.

3.5 LENGTH OF INTERBIRTH INTERVAL

Studies of data from the World Fertility Survey were the first to show conclusively that the pace of childbearing is closely linked to survival chances of children (Rutstein, 1984). Subsequent research has refined our understanding of the relationship

Childhood mortality and the relative risk of dying by mother's age at birth of child, Demographic and Health Surveys, 1985-1990

Country	Mother's age at birth	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
SUB-SAHARAN AFRICA											
Mali	< 20	87.8	90.9	178.7	196.7	340.3	1.50	1.73	1.61	1.24	1.35
	20-24	57.7	62.6	120.3	169.8	269.7	0.99	1.19	1.08	1.07	1.07
	25-34	58.5	52.5	111.0	159.2	252.5	1.00	1.00	1.00	1.00	1.00
	35+	94.3	47.9	142.2	158.9	278.5	1.61	0.91	1.28	1.00	1.10
Liberia	< 20	83.9	93.6	177.5	109.0	267.1	1.41	1.26	1.32	1.34	1.31
	20-24	65.2	90.8	156.0	98.3	239.0	1.09	1.22	1.16	1.21	1.17
	25-34	59.6	74.5	134.0	81.2	204.3	1.00	1.00	1.00	1.00	1.00
	35+	91.8	57.7	149.5	77.8	215.7	1.54	0.78	1.12	0.96	1.06
Senegal	< 20	64.3	55.3	119.6	134.8	238.3	1.69	1.25	1.45	1.01	1.16
	20-24	47.3	36.8	84.1	131.6	204.6	1.24	0.83	1.02	0.99	1.00
	25-34	38.1	44.3	82.4	133.3	204.7	1.00	1.00	1.00	1.00	1.00
	35+	55.9	30.6	86.4	119.7	195.8	1.47	0.69	1.05	0.90	0.96
Uganda	< 20	59.3	59.0	118.4	119.0	223.3	1.39	1.07	1.21	1.49	1.31
	20-24	44.2	61.8	106.0	91.2	187.5	1.04	1.12	1.08	1.14	1.10
	25-34	42.6	55.3	98.0	79.8	169.9	1.00	1.00	1.00	1.00	1.00
	35+	59.4	47.2	106.6	61.4	161.4	1.39	0.85	1.09	0.77	0.95
Ghana	< 20	60.1	36.4	96.4	94.1	181.4	1.48	1.11	1.31	1.37	1.32
	20-24	41.6	31.4	73.0	87.1	153.8	1.03	0.96	0.99	1.27	1.12
	25-34	40.6	32.9	73.5	68.9	137.3	1.00	1.00	1.00	1.00	1.00
	35+	62.6	38.6	101.2	76.5	169.9	1.54	1.18	1.38	1.11	1.24
Togo	< 20	49.6	40.7	90.3	92.2	174.1	1.17	1.02	1.10	1.17	1.13
	20-24	47.2	36.9	84.1	85.0	161.9	1.11	0.92	1.02	1.08	1.05
	25-34	42.5	40.0	82.4	78.5	154.5	1.00	1.00	1.00	1.00	1.00
	35+	44.4	36.6	81.0	76.6	151.4	1.05	0.92	0.98	0.98	0.98
Burundi	< 20	71.3	68.1	139.4	134.1	254.8	2.14	1.45	1.73	1.29	1.45
	20-24	45.0	43.8	88.8	106.4	185.7	1.35	0.93	1.11	1.03	1.06
	25-34	33.4	47.0	80.3	103.6	175.7	1.00	1.00	1.00	1.00	1.00
	35+	24.8	43.3	68.1	101.9	163.1	0.74	0.92	0.85	0.98	0.93
Sudan (North)	< 20	52.5	34.9	87.4	78.8	159.3	1.31	1.13	1.23	1.35	1.27
	20-24	40.5	40.3	80.8	64.8	140.4	1.01	1.31	1.14	1.11	1.12
	25-34	40.0	30.9	70.9	58.5	125.2	1.00	1.00	1.00	1.00	1.00
	35+	45.9	31.4	77.2	44.7	118.5	1.15	1.02	1.09	0.76	0.95
Ondo State, Nigeria	< 20	(45.8)	(38.0)	(83.8)	(66.9)	(145.0)	2.12	1.36	1.69	1.35	1.50
	20-24	33.7	39.2	72.9	53.7	122.7	1.56	1.40	1.47	1.08	1.27
	25-34	21.6	28.0	49.6	49.7	96.8	1.00	1.00	1.00	1.00	1.00
	35+	32.6	23.4	55.9	56.8	109.5	1.51	0.83	1.13	1.14	1.13
Kenya	< 20	32.0	35.2	67.2	44.8	109.0	1.67	1.14	1.34	1.62	1.43
	20-24	29.3	33.4	62.7	36.8	97.3	1.53	1.08	1.25	1.33	1.27
	25-34	19.2	31.0	50.1	27.6	76.3	1.00	1.00	1.00	1.00	1.00
	35+	25.1	39.7	64.8	36.1	98.6	1.31	1.28	1.29	1.31	1.29
Zimbabwe	< 20	37.3	37.8	75.1	36.9	109.2	1.42	1.40	1.41	1.62	1.46
	20-24	26.2	19.5	45.8	36.2	80.3	1.00	0.72	0.86	1.58	1.07
	25-34	26.3	27.0	53.3	22.8	74.9	1.00	1.00	1.00	1.00	1.00
	35+	43.1	23.2	66.3	28.3	92.7	1.64	0.86	1.24	1.24	1.24
Botswana	< 20	18.5	17.6	36.1	21.7	57.0	0.82	1.22	0.98	1.23	1.06
	20-24	24.4	19.0	43.4	16.0	58.7	1.08	1.32	1.17	0.91	1.09
	25-34	22.5	14.4	36.9	17.6	53.9	1.00	1.00	1.00	1.00	1.00
	35+	20.8	15.4	36.2	10.6	46.4	0.92	1.07	0.98	0.60	0.86

Table 3.4—*Continued*

Country	Mother's age at birth	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five-mortality ($_5q_0$)	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
NEAR EAST/ NORTH AFRICA											
Morocco	< 20	69.1	50.4	119.5	42.0	156.4	1.62	1.48	1.56	1.06	1.38
	20-24	43.6	36.0	79.6	35.0	111.8	1.02	1.06	1.04	0.88	0.99
	25-34	42.7	34.1	76.8	39.6	113.3	1.00	1.00	1.00	1.00	1.00
	35+	38.9	34.4	73.3	36.6	107.2	0.91	1.01	0.95	0.93	0.95
Egypt	< 20	61.0	68.7	129.8	61.7	183.4	1.44	1.69	1.56	1.63	1.56
	20-24	43.7	49.6	93.3	38.0	127.7	1.03	1.22	1.12	1.00	1.08
	25-34	42.4	40.7	83.1	37.8	117.8	1.00	1.00	1.00	1.00	1.00
	35+	52.8	34.1	86.9	48.3	130.9	1.24	0.84	1.05	1.28	1.11
Tunisia	< 20	(35.4)	(33.9)	(69.2)	(5.7)	(74.5)	1.28	1.36	1.32	0.27	1.02
	20-24	28.7	25.7	54.4	13.8	67.4	1.04	1.03	1.04	0.64	0.92
	25-34	27.6	24.9	52.5	21.5	72.9	1.00	1.00	1.00	1.00	1.00
	35+	31.1	33.1	64.3	24.4	87.0	1.13	1.33	1.22	1.13	1.19
ASIA											
Indonesia	< 20	57.0	43.8	100.8	35.6	132.8	1.94	1.18	1.51	0.88	1.27
	20-24	30.3	37.3	67.6	37.4	102.5	1.03	1.00	1.02	0.92	0.98
	25-34	29.4	37.2	66.6	40.5	104.4	1.00	1.00	1.00	1.00	1.00
	35+	30.1	48.8	78.9	43.8	119.2	1.02	1.31	1.19	1.08	1.14
Thailand	< 20	28.4	12.2	40.7	13.8	53.9	1.67	0.79	1.25	1.68	1.33
	20-24	24.5	11.9	36.4	10.0	46.0	1.44	0.77	1.12	1.22	1.14
	25-34	17.1	15.5	32.5	8.2	40.5	1.00	1.00	1.00	1.00	1.00
	35+	44.1	22.2	66.2	22.5	87.3	2.59	1.43	2.04	2.74	2.16
Sri Lanka	< 20	24.7	10.1	34.8	14.4	48.7	1.09	1.06	1.08	1.40	1.15
	20-24	16.7	12.9	29.6	9.0	38.3	0.74	1.35	0.92	0.87	0.91
	25-34	22.7	9.5	32.2	10.3	42.2	1.00	1.00	1.00	1.00	1.00
	35+	19.7	20.3	40.0	9.8	49.4	0.87	2.14	1.24	0.95	1.17
LATIN AMERICA/ CARIBBEAN											
Bolivia	< 20	44.5	57.3	101.8	55.5	151.6	1.14	1.29	1.22	1.12	1.18
	20-24	38.0	56.1	94.1	61.0	149.3	0.97	1.26	1.13	1.23	1.16
	25-34	39.1	44.3	83.4	49.7	129.0	1.00	1.00	1.00	1.00	1.00
	35+	48.2	50.6	98.8	55.2	148.5	1.23	1.14	1.18	1.11	1.15
Peru	< 20	42.5	58.6	101.1	32.3	130.1	1.25	1.44	1.35	0.87	1.19
	20-24	27.9	39.0	66.8	36.7	101.1	0.82	0.95	0.89	0.99	0.93
	25-34	34.1	40.9	74.9	36.9	109.0	1.00	1.00	1.00	1.00	1.00
	35+	40.4	52.0	92.3	54.7	142.0	1.18	1.27	1.23	1.48	1.30
Guatemala	< 20	46.2	52.2	98.4	62.4	154.7	1.49	1.24	1.35	1.52	1.39
	20-24	33.5	35.5	69.0	42.2	108.3	1.08	0.85	0.94	1.03	0.97
	25-34	31.1	41.9	73.1	41.1	111.2	1.00	1.00	1.00	1.00	1.00
	35+	50.9	54.3	105.2	(22.1)	(124.9)	1.64	1.29	1.44	0.54	1.12
Dominican Republic	< 20	42.6	44.4	86.9	28.2	112.6	1.20	1.78	1.44	1.17	1.36
	20-24	37.9	25.6	63.5	18.7	81.0	1.07	1.03	1.05	0.78	0.98
	25-34	35.4	24.9	60.3	24.1	82.9	1.00	1.00	1.00	1.00	1.00
	35+	58.1	35.1	93.2	28.2	118.8	1.64	1.41	1.55	1.17	1.43
El Salvador	< 20	53.0	47.1	100.0	18.2	116.5	1.67	1.65	1.66	0.96	1.49
	20-24	23.9	28.3	52.1	13.0	64.5	0.75	0.99	0.87	0.68	0.83
	25-34	31.6	28.5	60.1	19.0	78.0	1.00	1.00	1.00	1.00	1.00
	35+	49.7	51.2	100.9	(24.3)	(122.8)	1.57	1.80	1.68	1.28	1.57
Brazil	< 20	45.2	57.7	102.8	12.0	113.6	1.29	1.25	1.27	0.84	1.20
	20-24	30.0	43.8	73.8	13.4	86.2	0.86	0.95	0.91	0.94	0.91
	25-34	35.0	46.2	81.2	14.2	94.3	1.00	1.00	1.00	1.00	1.00
	35+	48.5	58.3	106.8	(8.4)	(114.3)	1.38	1.26	1.31	0.59	1.21
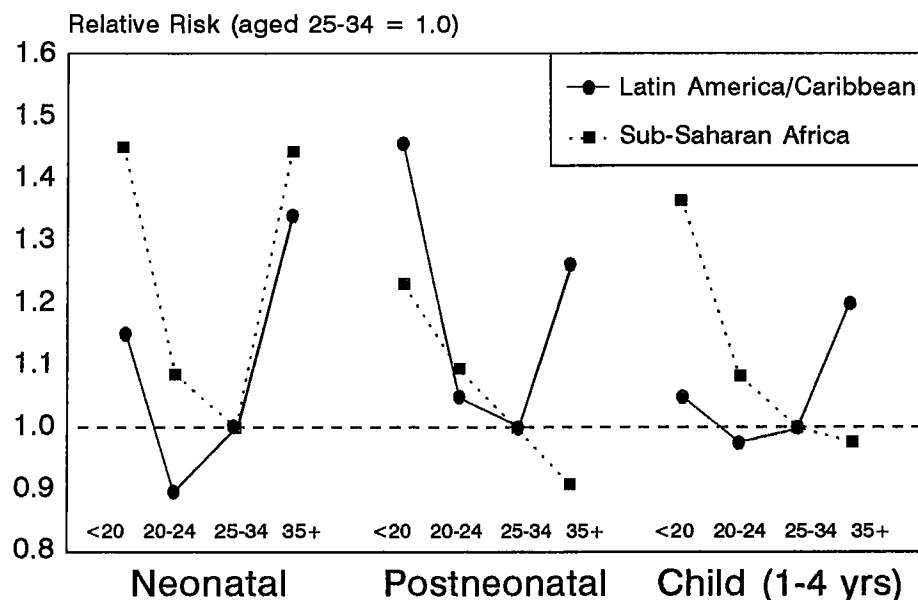
Table 3.4—*Continued*

Country	Mother's age at birth	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five-mortality ($_5q_0$)	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
Ecuador	< 20	33.0	28.9	62.0	19.6	80.3	0.85	1.08	0.94	0.79	0.91
	20-24	33.0	28.0	61.0	30.8	89.9	0.85	1.04	0.93	1.25	1.01
	25-34	38.8	26.9	65.7	24.6	88.7	1.00	1.00	1.00	1.00	1.00
	35+	52.4	27.7	80.1	(30.1)	(107.8)	1.35	1.03	1.22	1.22	1.22
Mexico	< 20	26.8	36.0	62.7	14.6	76.5	0.89	1.48	1.15	0.93	1.10
	20-24	27.3	25.7	53.0	11.9	64.3	0.91	1.05	0.98	0.76	0.93
	25-34	30.0	24.4	54.3	15.7	69.2	1.00	1.00	1.00	1.00	1.00
	35+	39.6	24.3	63.9	28.7	90.8	1.32	1.00	1.18	1.82	1.31
Colombia	< 20	17.7	26.2	43.9	15.9	59.1	0.88	1.75	1.25	1.18	1.23
	20-24	21.6	20.0	41.6	6.6	47.9	1.07	1.33	1.18	0.49	0.99
	25-34	20.3	15.0	35.2	13.5	48.3	1.00	1.00	1.00	1.00	1.00
	35+	21.7	11.6	33.3	(15.0)	(47.8)	1.07	0.78	0.95	1.11	0.99
Trinidad & Tobago	< 20	25.1	18.3	43.4	6.3	49.4	0.95	5.89	1.46	5.59	1.61
	20-24	16.4	7.1	23.5	3.2	26.7	0.62	2.30	0.79	2.87	0.87
	25-34	26.5	3.1	29.6	1.1	30.7	1.00	1.00	1.00	1.00	1.00
	35+	(30.7)	(7.1)	(37.8)	*	*	1.16	2.27	1.27	7.52	1.50

Note: Figures in parentheses are based on 250-500 births.
* Less than 250 births

Figure 3.4 Relative risk of dying associated with age of mother at birth, by age of child, medians for 12 sub-Saharan countries and 10 Latin American and Caribbean countries, Demographic and Health Surveys, 1985-1990

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between the short birth interval and heightened mortality risk. A part of the observed bivariate association appears to be due to common cause household factors mediated by replacement of a deceased child (Hobcraft et al., 1985), and by the bias induced by using interbirth (rather than interpregancy) intervals (Miller, 1989). Still, even after controlling for these factors, short interval length delineates mortality risk better than any other demographic variable, especially so for mortality during infancy (0-11 months). Using DHS data from 17 countries, Boerma and Bicego (1992) identified prenatal mechanisms, especially those involving maternal nutrition/depletion, as the key factors causing children with short preceding birth intervals to experience high mortality.

The following presentation focuses on the simple bivariate relationship between interval lengths of < 24 months, 24-47 months, and 48 + months and age-specific mortality. A separate mortality estimate is presented for the < 24 month category restricted to those children whose preceding sibling (i.e., the one born at the start of the interval) survived until the index child's birth or at least 23 months. The latter allows an assessment of the potential for an upward bias in the effect of short intervals on mortality introduced by replacement behavior.

Table 3.5 shows that, without exception, children born after a short interval (< 24 months) are at increased risk of under-five mortality, and that with a few exceptions, children born after a long interval (48+ months) are at lower risk relative to the 24-47 month category. For all countries together, short preceding intervals are associated with 57 percent higher under-five mortality and long intervals with 25 percent lower risk than intervals which are 24-47 months in length.

Generally, the most pronounced influence of short interval length on mortality occurs during the neonatal and postneonatal periods (depending on the country), and the weakest effect during the 1-4 years age period. While the maternal depletion hypothesis would predict larger effects during the neonatal than postneonatal period, these data show no such consistent pattern. Similar mixed findings were obtained from WFS data. This may be an indication of selective underreporting of neonatal deaths, or age at death misreporting (i.e., from 0 to 1 month). It seems more likely, however, that in some settings there exists a genuine effect whereby frail neonates are provided with care that allows greater chance of neonatal relative to postneonatal survival or that there exist other factors unrelated to adverse pregnancy outcome per se that diminish postneonatal survival chances among children with short birth intervals.

When restricting analysis of short intervals to births where the preceding sibling survived for at least 2 years before the birth of the index child, the interval-mortality relationship is significantly attenuated during the neonatal period especially, but also during the postneonatal period. Excess neonatal risk associated with short intervals is reduced from a median of 84 percent to a median of 55 percent, and during the postneonatal period from 72 to 53 percent excess risk. Child mortality (1-4 years) is however, on the whole, not markedly effected by this restriction. Indeed, in many countries, there is a small increase in excess risk observed using the restricted definition. These findings are very similar, both in magnitude and age pattern of effects, to those observed from analysis of WFS data.

Generally, longer than normal intervals (48+ months) have a protective effect at every age segment, but the effect is least pronounced during the neonatal period In several countries, the 48+ month category represents relatively high neonatal risk. These attenuated or reversed effects may well indicate that some long intervals may be "long" because of poor maternal health, pregnancy loss (unreported in DHS surveys), and perhaps some omitted neonatal deaths within the reference interval. In the latter case, of course, we suggest that the reference "long" interval may be composed of two or more short intervals. On the whole, however, intervals of 48+ months are associated with lower mortality, often much lower. Taking all countries together, long intervals are associated with 11 percent, 35 percent, and 41 percent lower risk of mortality during the neonatal, postneonatal, and 1-4 year age periods, respectively.

Figure 3.5 shows the age pattern of birth interval effects for the Latin America/Caribbean region and sub-Saharan Africa. In the first year of life, the results are similar, although the short interval effect is moderately more pronounced in Latin America than in sub-Saharan Africa. After the first birthday, important differences emerge: both the long and the short interval effects are significantly less pronounced in sub-Saharan Africa. For instance, short intervals are associated with 63 percent excess risk in the Latin America/Caribbean region, but only 14 percent excess risk in sub-Saharan Africa. This may be related to the importance of a maternal depletion influence in infancy, and the primacy of resource allocation/completion, after infancy. In sub-Saharan Africa, where extensive fostering and other types of extended family arrangements help to "offset" the cost of closely spaced children (Lloyd and Desai, 1992), the birth interval effect may be expected to be suppressed compared to Latin America where fertility is much lower and interfamilial mechanisms/adaptations to care for similarly aged children are not commonly in place.

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Table 3.5 Childhood mortality rates and the relative risk of dying by length of preceding birth interval

Childhood mortality and the relative risk of dying by length of the preceding birth interval, Demographic and Health Surveys, 1985-1990

Country	Preceding birth interval months	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
SUB-SAHARAN AFRICA											
Mali	< 24	117.9	83.8	201.7	230.7	385.9	3.14	1.72	2.34	1.54	1.73
	< 24[a]	87.5	75.4	162.9	238.0	362.1	2.33	1.55	1.89	1.59	1.62
	24-47	37.5	48.7	86.2	149.6	222.9	1.00	1.00	1.00	1.00	1.00
	48+	31.6	20.0	51.6	94.0	140.7	0.84	0.41	0.60	0.63	0.63
Liberia	< 24	94.1	118.1	212.3	96.0	287.9	1.53	1.71	1.63	0.99	1.34
	< 24[a]	75.8	99.1	175.0	90.7	249.8	1.24	1.44	1.34	0.93	1.16
	24-47	61.3	69.0	130.3	97.2	214.8	1.00	1.00	1.00	1.00	1.00
	48+	30.6	48.0	78.6	59.3	133.3	0.50	0.70	0.60	0.61	0.62
Senegal	< 24	64.2	54.9	119.0	139.4	241.8	1.71	1.44	1.58	1.01	1.19
	< 24[a]	55.2	50.3	105.5	136.4	227.5	1.47	1.32	1.40	0.99	1.12
	24-47	37.6	38.0	75.6	137.9	203.1	1.00	1.00	1.00	1.00	1.00
	48+	33.8	29.4	63.2	99.2	156.1	0.90	0.77	0.84	0.72	0.77
Uganda	< 24	61.8	78.5	140.3	101.3	227.4	1.60	1.63	1.62	1.25	1.41
	< 24[a]	45.8	70.4	116.2	104.3	208.4	1.19	1.46	1.34	1.28	1.29
	24-47	38.5	48.3	86.8	81.3	161.0	1.00	1.00	1.00	1.00	1.00
	48+	35.0	33.5	68.4	72.1	135.6	0.91	0.69	0.79	0.89	0.84
Ghana	< 24	63.9	55.5	119.4	86.8	195.8	1.56	1.84	1.68	1.09	1.35
	< 24[a]	54.5	53.4	107.9	89.7	187.9	1.33	1.77	1.52	1.12	1.29
	24-47	41.0	30.1	71.2	79.9	145.4	1.00	1.00	1.00	1.00	1.00
	48+	35.3	25.3	60.6	62.0	118.9	0.86	0.84	0.85	0.78	0.82
Togo	< 24	57.5	67.5	125.0	85.5	199.7	1.51	1.81	1.66	1.05	1.33
	< 24[a]	52.3	68.1	120.4	85.2	195.3	1.37	1.83	1.60	1.05	1.30
	24-47	38.1	37.3	75.4	81.4	150.6	1.00	1.00	1.00	1.00	1.00
	48+	44.1	18.2	62.3	82.2	139.4	1.16	0.49	0.83	1.01	0.93
Burundi	< 24	65.3	67.2	132.5	124.9	240.8	2.54	1.52	1.89	1.17	1.42
	< 24[a]	58.1	55.6	113.7	127.9	227.1	2.26	1.26	1.63	1.20	1.34
	24-47	25.7	44.2	69.9	106.6	169.1	1.00	1.00	1.00	1.00	1.00
	48+	12.2	21.4	33.7	64.8	96.3	0.48	0.49	0.48	0.61	0.57
Sudan (North)	< 24	49.9	46.9	96.8	86.1	174.5	1.51	1.59	1.55	1.68	1.58
	< 24[a]	43.6	42.4	86.0	84.4	163.2	1.32	1.44	1.37	1.65	1.48
	24-47	33.1	29.5	62.5	51.2	110.5	1.00	1.00	1.00	1.00	1.00
	48+	22.6	14.8	37.3	27.1	63.4	0.68	0.50	0.60	0.53	0.57
Ondo State, Nigeria	< 24	35.0	43.5	78.5	(37.3)	(112.9)	1.87	1.49	1.64	0.62	1.08
	< 24[a]	21.8	(37.2)	(59.1)	(37.4)	(94.2)	1.17	1.27	1.23	0.62	0.90
	24-47	18.7	29.2	47.9	59.9	105.0	1.00	1.00	1.00	1.00	1.00
	48+	24.3	(21.6)	(46.0)	(67.6)	(110.5)	1.30	0.74	0.96	1.13	1.05
Kenya	< 24	28.1	50.6	78.7	42.0	117.4	1.37	1.76	1.60	1.29	1.46
	< 24[a]	23.6	40.6	64.2	40.2	101.8	1.15	1.42	1.31	1.23	1.27
	24-47	20.5	28.7	49.2	32.6	80.2	1.00	1.00	1.00	1.00	1.00
	48+	20.3	18.2	38.5	17.2	55.0	0.99	0.63	0.78	0.53	0.69
Zimbabwe	< 24	48.1	31.3	79.3	49.8	125.2	1.98	1.25	1.61	2.11	1.75
	< 24[a]	46.6	28.3	74.9	53.1	124.1	1.92	1.13	1.52	2.25	1.73
	24-47	24.2	25.0	49.2	23.6	71.7	1.00	1.00	1.00	1.00	1.00
	48+	27.6	16.1	43.7	23.6	66.3	1.14	0.64	0.89	1.00	0.92
Botswana	< 24	36.3	30.3	66.5	21.6	86.7	1.88	1.78	1.83	1.12	1.58
	< 24[a]	35.3	23.6	58.9	23.0	80.6	1.83	1.38	1.62	1.19	1.47
	24-47	19.3	17.1	36.4	19.3	54.9	1.00	1.00	1.00	1.00	1.00
	48+	22.2	10.1	32.3	10.9	42.8	1.15	0.59	0.89	0.56	0.78

Table 3.5—*Continued*

Country	Preceding birth interval	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five-mortality $(_5q_0)$	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$
NEAR EAST/ NORTH AFRICA											
Morocco	< 24	62.3	57.1	119.4	47.8	161.5	1.85	1.97	1.91	1.27	1.65
	< 24[a]	50.5	56.1	106.6	47.4	148.9	1.50	1.93	1.70	1.26	1.52
	24-47	33.6	29.0	62.7	37.7	98.0	1.00	1.00	1.00	1.00	1.00
	48+	21.1	13.3	34.4	16.4	50.3	0.63	0.46	0.55	0.44	0.51
Egypt	< 24	79.9	78.6	158.4	77.0	223.3	2.77	2.56	2.66	2.53	2.53
	< 24[a]	65.0	75.4	140.5	76.7	206.4	2.26	2.46	2.36	2.52	2.34
	24-47	28.8	30.7	59.5	30.5	88.2	1.00	1.00	1.00	1.00	1.00
	48+	20.4	20.1	40.6	19.0	58.7	0.71	0.66	0.68	0.62	0.67
Tunisia	< 24	42.2	43.8	86.0	28.4	112.0	2.28	2.92	2.57	1.42	2.12
	< 24[a]	36.7	41.0	77.7	28.6	104.0	1.98	2.74	2.32	1.43	1.97
	24-47	18.5	15.0	33.5	20.0	52.8	1.00	1.00	1.00	1.00	1.00
	48+	22.3	11.8	34.1	10.1	43.8	1.20	0.79	1.02	0.50	0.83
ASIA											
Indonesia	< 24	50.8	58.5	109.3	49.2	153.2	1.81	1.72	1.76	1.06	1.45
	< 24[a]	34.0	52.6	86.7	49.5	131.8	1.21	1.55	1.40	1.06	1.25
	24-47	28.0	34.0	62.1	46.6	105.8	1.00	1.00	1.00	1.00	1.00
	48+	21.9	28.9	50.7	24.8	74.2	0.78	0.85	0.82	0.53	0.70
Thailand	< 24	39.6	19.7	59.2	19.5	77.6	2.04	1.01	1.52	2.26	1.64
	< 24[a]	36.4	18.6	55.1	20.7	74.6	1.88	0.95	1.42	2.39	1.58
	24-47	19.4	19.5	38.9	8.6	47.2	1.00	1.00	1.00	1.00	1.00
	48+	16.4	15.7	32.1	10.7	42.4	0.85	0.80	0.83	1.23	0.90
Sri Lanka	< 24	28.7	16.5	45.2	9.2	53.9	2.06	1.50	1.81	0.74	1.46
	< 24[a]	24.8	17.8	42.5	9.9	52.0	1.78	1.62	1.71	0.80	1.40
	24-47	13.9	11.0	24.9	12.5	37.1	1.00	1.00	1.00	1.00	1.00
	48+	20.8	12.1	32.9	8.5	41.1	1.49	1.10	1.32	0.68	1.11
LATIN AMERICA/ CARIBBEAN											
Bolivia	< 24	64.2	82.9	147.1	89.4	223.3	1.82	2.06	1.95	1.92	1.88
	< 24[a]	57.0	75.1	132.1	85.9	206.7	1.61	1.87	1.75	1.84	1.74
	24-47	35.3	40.2	75.5	46.6	118.5	1.00	1.00	1.00	1.00	1.00
	48+	20.3	20.7	40.9	41.8	81.1	0.57	0.51	0.54	0.90	0.68
Peru	< 24	55.3	70.0	125.3	57.9	175.9	2.00	1.87	1.93	1.47	1.73
	< 24[a]	42.8	63.3	106.1	52.7	153.2	1.55	1.69	1.63	1.34	1.50
	24-47	27.6	37.4	65.0	39.4	101.8	1.00	1.00	1.00	1.00	1.00
	48+	18.1	19.5	37.7	18.3	55.3	0.66	0.52	0.58	0.47	0.54
Guatemala	< 24	59.1	65.8	124.9	63.5	180.4	2.56	2.19	2.35	1.69	2.03
	< 24[a]	47.3	60.3	107.6	59.6	160.7	2.05	2.01	2.02	1.58	1.81
	24-47	23.1	30.0	53.1	37.6	88.7	1.00	1.00	1.00	1.00	1.00
	48+	20.2	34.9	55.1	18.3	72.4	0.87	1.16	1.04	0.49	0.82
Dominican Republic	< 24	47.8	37.6	85.4	34.2	116.7	1.49	1.44	1.47	1.81	1.54
	< 24[a]	38.2	34.9	73.0	34.0	104.6	1.19	1.34	1.26	1.80	1.38
	24-47	32.1	26.1	58.2	18.9	75.9	1.00	1.00	1.00	1.00	1.00
	48+	33.7	19.8	53.5	26.2	78.3	1.05	0.76	0.92	1.39	1.03
El Salvador	< 24	32.5	55.0	87.5	(31.8)	(116.5)	1.51	1.60	1.56	0.95	1.33
	< 24[a]	27.0	48.7	75.6	(36.0)	(108.9)	1.25	1.42	1.35	1.08	1.24
	24-47	21.6	34.3	55.9	(33.5)	(87.5)	1.00	1.00	1.00	1.00	1.00
	48+	16.9	(26.1)	(42.9)	(5.3)	(48.0)	0.78	0.76	0.77	0.16	0.55
Brazil	< 24	47.4	90.0	137.4	22.6	156.8	1.82	2.62	2.28	1.67	2.15
	< 24[a]	40.1	74.2	114.3	22.7	134.4	1.54	2.16	1.90	1.67	1.84
	24-47	26.0	34.3	60.3	13.6	73.0	1.00	1.00	1.00	1.00	1.00
	48+	28.5	21.0	49.5	3.9	53.2	1.10	0.61	0.82	0.28	0.73

Table 3.5—*Continued*

Country	Preceding birth interval	Mortality rates (deaths per 1,000)					Relative risk of dying				
		Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$
Ecuador	< 24	53.0	41.2	94.2	43.9	133.9	1.74	1.93	1.82	1.71	1.76
	< 24[a]	49.8	36.1	86.0	44.6	126.7	1.63	1.69	1.66	1.73	1.66
	24-47	30.5	21.3	51.8	25.7	76.2	1.00	1.00	1.00	1.00	1.00
	48+	28.5	17.1	45.6	7.2	52.4	0.93	0.80	0.88	0.28	0.69
Mexico	< 24	44.4	39.5	83.8	22.2	104.2	1.89	1.60	1.74	1.11	1.55
	< 24[a]	38.8	37.3	76.2	21.4	95.9	1.66	1.51	1.58	1.07	1.43
	24-47	23.5	24.7	48.1	20.1	67.2	1.00	1.00	1.00	1.00	1.00
	48+	30.5	13.2	43.7	8.0	51.3	1.30	0.54	0.91	0.40	0.76
Colombia	< 24	24.0	29.5	53.5	20.4	72.8	1.15	1.45	1.30	1.94	1.42
	< 24[a]	23.2	26.5	49.7	20.1	68.9	1.11	1.30	1.21	1.91	1.34
	24-47	20.9	20.4	41.2	10.5	51.3	1.00	1.00	1.00	1.00	1.00
	48+	16.6	7.7	24.2	2.7	26.9	0.79	0.38	0.59	0.26	0.52
Trinidad & Tobago	< 24	31.7	12.3	44.0	3.1	46.9	2.87	1.98	2.55	0.71	2.19
	< 24[a]	27.6	13.1	40.7	3.2	43.8	2.50	2.11	2.36	0.76	2.04
	24-47	11.1	6.2	17.3	4.3	21.5	1.00	1.00	1.00	1.00	1.00
	48+	27.4	0.0	27.4	1.7	29.1	2.48	0.00	1.59	0.40	1.35

Note: Figures in parentheses are based on 250-500 births.
[a]Restricted to births whose preceding sibling survived until the birth of the index child or at least 23 months.

Figure 3.5 Relative risk of dying associated with length of preceding birth interval, by age of child; medians for 12 sub-Saharan countries and 10 Latin American and Caribbean countries, Demographic and Health Surveys, 1985-1990
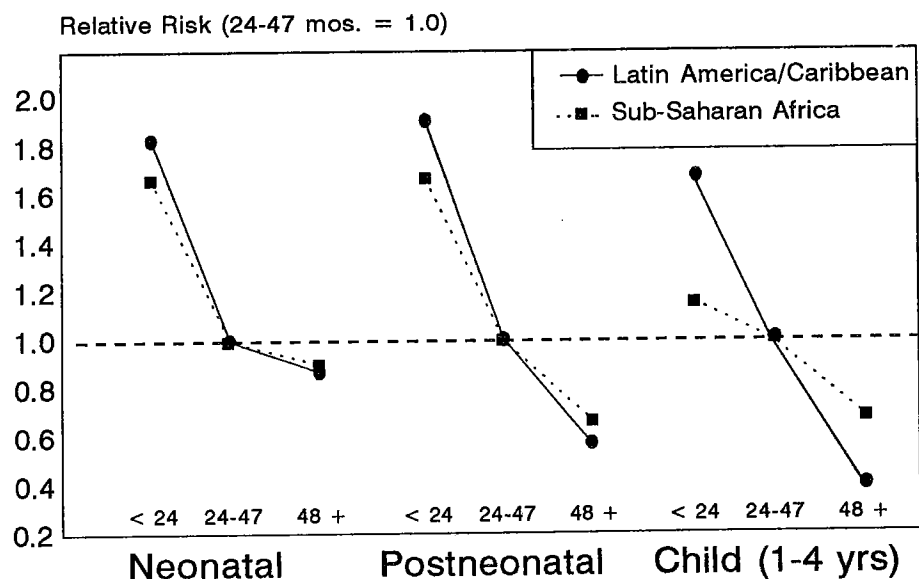
Table 3.6 Median relative risk of dying by selected biodemographic variables

Median relative risk of dying by selected biodemographic variables, Sub-Saharan Africa, Latin America and the Caribbean, and all DHS survey countries combined, 1985-1990

Country	Sub-Saharan Africa (12 countries)					Latin America/Caribbean (10 countries)					All countries (28)				
	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$	Neonatal mortality (NN)	Post-neonatal mortality (PNN)	Infant mortality $(_1q_0)$	Child mortality $(_4q_1)$	Under-five mortality $(_5q_0)$
Sex															
Male	1.34	1.00	1.19	1.00	1.11	1.28	1.11	1.20	0.93	1.14	1.31	1.06	1.19	0.97	1.11
Female	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Multiple Birth															
Twins	4.71	2.38	3.47	1.37	2.42	5.25	2.67	3.83	2.62	3.43	5.01	2.55	3.76	1.45	2.68
Singleton	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Birth Order															
1	1.42	1.05	1.19	0.98	1.08	1.22	0.95	1.05	0.65	0.92	1.25	0.98	1.12	0.95	1.06
2-3	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4-6	0.96	1.00	0.98	0.94	0.97	1.31	1.08	1.26	1.49	1.35	1.12	1.07	1.08	1.16	1.10
7+	1.23	1.17	1.19	0.96	1.07	1.76	1.27	1.76	1.99	1.80	1.53	1.24	1.35	1.19	1.30
Mother's Age at Birth (years)															
< 20	1.45	1.23	1.32	1.34	1.32	1.17	1.46	1.31	1.04	1.22	1.40	1.28	1.33	1.24	1.31
20-24	1.09	1.10	1.10	1.09	1.10	0.89	1.04	0.94	0.97	0.95	1.03	1.05	1.04	1.03	1.03
25-34	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
35+	1.43	0.91	1.11	0.98	1.02	1.34	1.27	1.25	1.20	1.26	1.32	1.05	1.21	1.11	1.15
Length of Preceding Birth Interval (months)															
< 24	1.66	1.67	1.64	1.14	1.41	1.82	1.90	1.88	1.68	1.75	1.84	1.72	1.75	1.28	1.57
< 24[a]	1.35	1.43	1.46	1.19	1.30	1.58	1.69	1.65	1.63	1.58	1.55	1.53	1.59	1.27	1.45
24-47	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
48+	0.91	0.64	0.81	0.67	0.77	0.90	0.58	0.85	0.40	0.71	0.89	0.65	0.83	0.59	0.75

[a]Restricted to births whose preceding sibling survived until the birth of the index child or at least 23 months.

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4 Socioeconomic Differentials

This section reports on differentials in infant and child mortality by socioeconomic characteristics of the family. Four classes of characteristics are examined: residence, migration, education and literacy, and occupation. Socioeconomic characteristics are highly correlated with one another and with biobehavioral characteristics so that caution must be used in interpreting the bivariate results. Using an appropriate model, simultaneous consideration should be given to the characteristics to differentiate properly among their effects. Such a model is beyond the scope of this report, which will be limited to consideration of one characteristic at a time.

The mortality rates in this section are calculated for the 10-year period preceding the date of the survey (excluding the month of interview) in order to minimize the amount of sampling variation. The mortality rates are calculated using the synthetic cohort direct methodology as described in Section 1 and Appendix A.

4.1 RESIDENCE

Urban-Rural Residence

Place of residence, whether urban or rural, is defined at the time of interview according to the location of the interview (de facto place). Consequently, for migrants, some births and/or deaths may have occurred in a place of residence of a different type. The DHS-I surveys did not include a migration history that would allow the classification of exposure and deaths according to the place of residence at the time of the event.

The definition of a location as urban or rural is country-specific and follows the official classification of the country, usually that of the census, and is embodied in the sampling frame itself. Neither interviewers nor respondents were asked to classify their current location.

Table 4.1 presents the distribution of births in the 10 years prior to the survey according to mother's current place of residence and type of water supply (taken as indicative of the level of development of the urban area). The proportion of children born to rural mothers varies from over 80 percent in Burundi (97 percent), Uganda (91 percent), Kenya (87 percent), Sri Lanka (86 percent), and Thailand (84 percent) to under 40 percent in Mexico (39 percent), Colombia (38 percent) and Brazil (33 percent). In a number of countries, very few children were born to mothers with a piped supply of water: Burundi (1 percent), Mali, Togo, Uganda (2 percent), Sri Lanka (5 percent), Kenya (6 percent), Ghana, Liberia, Indonesia (8 percent) and Botswana and Thailand (9 percent). Colombia is the country with the most children born to mothers living in an organized urban area (55 percent).

Table 4.2 shows the infant and child mortality rates according to type of area along with risk ratios, relative to rural areas as the base (equals 1.00).

Rural areas tend to have higher mortality than urban areas in the countries surveyed: over all 28 countries, under-five mortality rates are about 40 percent greater in rural areas, corresponding to an average excess of 37 more deaths for each 1,000 births, than in the urban areas. Surprisingly, although the differences between urban and rural mortality rates for individual countries vary from an excess of 113 and 103 more deaths (Senegal and Mali) to 9 fewer deaths (Trinidad and Tobago), the regional averages are close to each other, from 34 more deaths in rural areas in Latin America to 39 more deaths in sub-Saharan Africa. Because of its higher overall mortality, the excess relative risk in rural areas is lower in sub-Saharan Africa, where it is about 30 percent greater, than in Latin American or the Near East/North Africa region and Asia, where it is about 50 percent greater.

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Table 4.1 Births in the 10 years preceding the survey by urban-rural residence and type of urban water supply

Percent distribution of births in the 10 years prior to survey by urban-rural residence and type of urban water supply, Demographic and Health Surveys, 1985-1990

Country	Urban		Rural	Total percent	Number of births
	Piped water	No piped water			
SUB-SAHARAN AFRICA					
Mali	2	21	76	100.0	6,925
Liberia	8	32	60	100.0	9,568
Senegal	13	22	65	100.0	8,284
Uganda	2	7	91	100.0	9,178
Ghana	8	19	73	100.0	7,703
Togo	2	23	74	100.0	6,005
Ondo State, Nigeria	4	36	60	100.0	5,671
Burundi	1	3	97	100.0	7,268
Sudan (North)	24	10	66	100.0	13,150
Kenya	6	6	87	100.0	13,874
Zimbabwe	25	1	73	100.0	6,601
Botswana	9	17	73	100.0	6,323
NEAR EAST/ NORTH AFRICA					
Morocco	23	12	66	100.0	12,487
Egypt	39	3	58	100.0	16,757
Tunisia	43	9	48	100.0	8,766
ASIA					
Indonesia	8	19	73	100.0	17,769
Thailand	9	7	84	100.0	7,854
Sri Lanka	5	9	86	100.0	8,348
LATIN AMERICA/ CARIBBEAN					
Bolivia	29	20	51	100.0	11,706
Peru	32	21	46	100.0	6,368
Guatemala	18	10	72	100.0	8,944
Dominican Republic	20	37	43	100.0	8,614
El Salvador	24	23	53	100.0	5,866
Brazil	47	19	33	100.0	6,828
Ecuador	34	14	52	100.0	6,150
Mexico	34	27	39	100.0	11,209
Colombia	55	7	38	100.0	5,442
Trinidad & Tobago	27	15	58	100.0	3,762

Table 4.2 Infant and child mortality by urban-rural residence, and risk ratios

Infant and child mortality by urban-rural residence, and risk ratios, Demographic and Health Surveys, 1985-1990

Country	Neonatal mortality			Postneonatal mortality			Infant mortality			Child mortality			Under-five mortality		
	Urban	Rural	Risk ratio	Urban	Rural	Risk ratio	Urban	Rural	Risk ratio	Urban	Rural	Risk ratio	Urban	Rural	Risk ratio
SUB-SAHARAN AFRICA															
Mali	42	77	0.55	47	67	0.70	90	144	0.63	121	185	0.65	200	303	0.66
Liberia	60	78	0.77	80	83	0.96	140	161	0.87	90	94	0.96	218	240	0.91
Senegal	31	57	0.54	39	45	0.87	70	102	0.69	72	165	0.44	137	250	0.55
Uganda	48	49	0.98	56	57	0.98	104	106	0.98	67	93	0.72	164	189	0.87
Ghana	43	48	0.90	23	38	0.61	66	87	0.76	70	83	0.84	131	163	0.80
Togo	46	45	1.02	28	42	0.67	75	87	0.86	62	90	0.69	132	170	0.78
Ondo State, Nigeria	26	30	0.87	29	31	0.94	55	61	0.90	46	58	0.79	99	116	0.85
Burundi	22	39	0.56	63	47	1.34	84	86	0.98	86	108	0.80	164	184	0.89
Sudan (North)	37	46	0.80	37	33	1.12	74	79	0.94	46	71	0.65	117	144	0.81
Kenya	24	25	0.96	33	34	0.97	57	59	0.97	34	34	1.00	89	92	0.97
Zimbabwe	22	33	0.67	15	30	0.50	37	63	0.59	17	35	0.49	53	96	0.55
Botswana	24	22	1.09	15	17	0.88	38	39	0.97	18	17	1.06	55	55	1.00
Average			0.81			0.88			0.84			0.76			0.80
NEAR EAST/ NORTH AFRICA															
Morocco	38	49	0.78	26	42	0.62	64	91	0.70	15	51	0.29	79	137	0.58
Egypt	32	57	0.56	33	57	0.58	64	114	0.56	25	56	0.45	88	163	0.54
Tunisia	27	31	0.87	23	31	0.74	50	62	0.81	13	25	0.52	62	85	0.73
ASIA															
Indonesia	23	39	0.59	27	44	0.61	50	83	0.60	28	43	0.65	76	123	0.62
Thailand	20	25	0.80	6	16	0.38	26	41	0.63	9	11	0.82	34	52	0.65
Sri Lanka	22	21	1.05	13	12	1.08	34	32	1.06	6	11	0.55	40	43	0.93
Average			0.77			0.67			0.73			0.55			0.67
LATIN AMERICA/ CARIBBEAN															
Bolivia	35	47	0.74	39	59	0.66	74	107	0.69	42	69	0.61	113	168	0.67
Peru	25	46	0.54	31	60	0.52	56	106	0.53	22	60	0.37	76	160	0.48
Guatemala	34	37	0.92	33	47	0.70	67	84	0.80	35	49	0.71	99	129	0.77
Dominican Republic	43	36	1.19	30	31	0.97	72	67	1.07	23	25	0.92	93	91	1.02
El Salvador	30	41	0.73	27	42	0.64	58	82	0.71	12	23	0.52	69	104	0.66
Brazil	32	44	0.73	41	62	0.66	73	106	0.69	12	15	0.80	84	120	0.70
Ecuador	31	44	0.70	21	34	0.62	52	78	0.67	14	37	0.38	65	112	0.58
Mexico	22	41	0.54	20	38	0.53	42	79	0.53	8	27	0.30	50	104	0.48
Colombia	21	20	1.05	17	21	0.81	37	41	0.90	9	17	0.53	46	57	0.81
Trinidad & Tobago	27	20	1.35	7	8	0.88	34	28	1.21	5	3	1.67	39	30	1.30
Average			0.85			0.70			0.78			0.68			0.75
Total			0.82			0.77			0.80			0.68			0.76

Note: *Risk ratio* is the ratio of urban to rural mortality.

Figure 4.1 shows the pattern of excess rural mortality by the age of the child, according to region. In the Latin America/Caribbean region and the Asia/Near East/North Africa region the excess relative risk in rural areas increases dramatically with increasing age of child; however, there is little variation in the excess risk in sub-Saharan Africa.

Type of Urban Area

A second classification of type of urban area attempts to distinguish urban residents living in more and less developed areas. Given the characteristics available in the DHS surveys, water supply was used to distinguish the two urban areas. The women living in households with water piped into the residence or into the yard or plot are categorized as being from the more developed areas and women with other sources of household water, such as public tap, wells, springs, lakes, and trucked water, are classified as from the poorer urban areas.

Table 4.3 presents infant and child mortality rates by urban-rural residence and the type of urban water supply; Table 4.4 shows the relative risks compared to rural areas. Overall, urban areas with no piped water supply have almost the same level (91 percent) of under-five mortality as rural areas. Urban areas with piped water have mortality levels one-third lower than rural areas.

Figure 4.1 Relative risk of dying associated with rural residence, by age of child; medians for sub-Saharan Africa, Latin America and the Caribbean, and Asia/Near East/North Africa, Demographic and Health Surveys, 1985-1990
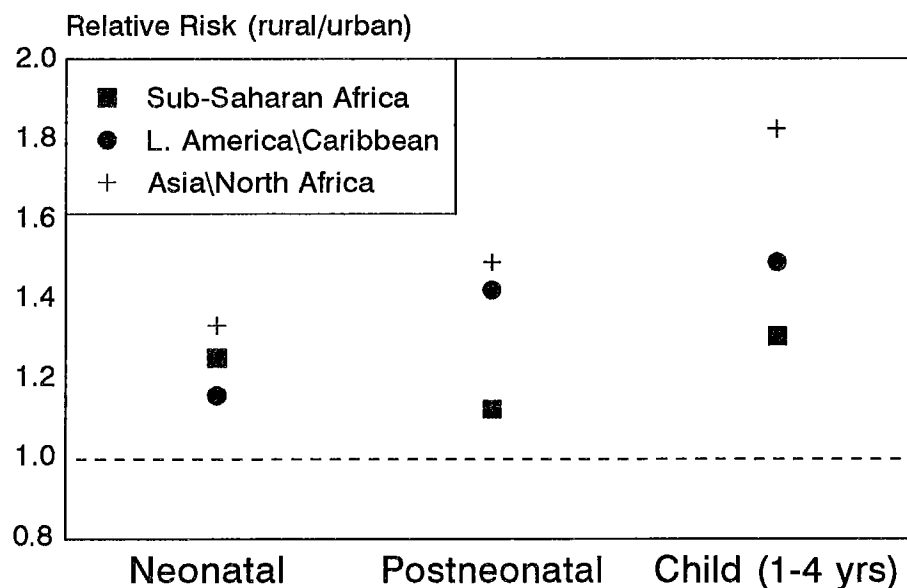
Table 4.3 Infant and child mortality by urban-rural residence and type of urban water supply

Infant and child mortality by urban-rural residence and type of urban water supply, Demographic and Health Surveys, 1985-1990

Country	Neonatal mortality			Postneonatal mortality			Infant mortality			Child mortality			Under-five mortality		
	Urban			Urban			Urban			Urban			Urban		
	Piped water	No piped water	Rural	Piped water	No piped water	Rural	Piped water	No piped water	Rural	Piped water	No piped water	Rural	Piped water	No piped water	Rural
SUB-SAHARAN AFRICA															
Mali	*	44	77	*	47	67	*	91	144	*	126	185	*	206	303
Liberia	63	59	78	72	83	83	135	142	161	(89)	90	94	(212)	219	240
Senegal	29	33	57	27	46	45	56	78	102	45	89	165	98	161	250
Uganda	(33)	53	49	(60)	55	57	(93)	107	106	*	74	93	*	173	189
Ghana	37	46	48	13	27	38	49	73	87	(36)	85	83	(83)	152	163
Togo	*	48	45	*	29	42	*	77	87	*	65	90	*	138	170
Ondo State, Nigeria	(28)	26	30	*	30	31	*	56	61	*	50	58	*	103	116
Burundi	*	23	39	*	73	47	*	96	86	*	109	108	*	195	184
Sudan (North)	37	37	46	34	42	33	72	79	79	34	78	71	104	151	144
Kenya	22	26	25	24	42	34	45	68	59	23	45	34	67	111	92
Zimbabwe	22	*	33	16	*	30	38	*	63	16	*	35	54	*	96
Botswana	25	23	22	13	16	17	38	39	39	8	23	17	46	61	55
NEAR EAST/ NORTH AFRICA															
Morocco	36	42	49	19	40	42	55	81	91	13	20	51	68	100	137
Egypt	31	33	57	30	(63)	57	62	(96)	114	25	(34)	56	85	(127)	163
Tunisia	26	31	31	21	31	31	47	62	62	10	28	25	57	88	85
ASIA															
Indonesia	29	21	39	23	28	44	52	49	83	22	30	43	73	78	123
Thailand	11	31	25	5	8	16	16	39	41	5	13	11	21	52	52
Sri Lanka	(21)	22	21	(18)	10	12	(40)	32	32	(9)	4	11	(48)	36	43
LATIN AMERICA/ CARIBBEAN															
Bolivia	29	43	47	36	44	59	65	87	107	33	55	69	96	138	168
Peru	24	26	46	23	43	60	47	69	106	20	26	60	66	93	160
Guatemala	33	35	37	35	29	47	68	65	84	19	64	49	85	125	129
Dominican Republic	37	46	36	21	34	31	58	80	67	22	23	25	79	101	91
El Salvador	23	37	41	24	31	42	48	68	82	9	15	23	56	82	104
Brazil	28	41	44	26	77	62	54	118	106	9	22	15	63	137	120
Ecuador	23	49	44	21	21	34	44	70	78	11	22	37	55	90	112
Mexico	21	24	41	15	25	38	36	48	79	3	16	27	39	63	104
Colombia	19	(34)	20	16	(21)	21	35	(55)	41	7	(22)	17	42	(76)	57
Trinidad and Tobago	31	21	20	4	13	8	35	33	28	5	(4)	3	40	(37)	30

Note: Figures in parentheses are based on 250-500 births.
* Less than 250 births

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Table 4.4 Relative risk of dying among children under five by urban-rural residence and type of urban water supply

Relative risk of dying among children under five by urban-rural residence and type of urban water supply, Demographic and Health Surveys, 1985-1990

Country	Neonatal mortality			Postneonatal mortality			Infant mortality			Child mortality			Under-five mortality		
	Urban			Urban			Urban			Urban			Urban		
	Piped water	No piped water	Rural	Piped water	No piped water	Rural	Piped water	No piped water	Rural	Piped water	No piped water	Rural	Piped water	No piped water	Rural
SUB-SAHARAN AFRICA															
Mali	*	0.57	1.00	*	0.70	1.00	*	0.63	1.00	*	0.68	1.00	*	0.68	1.00
Liberia	0.81	0.76	1.00	0.87	1.00	1.00	0.84	0.88	1.00	0.95	0.96	1.00	0.88	0.91	1.00
Senegal	0.51	0.58	1.00	0.60	1.02	1.00	0.55	0.76	1.00	0.27	0.54	1.00	0.39	0.64	1.00
Uganda	0.67	1.08	1.00	1.05	0.96	1.00	0.88	1.01	1.00	*	0.80	1.00	*	0.92	1.00
Ghana	0.77	0.96	1.00	0.34	0.71	1.00	0.56	0.84	1.00	0.43	1.02	1.00	0.51	0.93	1.00
Togo	*	1.07	1.00	*	0.69	1.00	*	0.89	1.00	*	0.72	1.00	*	0.81	1.00
Ondo State, Nigeria	(0.93)	0.87	1.00	*	0.97	1.00	*	1.10	1.00	*	0.86	1.00	*	0.89	1.00
Burundi	*	0.59	1.00	*	1.55	1.00	*	1.12	1.00	*	1.01	1.00	*	1.06	1.00
Sudan (North)	0.80	0.80	1.00	1.03	1.27	1.00	0.91	1.00	1.00	0.48	1.10	1.00	0.72	1.05	1.00
Kenya	0.88	1.04	1.00	0.71	1.24	1.00	0.76	1.15	1.00	0.68	1.32	1.00	0.73	1.21	1.00
Zimbabwe	0.67	*	1.00	0.53	*	1.00	0.60	*	1.00	0.46	*	1.00	0.56	*	1.00
Botswana	1.14	1.05	1.00	0.76	0.94	1.00	0.97	1.00	1.00	0.47	1.35	1.00	0.84	1.11	1.00
Average	0.80	0.85	1.00	0.74	1.01	1.00	0.76	0.94	1.00	0.53	0.94	1.00	0.66	0.93	1.00
ASIA/NEAR EAST/ NORTH AFRICA															
Morocco	0.73	0.86	1.00	0.45	0.95	1.00	0.60	0.89	1.00	0.25	0.39	1.00	0.50	0.73	1.00
Egypt	0.54	0.58	1.00	0.53	1.11	1.00	0.54	0.84	1.00	0.45	0.61	1.00	0.52	0.78	1.00
Tunisia	0.84	1.00	1.00	0.68	1.00	1.00	0.76	1.00	1.00	0.40	1.12	1.00	0.67	1.04	1.00
Indonesia	0.74	0.54	1.00	0.52	0.64	1.00	0.63	0.59	1.00	0.51	0.70	1.00	0.59	0.63	1.00
Thailand	0.44	1.24	1.00	0.31	0.50	1.00	0.39	0.95	1.00	0.45	1.18	1.00	0.40	1.00	1.00
Sri Lanka	1.00	1.05	1.00	1.50	0.83	1.00	1.25	1.00	1.00	0.82	0.36	1.00	1.12	0.84	1.00
Average	0.72	0.88	1.00	0.67	0.84	1.00	0.70	0.88	1.00	0.48	0.73	1.00	0.63	0.84	1.00
LATIN AMERICA/ CARIBBEAN															
Bolivia	0.62	0.91	1.00	0.61	0.75	1.00	0.61	0.81	1.00	0.48	0.80	1.00	0.57	0.82	1.00
Peru	0.52	0.57	1.00	0.38	0.72	1.00	0.44	0.65	1.00	0.33	0.43	1.00	0.41	0.58	1.00
Guatemala	0.89	0.95	1.00	0.74	0.62	1.00	0.81	0.77	1.00	0.39	1.31	1.00	0.66	0.97	1.00
Dominican Republic	1.03	1.28	1.00	0.68	1.10	1.00	0.87	1.19	1.00	0.88	0.92	1.00	0.87	1.11	1.00
El Salvador	0.56	0.90	1.00	0.57	0.74	1.00	0.59	0.83	1.00	0.39	0.65	1.00	0.54	0.79	1.00
Brazil	0.64	0.93	1.00	0.42	1.24	1.00	0.51	1.11	1.00	0.60	1.47	1.00	0.53	1.14	1.00
Ecuador	0.52	1.11	1.00	0.62	0.62	1.00	0.56	0.90	1.00	0.30	0.59	1.00	0.49	0.80	1.00
Mexico	0.51	0.59	1.00	0.39	0.66	1.00	0.46	0.61	1.00	0.11	0.59	1.00	0.38	0.61	1.00
Colombia	0.95	1.70	1.00	0.76	1.00	1.00	0.85	1.34	1.00	0.41	1.29	1.00	0.74	1.33	1.00
Trinidad and Tobago	1.55	1.05	1.00	0.50	1.63	1.00	1.25	1.18	1.00	1.67	1.33	1.00	1.33	1.23	1.00
Average	0.78	1.00	1.00	0.57	0.91	1.00	0.69	0.94	1.00	0.56	0.94	1.00	0.65	0.94	1.00
Total	0.77	0.91	1.00	0.65	0.93	1.00	0.72	0.93	1.00	0.53	0.89	1.00	0.65	0.91	1.00

Note: Figures in parentheses are based on 250-500 births.
* Less than 250 births

4.2 MIGRATION

Information used to determine migration status was obtained from respondents. Women were asked the following questions:

"For most of the time until you were 12 years old, did you live in the countryside, in a town, or in a city?"

"How long have you been living continuously in (NAME OF VILLAGE, TOWN, CITY)?"

"Just before you moved here, did you live in the countryside, in a town, or in a city"?

Through these questions, women were asked to classify the type of area from which they moved, which may be different from the official classification either now or at the time they lived there. Using the answers to the above questions, mothers were classified into the following categories according to their duration of residence:

- Urban native;
- Long-term urban migrant (10 or more years of residence);
- Recent urban migrant (less than 10 years of residence);
- Rural resident (whether native or migrant).

Since mortality rates are calculated for the period 0-9 years before the survey, this classification separates births and exposure according to their proper location.

Table 4.5 presents infant and child mortality rates according to duration of residence in urban areas. For many countries the number of births to short-term migrants is insufficient to allow presentation of stable mortality rates (see Appendix Table C.1). Not surprisingly, urban natives in general have the lowest mortality rates, followed by long-term migrants and then short-term migrants, who have rates that are close to those for residents of rural areas (see Table 4.6). The advantage in mortality of urban natives and long-term migrants increases with increasing age of children: averaging over all the surveys, urban natives and long-term migrants have about 80 percent of the mortality of rural residents during the neonatal period but at ages one to four years, mortality is only 57 percent and 73 percent that of rural residents, respectively. The advantage of long duration of urban residence varies by region, and there is less of an advantage in sub-Saharan Africa than in the Asia/Near East/North Africa region or Latin America.

4.3 EDUCATION AND LITERACY

Information on respondent's education was collected using the following questions:

"Have you ever attended school?"
"What was the highest level of school you attended?"

"What was the highest (Grade, Form, Year) you completed at that level?"

For women who had attended primary school, an additional question on literacy was asked, "Can you read a letter or newspaper easily, with difficulty or not at all?" Women who had not attended school were assumed to be illiterate. Women were also asked similar questions about their current or last husband/partner.

The categories used for women's and husband's level of education are: no schooling, primary incomplete, primary complete, and secondary or above. In defining the education variables, information is used about both educational level and completed years of schooling at that level.

Those who had not been to school at all or who had been to school but had not completed the first year of primary are grouped into the "no schooling or none" category (no education). This category also includes people who had attended only preschool, kindergarten or Koranic instruction.

The number of years of schooling that constitutes primary education differs across countries. There are five years of primary schooling in Colombia, Morocco, Peru and Sri Lanka; six years in Bolivia, Burundi, Ecuador, Egypt, Guatemala, Indonesia, Liberia, Mexico, Ondo State (Nigeria), Senegal, Sudan, Togo, and Tunisia; seven years in Botswana, Kenya, Thailand, Trinidad and Tobago, Uganda, and Zimbabwe; eight years in Brazil, the Dominican Republic, and Ghana; and nine years in El Salvador and Mali. Those who had attained at least one complete year of schooling but fewer than the required number of years to complete the primary level are grouped into the "primary incomplete" category. Those who successfully completed the required number of years for the primary level or began but did not finish the first year at the secondary level are included to be in the "primary complete" category. Those who completed one or more years at the secondary level or had education beyond the secondary level are grouped into the "secondary or higher" category.

An alternative formulation of the education variable is constructed on the basis of total completed years schooling and is categorized in the following groups: "No schooling (0)," "1-3 years," "4-6 years," and "7 or more years."

Mother's Level of Education

Comparative study of the impact of education on infant and child mortality is complicated by three factors. As noted above the number of years of schooling to complete a given level varies widely among countries. While one country's school system may consist of five years of primary and five years of secondary, another's consists of nine years of primary and three years of secondary. Thus in our categorization according to level, a woman with seven completed years of education would be well into her secondary school level in the first country but would be classified

Table 4.5 Infant and child mortality by duration of urban residence

Infant and child mortality by duration of residence in urban areas, Demographic and Health Surveys, 1985-1990

Country	Neonatal mortality				Postneonatal mortality				Infant mortality				Child mortality				Under-five mortality			
	Urban native	Long-term migrant	Short-term migrant	Rural resident	Urban native	Long-term migrant	Short-term migrant	Rural resident	Urban native	Long-term migrant	Short-term migrant	Rural resident	Urban native	Long-term migrant	Short-term migrant	Rural resident	Urban native	Long-term migrant	Short-term migrant	Rural resident
SUB-SAHARAN AFRICA																				
Mali	33	68	(32)	77	40	52	(71)	67	73	120	(103)	144	102	144	*	185	167	247	*	303
Liberia	62	*	*	78	81	*	*	83	143	*	*	161	91	*	*	94	221	*	*	240
Senegal	28	38	(34)	57	30	42	(73)	45	58	80	(107)	102	59	77	*	165	114	151	*	250
Uganda	52	35	(61)	49	(75)	49	(41)	57	(127)	84	(102)	106	(58)	(75)	*	93	(178)	(152)	*	189
Ghana	47	(27)	*	48	22	*	*	38	69	*	*	87	66	*	*	83	131	*	*	163
Togo	(47)	46	*	45	(20)	31	*	42	(66)	77	*	87	*	56	*	90	*	128	*	170
Ondo State, Nigeria	24	31	*	30	35	20	*	31	59	51	*	61	43	(59)	*	58	100	(107)	*	116
Burundi	(29)	(16)	*	39	(60)	(66)	*	47	(89)	(82)	*	86	(71)	(92)	*	108	(154)	(166)	*	184
Sudan (North)	35	44	(42)	46	33	49	(35)	33	68	93	(77)	79	44	47	*	71	109	136	*	144
Kenya	27	18	23	25	23	60	22	34	50	78	45	59	27	35	(54)	34	76	110	(97)	92
Zimbabwe	*	22	*	33	*	14	*	30	*	36	*	63	*	17	*	35	*	53	*	96
Botswana	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
NEAR EAST/ NORTH AFRICA																				
Morocco	38	41	33	49	19	30	43	42	57	70	76	91	6	22	(36)	50	63	91	(109)	137
Egypt	31	32	(46)	57	30	43	(49)	57	60	74	(95)	114	23	36	*	56	82	107	*	163
Tunisia	27	20	34	31	20	29	(34)	31	47	49	(68)	62	12	13	(23)	25	58	61	(89)	85
ASIA																				
Indonesia	21	25	36	39	26	26	32	44	47	51	68	83	27	34	(22)	43	72	83	(89)	123
Thailand	21	17	19	25	9	0	(7)	16	30	17	(26)	41	7	7	(18)	11	36	24	(44)	52
Sri Lanka	28	(11)	*	21	17	(6)	*	12	44	(17)	*	32	8	(2)	*	11	52	(19)	*	43
LATIN AMERICA/ CARIBBEAN																				
Bolivia	29	51	(63)	47	35	55	(45)	59	65	106	(108)	107	36	62	(77)	69	98	161	(176)	168
Peru	24	(20)	*	46	27	(48)	*	60	51	(69)	*	106	18	(35)	*	60	68	(101)	*	160
Guatemala	32	(44)	(33)	37	31	(37)	(37)	47	63	(81)	(70)	84	30	(27)	*	49	91	(106)	*	129
Dominican Republic	45	37	45	36	23	37	38	31	68	75	83	67	19	25	29	25	86	98	110	91
El Salvador	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Brazil	31	34	(38)	44	39	56	(33)	62	70	90	(71)	106	11	23	(5)	15	81	111	(76)	120
Ecuador	27	34	*	44	18	24	*	34	45	58	*	78	10	18	*	37	55	75	*	112
Mexico	22	24	*	41	20	17	*	38	42	41	*	79	9	8	*	27	50	48	*	104
Colombia	19	26	(21)	20	18	15	(12)	21	37	41	(33)	41	7	6	*	17	44	46	*	57
Trinidad & Tobago	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U

Note: Short-term migrants are persons who have resided in urban areas for less than 10 years. Figures in parentheses are based on 250-500 births.
U = Unknown (data not available)
* Less than 250 births

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Table 4.6 Relative risk of dying among children under five by duration of urban residence

Relative risk of dying among children under five by duration of residence in urban areas, Demographic and Health Surveys, 1985-1990

Country	Neonatal mortality				Postneonatal mortality				Infant mortality				Child mortality				Under-five mortality			
	Urban native	Long-term migrant	Short-term migrant	Rural resident	Urban native	Long-term migrant	Short-term migrant	Rural resident	Urban native	Long-term migrant	Short-term migrant	Rural resident	Urban native	Long-term migrant	Short-term migrant	Rural resident	Urban native	Long-term migrant	Short-term migrant	Rural resident
SUB-SAHARAN AFRICA																				
Mali	0.43	0.88	(0.42)	1.00	0.60	0.78	(1.06)	1.00	0.51	0.83	(0.72)	1.00	0.55	0.78	*	1.00	0.55	0.82	*	1.00
Liberia	0.79	*	*	1.00	0.98	*	*	1.00	0.89	*	*	1.00	0.97	*	*	1.00	0.92	*	*	1.00
Senegal	0.49	0.67	(0.60)	1.00	0.67	0.93	(1.62)	1.00	0.57	0.78	(1.05)	1.00	0.36	0.47	*	1.00	0.46	0.60	*	1.00
Uganda	1.06	0.71	(1.24)	1.00	(1.32)	0.86	(0.72)	1.00	(1.20)	0.79	(0.96)	1.00	(0.62)	(0.81)	*	1.00	(0.94)	(0.80)	*	1.00
Ghana	0.98	(0.56)	*	1.00	0.58	*	*	1.00	0.79	*	*	1.00	0.80	*	*	1.00	0.80	*	*	1.00
Togo	(1.04)	1.02	*	1.00	(0.48)	0.74	*	1.00	(0.76)	0.89	*	1.00	*	0.62	*	1.00	*	0.75	*	1.00
Ondo State, Nigeria	0.80	1.03	*	1.00	1.13	0.65	*	1.00	0.97	0.84	*	1.00	0.74	(1.02)	*	1.00	0.86	(0.92)	*	1.00
Burundi	(0.74)	(0.41)	*	1.00	(1.28)	(1.40)	*	1.00	(1.03)	(0.95)	*	1.00	(0.66)	(0.85)	*	1.00	(0.84)	(0.90)	*	1.00
Sudan (North)	0.76	0.96	(0.91)	1.00	1.00	1.48	(1.06)	1.00	0.86	1.18	(0.97)	1.00	0.62	0.66	*	1.00	0.76	0.94	*	1.00
Kenya	1.08	0.72	0.92	1.00	0.68	1.76	0.65	1.00	0.85	1.32	0.76	1.00	0.79	1.03	(1.5)	1.00	0.83	1.20	(1.05)	1.00
Zimbabwe	*	0.67	*	1.00	*	0.47	*	1.00	*	0.57	*	1.00	*	0.49	*	1.00	*	0.55	*	1.00
Botswana	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Average	0.82	0.79	0.82	1.00	0.87	1.00	1.02	1.00	0.84	0.91	0.89	1.00	0.68	0.78	1.5	1.00	0.77	0.85	1.05	1.00
ASIA/NEAR EAST/NORTH AFRICA																				
Morocco	0.78	0.84	0.67	1.00	0.45	0.71	1.02	1.00	0.63	0.77	0.84	1.00	0.12	0.44	(0.7	)1.00	0.46	0.66	(0.80)	1.00
Egypt	0.54	0.56	(0.81)	1.00	0.53	0.75	(0.86)	1.00	0.53	0.65	(0.83)	1.00	0.41	0.64	*	1.00	0.50	0.66	*	1.00
Tunisia	0.87	0.65	1.10	1.00	0.65	0.94	(1.10)	1.00	0.76	0.79	(1.10)	1.00	0.48	0.52	(0.9	)1.00	0.68	0.72	(1.05)	1.00
Indonesia	0.54	0.64	0.92	1.00	0.59	0.59	0.73	1.00	0.57	0.61	0.82	1.00	0.63	0.79	(0.5	)1.00	0.59	0.67	(0.72)	1.00
Thailand	0.84	0.68	0.76	1.00	0.56	0.00	(0.44)	1.00	0.73	0.41	(0.63)	1.00	0.64	0.64	(1.64)	1.00	0.69	0.46	(0.85)	1.00
Sri Lanka	1.33	(0.52)	*	1.00	1.42	(0.50)	*	1.00	1.38	(0.53)	*	1.00	0.73	(0.18)	*	1.00	1.21	(0.44)	*	1.00
Average	0.82	0.65	0.85	1.00	0.70	0.58	0.83	1.00	0.76	0.63	0.84	1.00	0.50	0.54	0.95	1.00	0.69	0.60	0.85	1.00
LATIN AMERICA/CARIBBEAN																				
Bolivia	0.62	1.09	(1.34)	1.00	0.59	0.93	(0.76)	1.00	0.61	0.99	(1.01)	1.00	0.52	0.90	(1.12)	1.00	0.58	0.96	(1.05)	1.00
Peru	0.52	(0.43)	*	1.00	0.45	(0.80)	*	1.00	0.48	(0.65)	*	1.00	0.30	(0.58)	*	1.00	0.43	(0.63)	*	1.00
Guatemala	0.86	(1.19)	(0.89)	1.00	0.66	(0.79)	0.79	1.00	0.75	(0.96)	(0.83)	1.00	0.61	(0.55)	*	1.00	0.71	(0.82)	*	1.00
Dominican Republic	1.25	1.03	1.25	1.00	0.74	1.19	1.23	1.00	1.01	1.12	1.24	1.00	0.76	1.00	1.16	1.00	0.95	1.08	1.21	1.00
El Salvador	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Brazil	0.70	0.77	(0.86)	1.00	0.63	0.90	(0.53)	1.00	0.66	0.85	(0.67)	1.00	0.73	1.53	(0.33)	1.00	0.68	0.93	(0.72)	1.00
Ecuador	0.61	0.77	*	1.00	0.53	0.71	*	1.00	0.58	0.74	*	1.00	0.27	0.49	*	1.00	0.49	0.67	(0.85)	1.00
Mexico	0.54	0.59	*	1.00	0.53	0.45	*	1.00	0.53	0.52	*	1.00	0.33	0.30	*	1.00	0.48	0.46	*	1.00
Colombia	0.95	1.30	(1.05)	1.00	0.86	0.71	(0.57)	1.00	0.90	1.00	(0.80)	1.00	0.41	0.35	*	1.00	0.77	0.81	*	1.00
Trinidad & Tobago	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Average	0.76	0.92	1.08	1.00	0.62	0.80	0.78	1.00	0.69	0.88	0.91	1.00	0.49	0.79	0.87	1.00	0.63	0.83	0.96	1.00
Total	0.80	0.81	0.92	1.00	0.74	0.83	0.88	1.00	0.77	0.83	0.88	1.00	0.57	0.73	1.00	1.00	0.70	0.79	0.92	1.00

Note: Short-term migrants are persons who have resided in urban areas for less than 10 years. Figures in parentheses are based on 250-500 births.
U = Unknown (data not available)
* Less than 250 births

as primary incomplete in the second country. Classifying by years of schooling does not solve the problem since there is a much greater impact of completing primary school than just completing one more year of schooling. In part this is due to selectivity between persons who complete a level and those who drop out before doing so. A second factor that complicates both internal and cross-national comparisons is change in the educational system. Quite a few countries have changed the number of years of schooling required to complete the primary level, either raising or lowering them, confounding comparisons across age cohorts. The third complication is the variation in educational quality across countries and over time.

Table 4.7 shows the percentages of births that occurred in the 10 years prior to the survey according to mother's education. The variation across countries is vast: in Burundi, Mali, Morocco, and Senegal more than 80 percent of children were born to mothers with no education; in these countries 5 percent or fewer were born to women with secondary or higher education. At the other extreme are Sri Lanka and Trinidad and Tobago with 58 percent and 42 percent of children born to women with secondary or higher education, respectively. In these countries, and in Colombia, the Dominican Republic and Thailand, 11 percent or fewer children were born to mothers with no education.

Table 4.8 presents infant and child mortality rates according to level of mother's education. This table reveals the great impact that a woman's education has on her child's survival chances. Among the 23 countries where comparison is possible, six have differences in under five mortality of over 100 deaths per 1,000 births between mothers with no education and those with more than completed primary education, the largest difference being 151 for Senegal and followed by Peru (116), Egypt (113), Brazil (111), Ecuador (110) and Bolivia (109). The smallest differences occur in Ondo State of Nigeria (14), Botswana (16) and Sri Lanka (35). Over all 23 countries the average difference is 76 deaths per 1,000 births.

There are large mortality differentials between countries for a given educational category. Among all the countries, Mali has the highest under-five mortality rate for women with no education (290 deaths per 1,000 births). Two other countries, Liberia and Senegal, also have under-five mortality rates that exceed 200 (242

and 226, respectively). In the Near East/North Africa region Egypt has the highest rate for the no education category (161), and in Latin America this distinction goes to Bolivia (179) followed by Peru (169). In only five countries does the under-five mortality rate for mothers with no education fall below 100 deaths per 1,000 births. In order of decreasing mortality, they are Tunisia (84), Thailand (76), Colombia (72), Sri Lanka (71) and Botswana (62). Thus the range of under-five mortality for women with no education is about four to one.

There is an even greater range of variation of under-five mortality for women with secondary or more education. Liberia and Uganda have rates that exceed 130 per 1,000 while there are four countries with rates of 30 or below: Brazil, El Salvador, Mexico, and Thailand. (Four countries in sub-Saharan Africa do not have enough births to calculate stable estimates of the mortality rates.)

The great range of mortality for women within a given education category indicates the potential for improvement in mortality conditions that is possible even in the absence of change in the level of education of women.

Table 4.9 shows for each country the risk of mortality by education category in relation to the risk for children whose mothers have incomplete primary schooling. Shown as well are regional averages and the average of all countries. The primary incomplete category was chosen for comparison because it is the only one in which there are substantial numbers of births in all countries (see Table 4.8).

The impact of mother's education on mortality varies according to the age of the child. From Table 4.9 and Figure 4.2, it is apparent that the older the child, the greater the differential in mortality by mother's education. During the neonatal period the risks of dying for children of mothers with no education are 34 percent, 59 percent and 80 percent higher than the risks for children of mothers with secondary or higher education, respectively for sub-Saharan Africa, Asia/Near East/North Africa, and Latin America. In contrast, for children between ages one and four years, the excess risks are 165 percent, 430 percent, and 409 percent for children of mothers with no education. It is also clear that the impact of mothers education is less important in sub-Saharan Africa than in the other regions at all three ages.

Table 4.7 Births in the 10 years preceding the survey by mother's education

Percent distribution of births in the 10 years preceding the survey by mother's level of education and, for women who have no education, husband's literacy, Demographic and Health Surveys, 1985-1990

Country	No education		Primary incomplete	Primary complete	Secondary or higher	Total percent	Number of births
	Husband illiterate/ No husband	Husband literate					
SUB-SAHARAN AFRICA							
Mali	68	19	11	1	1	100.0	6,925
Liberia	44	26	12	3	15	100.0	9,568
Senegal	69	15	5	5	5	100.0	8,284
Uganda	12	32	40	8	7	100.0	9,178
Ghana	27	21	21	27	4	100.0	7,703
Togo	47	24	17	6	7	100.0	6,005
Ondo State, Nigeria	25	25	16	17	17	100.0	5,671
Burundi	41	42	13	3	2	100.0	7,268
Sudan (North)	30	32	20	6	11	100.0	13,150
Kenya	10	22	32	21	15	100.0	13,874
Zimbabwe	5	15	43	21	15	100.0	6,601
Botswana	20	13	27	23	17	100.0	6,323
NEAR EAST/ NORTH AFRICA							
Morocco	47	40	5	4	5	100.0	12,487
Egypt	37	18	24	8	14	100.0	16,757
Tunisia	25	34	18	13	10	100.0	8,766
ASIA							
Indonesia	8	13	41	23	16	100.0	17,769
Thailand	4	7	76	3	10	100.0	7,854
Sri Lanka	2	9	21	11	58	100.0	8,348
LATIN AMERICA/ CARIBBEAN							
Bolivia	12	12	45	5	26	100.0	11,706
Peru	4	15	31	17	33	100.0	6,368
Guatemala	23	29	34	8	6	100.0	8,944
Dominican Republic	3	5	66	6	21	100.0	8,614
El Salvador	10	19	62	0	9	100.0	5,866
Brazil	7	8	65	6	14	100.0	6,828
Ecuador	3	10	35	24	28	100.0	6,150
Mexico	18	0	40	21	21	100.0	11,209
Colombia	3	6	46	15	30	100.0	5,442
Trinidad & Tobago	0	1	33	24	42	100.0	3,762

Table 4.8 Infant and child mortality by mother's education

Infant and child mortality by mother's level of education, Demographic and Health Surveys, 1985-1990

Country	Neonatal mortality				Postneonatal mortality				Infant mortality				Child mortality				Under-five mortality			
	No educa-tion	Primary incom-plete	Primary com-plete	Second-ary or higher	No educa-tion	Primary incom-plete	Primary com-plete	Second-ary or higher	No educa-tion	Primary incom-plete	Primary com-plete	Second-ary or higher	No educa-tion	Primary incom-plete	Primary com-plete	Second-ary or higher	No educa-tion	Primary incom-plete	Primary com-plete	Second-ary or higher
SUB-SAHARAN AFRICA																				
Mali	74	38	*	*	65	38	*	*	139	75	*	*	175	139	*	*	290	203	*	*
Liberia	75	60	(51)	62	88	83	*	50	163	143	*	113	95	107	*	72	242	235	*	176
Senegal	51	(51)	(20)	(28)	45	(25)	(38)	(23)	96	76	(58)	(51)	144	(89)	(69)	(25)	226	(158)	(123)	(75)
Uganda	48	48	47	55	66	56	37	31	115	105	84	86	90	101	(78)	50	195	195	(156)	132
Ghana	47	50	45	(50)	40	42	16	(31)	87	91	62	80	96	68	64	*	175	153	122	*
Togo	44	52	(46)	(42)	44	31	(22)	(40)	88	84	(68)	(80)	89	79	*	*	170	156	*	*
Ondo State, Nigeria	30	36	24	22	27	38	23	(19)	57	74	47	63	56	(71)	(42)	(35)	110	(139)	(88)	(96)
Burundi	39	40	(32)	(14)	49	43	*	(19)	88	83	*	(33)	113	74	*	*	191	151	*	*
Sudan (North)	45	39	46	33	37	30	28	30	82	69	75	63	76	42	(35)	23	152	108	(107)	84
Kenya	27	25	25	21	45	33	25	22	72	59	50	42	40	38	25	24	109	95	73	65
Zimbabwe	34	32	29	22	43	26	17	16	77	58	46	38	48	31	23	8	122	86	69	46
Botswana	23	17	27	22	21	17	11	15	44	34	38	37	19	16	22	9	62	49	59	46
NEAR EAST/ NORTH AFRICA																				
Morocco	47	26	(37)	42	39	28	(14)	21	86	54	(51)	62	43	15	(5)	(0)	125	69	(55)	(62)
Egypt	55	42	37	24	57	45	30	13	112	88	67	38	55	37	22	11	161	122	88	48
Tunisia	33	28	17	23	29	28	23	12	62	57	40	34	24	13	11	5	84	69	51	39
ASIA																				
Indonesia	41	39	33	17	60	43	29	19	101	82	62	36	48	50	27	12	144	128	88	48
Thailand	34	25	(13)	11	21	15	(3)	7	55	40	(16)	19	22	11	*	2	76	50	*	21
Sri Lanka	25	20	19	21	27	12	18	7	52	33	37	28	20	10	8	9	71	43	44	36
LATIN AMERICA/ CARIBBEAN																				
Bolivia	57	45	29	22	59	58	30	28	116	103	59	50	71	66	49	21	179	162	106	70
Peru	60	34	27	23	59	62	46	18	119	96	73	42	57	57	32	11	169	148	103	53
Guatemala	37	38	30	31	46	47	28	11	83	85	58	42	59	35	19	(2)	137	117	76	(44)
Dominican Republic	53	40	46	33	43	33	(31)	15	96	73	(77)	48	46	24	(16)	14	137	96	(92)	61
El Salvador	57	30	*	12	43	35	*	12	100	64	*	25	30	14	*	(5)	127	77	*	(30)
Brazil	48	36	(38)	20	66	56	(10)	3	115	93	(49)	23	26	13	(9)	4	138	104	(57)	27
Ecuador	61	46	31	22	43	30	28	17	105	75	59	39	61	35	13	10	159	107	71	49
Mexico	42	34	23	18	41	31	23	10	83	64	46	28	34	19	5	1	114	82	51	29
Colombia	28	23	23	13	21	21	13	15	49	44	36	29	23	17	4	2	72	61	39	31
Trinidad & Tobago	*	14	19	32	*	10	6	6	*	24	25	39	*	5	3	2	*	29	28	40

Note: Figures in parenthese are based on 250-500 births.
* Less than 250 births

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Table 4.9 Relative risk of dying among children under five by mother's education

Relative risk of dying among children under five by mother's level of education, Demographic and Health Surveys, 1985-1990

Country	Neonatal mortality				Postneonatal mortality				Infant mortality				Child mortality				Under-five mortality			
	No education	Primary incomplete	Primary complete	Secondary or higher	No education	Primary incomplete	Primary complete	Secondary or higher	No education	Primary incomplete	Primary complete	Secondary or higher	No education	Primary incomplete	Primary complete	Secondary or higher	No education	Primary incomplete	Primary complete	Secondary or higher
SUB-SAHARAN AFRICA																				
Mali	1.95	1.00	*	*	1.71	1.00	*	*	1.85	1.00	*	*	1.26	1.00	*	*	1.43	1.00	*	*
Liberia	1.25	1.00	(0.85)	*	1.06	1.00	*	0.60	1.14	1.00	*	0.79	0.89	1.00	*	0.67	1.03	1.00	*	0.75
Senegal	1.00	(1.00)	(0.39)	1.03	1.80	(1.00)	(1.52)	(0.92)	1.26	(1.00)	(0.76)	(0.67)	1.62	(1.00)	(0.78)	(0.28)	1.43	(1.00)	(0.78)	(0.47)
Uganda	1.00	1.00	0.98	(0.55)	1.18	1.00	0.66	0.55	1.10	1.00	0.80	0.82	0.89	1.00	(0.77)	0.50	1.00	1.00	(0.80)	0.68
Ghana	0.94	1.00	0.90	1.15	0.95	1.00	0.38	(0.74)	0.96	1.00	0.68	0.88	1.41	1.00	0.94	*	1.14	1.00	0.80	*
Togo	0.85	1.00	(0.88)	(1.00)	1.42	1.00	(0.71)	(0.42)	1.05	1.00	0.81	0.64	1.13	1.00	*	*	1.09	1.00	*	*
Ondo State, Nigeria	0.83	1.00	0.67	0.61	0.71	1.00	0.61	1.05	0.77	1.00	0.64	0.85	(0.79)	(1.00)	(0.59)	(0.49)	(0.79)	(1.00)	(0.63)	(0.69)
Burundi	0.98	1.00	(0.80)	(0.35)	1.14	1.00	*	(0.44)	1.06	1.00	*	0.40	1.53	1.00	*	*	1.26	1.00	*	*
Sudan (North)	1.15	1.00	1.18	0.85	1.23	1.00	0.93	1.00	1.19	1.00	1.09	0.91	1.81	1.00	(0.83)	0.55	1.41	1.00	(0.99)	0.78
Kenya	1.08	1.00	1.00	0.84	1.36	1.00	0.76	0.67	1.22	1.00	0.85	0.71	1.05	1.00	0.66	0.63	1.15	1.00	0.77	0.68
Zimbabwe	1.06	1.00	0.91	0.69	1.65	1.00	0.65	0.62	1.33	1.00	0.79	0.66	1.55	1.00	0.74	0.26	1.42	1.00	0.80	0.53
Botswana	1.35	1.00	1.59	1.29	1.24	1.00	0.65	0.88	1.29	1.00	1.12	1.09	1.19	1.00	1.38	0.56	1.27	1.00	1.20	0.94
Average	1.12	1.00	0.92	0.83	1.29	1.00	0.76	0.72	1.18	1.00	0.84	0.77	1.26	1.00	0.84	0.49	1.20	1.00	0.85	0.69
ASIA/NEAR EAST/ NORTH AFRICA																				
Morocco	1.81	1.00	(1.42)	1.62	1.39	1.00	(0.50)	0.75	1.59	1.00	(0.94)	1.15	2.87	1.00	(0.33)	(0.00)	1.81	1.00	(0.80)	(0.90)
Egypt	1.31	1.00	0.88	0.57	1.27	1.00	0.67	0.29	1.27	1.00	0.76	0.43	1.49	1.00	0.59	0.30	1.32	1.00	0.72	0.39
Tunisia	1.18	1.00	0.61	0.82	1.04	1.00	0.82	0.43	1.09	1.00	0.70	0.60	1.85	1.00	0.85	0.38	1.22	1.00	0.74	0.57
Indonesia	1.05	1.00	0.85	0.44	1.40	1.00	0.67	0.44	1.23	1.00	0.76	0.44	0.96	1.00	0.54	0.24	1.13	1.00	0.69	0.38
Thailand	1.36	1.00	(0.52)	0.44	1.40	1.00	(0.20)	0.47	1.38	1.00	(0.40)	0.48	2.00	1.00	*	0.18	1.52	1.00	*	0.42
Sri Lanka	1.25	1.00	0.95	1.05	2.25	1.00	1.50	0.58	1.58	1.00	1.12	0.85	2.00	1.00	0.80	0.90	1.65	1.00	1.02	0.84
Average	1.27	1.00	0.88	0.81	1.46	1.00	0.72	0.54	1.33	1.00	0.79	0.67	1.75	1.00	0.67	0.34	1.41	1.00	0.80	0.59
LATIN AMERICA/ CARIBBEAN																				
Bolivia	1.27	1.00	0.64	0.49	1.02	1.00	0.52	0.48	1.13	1.00	0.57	0.49	1.08	1.00	0.74	0.32	1.10	1.00	0.65	0.43
Peru	1.76	1.00	0.79	0.68	0.95	1.00	0.74	0.29	1.24	1.00	0.76	0.44	1.00	1.00	0.56	0.19	1.14	1.00	0.70	0.36
Guatemala	0.97	1.00	0.79	0.82	0.98	1.00	0.60	0.23	0.98	1.00	0.68	0.49	1.69	1.00	0.54	(0.06)	1.17	1.00	0.65	(0.38)
Dominican Republic	1.33	1.00	1.15	0.83	1.30	1.00	(0.94)	0.45	1.32	1.00	1.05	0.66	1.92	1.00	(0.67)	0.58	1.43	1.00	(0.96)	0.64
El Salvador	1.90	1.00	*	0.40	1.23	1.00	*	0.34	1.56	1.00	*	0.39	2.14	1.00	*	(0.36)	1.65	1.00	*	(0.39)
Brazil	1.33	1.00	(1.06)	0.56	1.18	1.00	(0.18)	0.05	1.24	1.00	(0.53)	0.25	2.00	1.00	(0.69)	0.31	1.33	1.00	(0.55)	0.26
Ecuador	1.33	1.00	0.67	0.48	1.43	1.00	0.93	0.57	1.40	1.00	0.79	0.52	1.74	1.00	0.37	0.29	1.49	1.00	0.66	0.46
Mexico	1.24	1.00	0.68	0.53	1.32	1.00	0.74	0.32	1.30	1.00	0.72	0.44	1.79	1.00	0.26	0.05	1.39	1.00	0.62	0.35
Colombia	1.22	1.00	1.00	0.57	1.00	1.00	0.62	0.71	1.11	1.00	0.82	0.66	1.35	1.00	0.24	0.12	1.18	1.00	0.64	0.51
Trinidad & Tobago	*	1.00	1.36	2.29	*	1.00	0.60	0.60	*	1.00	1.04	1.63	*	1.00	0.60	0.40	*	1.00	0.97	1.38
Average	1.37	1.00	0.90	0.76	1.16	1.00	0.65	0.41	1.25	1.00	0.77	0.60	1.63	1.00	0.52	0.27	1.32	1.00	0.71	0.52
Total	1.25	1.00	0.90	0.81	1.29	1.00	0.71	0.56	1.25	1.00	0.80	0.68	1.52	1.00	0.67	0.36	1.29	1.00	0.78	0.59

Note: Figures in parentheses are based on 250-500 births.
* Less than 250 births

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Figure 4.2 Relative risk of dying associated with mother's education, by age of child; medians for sub-Saharan Africa, Latin America and the Caribbean, and Asia/Near East/North Africa, Demographic and Health Surveys, 1985-1990
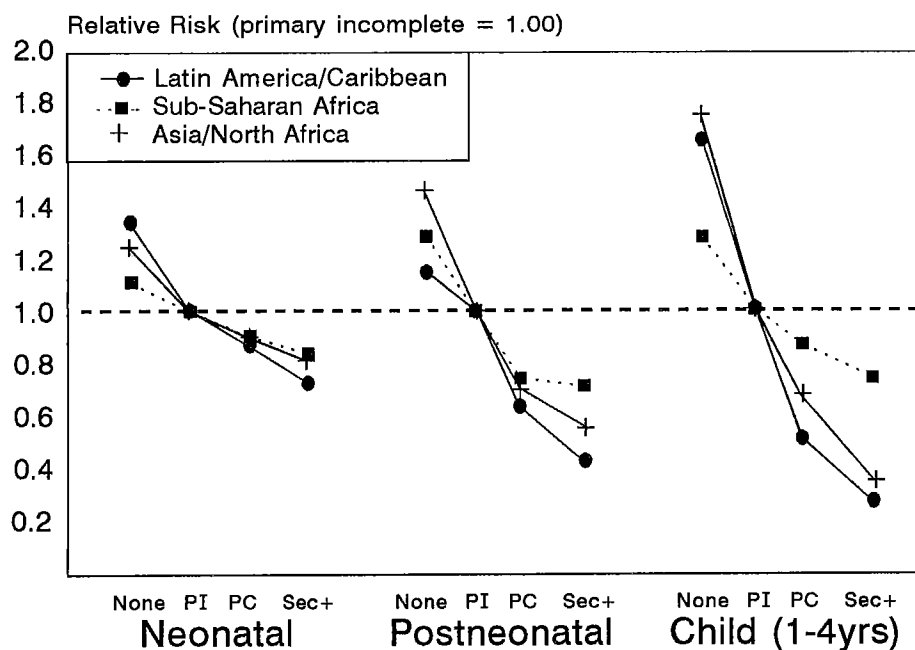
Change over Time

Table 4.10 compares the change in mortality rates according to years of education between the WFS and the DHS surveys for the 16 countries that had both surveys. The rates are presented by years of education since this grouping was used in the WFS comparative studies.

In general, the mortality rates fell most in the categories 0 and 1-3 years of education, with average drops of 37 and 40 deaths per 1,000, respectively, while the groups 4-6 years and 7+ years dropped by 23 and 13 deaths per 1,000, respectively. Thus, the gap in mortality between children of mothers with lower and higher levels of education narrowed somewhat in the approximate 10-year period between the surveys.

The countries with the greatest changes were Egypt and Kenya with large changes in mortality distributed over all education groups. Relative to the level of mortality in the WFS surveys, Colombia, Sri Lanka and Thailand also had large changes, in addition to Egypt and Kenya. The surveys for Ghana show a substantial rise in mortality in three of the four education groups, but doubt has been cast on the quality of the Ghana WFS mortality data (Sullivan et al., 1990).

Father's Literacy

For mothers with no education, having someone literate in the household may be important for relaying information and access to health care. For these women, partner's literacy is taken as representative of having a literate household member. Table 4.11 presents infant and child mortality rates for children of women who have no education according to father's literacy. In general having a literate father increases a child's chances of survival. The largest and smallest effects occur in sub-Saharan Africa: father's literacy makes a difference of 91, 70, 52 and 35 deaths per 1,000 in Senegal, Zimbabwe, Togo and Uganda, respectively, but only 3, 6, 7, and 9 deaths in Sudan, Mali, Ondo State, and Burundi, respectively. In two countries, Kenya and El Salvador, father's literacy combined with mother's illiteracy raises the mortality rate by 16 and 11 deaths per 1,000 births, above that for children with both parents illiterate.

For purposes of reference and comparison with World Fertility Survey results, infant and child mortality rates are tabulated according to the literacy of both mother and father in Appendix Table C.2. The proportion of births in each literacy category is presented in Appendix Table C.3.

Table 4.10 Trends in infant and child mortality by mother's education

Trends in infant and child mortality by number of years mother attended school, selected WFS and DHS surveys, 1975-1990

Country	Infant mortality				Child mortality				Under-five mortality			
	No. of years mother attended school				No. of years mother attended school				No. of years mother attended school			
	0	1-3	4-6	7+	0	1-3	4-6	7+	0	1-3	4-6	7+
SUB-SAHARAN AFRICA												
Senegal												
DHS 1986	96	*	63	(53)	144	*	(63)	(25)	226	*	(122)	(77)
WFS 1978	121	(71)	94	(31)	186	103	42	35	284	167	132	65
Ghana												
DHS 1988	87	(69)	97	70	96	(53)	79	59	174	(119)	169	125
WFS 1979	77	(62)	66	70	68	69	33	37	140	127	97	104
Sudan (North)												
DHS 1989-90	82	74	68	62	76	59	28	23	152	129	95	84
WFS 1979-80	80	88	(83)	(57)	77	62	36	27	151	145	116	82
Kenya												
DHS 1989	72	60	58	47	40	43	36	24	109	101	92	70
WFS 1977-78	104	89	82	70	78	67	45	43	174	150	123	110
NEAR EAST/ NORTH AFRICA												
Morocco												
DHS 1987	86	(53)	63	(50)	43	(24)	3	(0)	125	(76)	66	(50)
WFS 1980	99	(100	(54)	(80)	65	30	20	0	158	127	73	80
Egypt												
DHS 1988-89	113	93	77	43	54	37	33	13	161	127	108	55
WFS 1980	147	143	125	78	92	101	73	25	225	230	189	101
Tunisia												
DHS 1988	62	58	47	34	24	(14)	12	5	84	(71)	58	39
WFS 1978	79	(90)	67	(21)	48	12	21	0	12	101	87	21
ASIA												
Indonesia[1]												
DHS 1987	95	81	67	33	53	48	32	7	143	126	97	40
WFS 1976	102	109	82	55	81	90	63	20	175	189	140	74
Thailand												
DHS 1987	55	(57)	39	18	22	(33)	9	2	76	(88)	48	19
WFS 1975	97	(76)	71	(18)	44	41	26	9	137	114	95	27
Sri Lanka												
DHS 1987	52	37	32	27	20	10	10	8	71	47	41	35
WFS 1975	77	70	59	39	38	32	25	14	112	100	83	52
LATIN AMERICA/ CARIBBEAN												
Peru												
DHS 1986	119	96	74	42	57	58	34	11	169	148	106	52
WFS 1977-78	136	118	67	45	99	68	28	9	222	178	93	54
Dominican Republic												
DHS 1986	98	76	74	52	43	26	23	14	136	100	96	66
WFS 1975	126	94	86	61	74	45	36	10	191	135	119	70
Ecuador												
DHS 1987	105	87	57	39	61	37	19	10	159	121	74	49
WFS 1979-80	88	98	76	48	78	63	37	20	159	155	110	67
Mexico												
DHS 1987	81	71	47	28	34	22	7	1	112	91	54	29
WFS 1976-77	90	80	65	47	59	31	14	6	144	108	78	53
Colombia												
DHS 1986	57	47	34	24	23	19	6	1	78	65	40	25
WFS 1976	85	80	46	40	54	45	31	17	134	121	76	56
Trinidad & Tobago												
DHS 1987	*	*	22	33	*	*	5	2	*	*	27	36
WFS 1977	(79)	(64)	48	39	0	4	12	8	79	68	59	47

Note: Figures in parentheses are based on 250-500 births.
* Less than 250 births
[1]Java and Bali only

Infant and child mortality among children of mothers who have no education by father's literacy, Demographic and Health Surveys, 1985-1990

	Mortality among children of mothers who have no education									
	Neonatal mortality		Postneonatal mortality		Infant mortality		Child mortality		Under-five mortality	
Country	Father literate	Father illiterate	Father literate	Father illiterate	Father literate	Father illiterate	Father literate	Father illiterate	Father literate	Father illiterate
SUB-SAHARAN AFRICA										
Mali	90	69	69	64	159	134	150	182	285	291
Liberia	70	78	79	93	149	171	92	96	228	251
Senegal	32	55	31	48	63	103	96	155	153	242
Uganda	46	54	61	80	108	135	87	98	185	220
Ghana	43	50	41	40	84	90	87	103	164	184
Togo	44	44	28	53	72	97	68	100	135	187
Ondo State, Nigeria	30	30	29	24	59	55	50	62	106	113
Burundi	37	41	47	50	85	91	111	116	187	196
Sudan (North)	46	44	36	38	83	82	74	78	150	153
Kenya	29	23	49	37	77	61	40	40	114	98
Zimbabwe	27	(55)	34	(68)	61	(123)	45	(57)	103	(173)
Botswana	22	24	13	26	35	49	20	19	54	67
NEAR EAST/ NORTH AFRICA										
Morocco	46	48	35	42	81	89	33	51	111	136
Egypt	43	61	59	57	102	118	46	59	143	169
Tunisia	31	35	27	32	58	67	17	32	74	97
ASIA										
Indonesia	41	41	56	66	97	107	45	54	137	156
Thailand	(39)	*	(20)	*	(59)	*	12	*	(70)	*
Sri Lanka	23	*	31	*	54	*	24	*	76	*
LATIN AMERICA/ CARIBBEAN										
Bolivia	52	62	64	54	116	116	64	78	172	185
Peru	56	(73)	58	(61)	114	(134)	55	(65)	163	(191)
Guatemala	35	39	48	43	84	82	49	71	129	147
Dominican Republic	47	(63)	(44)	(43)	(90)	(106)	(35)	(63)	(122)	(162)
El Salvador	63	45	39	(50)	102	(94)	31	(28)	131	(120)
Brazil	56	39	59	(75)	116	(114)	23	(29)	136	(140)
Ecuador	63	*	47	*	111	*	70	*	173	*
Mexico	*	42	*	41	*	83	*	34	*	114
Colombia	(27)	*	(22)	*	(48)	*	(22)	*	(69)	*
Trinidad & Tobago	*	*	*	*	*	*	*	*	*	*

Note: Figures in parentheses are based on 250-500 births.
* Less than 250 births.

4.4 FATHER'S OCCUPATION

Mother's and father's occupations are important influences on children's risk of dying. Working in certain occupational categories can bring benefits from increased opportunities for health care, especially if provided by the employer or employment linked (e.g., social security). Occupation is also an important determinant of socioeconomic status since it is closely linked to remuneration and is reflective of education and wealth. For women, some occupations (e.g., farming, peddling, etc.) may have negative consequences for the child since the diversion of time from child care is not counterbalanced by the benefits noted above.

Since the DHS-I surveys did not collect information on mother's occupation nor on her work status during the period the child was exposed to the risk of dying, the focus is on the father's occupation. Based on the question asked to women for their current or latest partner, "What kind of work does (did) your husband/partner mainly do?" occupations have been grouped into four categories: agriculture, blue collar (skilled and unskilled), sales and services, and professional, technical and clerical (PTC) occupations. A fifth category includes unmarried women and women whose partners are not employed. In Liberia, El Salvador, and Mexico partner's occupation was not available from the data files.

Table 4.12 shows the distributions of births in the 10 years prior to the survey according to father's occupation. The percentage of children whose fathers have agricultural occupations varies from 80 and 71 percent in Burundi and Mali, respectively, to only 6 percent in Trinidad and Tobago. Less than 10 percent of children have fathers with professional, technical, or clerical occupations in Botswana, Burundi, Colombia, Guatemala, Thailand, and Togo.

Infant and child mortality rates according to father's occupation are shown in Table 4.13. Because of the small numbers of births for most countries, the category "not employed/no husband" is not shown. For most countries, there is a great variation in under-five mortality according to father's occupation category, with

agricultural occupations having twice the level of mortality as the PTC occupations in 9 of 25 countries and at least 50 percent higher mortality in 18 countries. Rates for children with fathers in blue collar and sales and service occupations are intermediate between agriculture and PTC, being somewhat higher for blue collar in most countries.

Within occupational categories there is wide variation across countries, even at the PTC level: lows of 17, 26 and 29 under-five deaths per 1,000 births in Colombia, Thailand and Sri Lanka to highs of 197 in Mali and 155 in Uganda. Examining the age range for rates, it is apparent that much of the variation over occupations and among countries within occupational categories occurs at ages one to four years, similar to the findings for education.

Table 4.12 Births in the 10 years preceding the survey by father's occupation

Percent distribution of births in the 10 years preceding the survey by father's occupation, Demographic and Health Surveys 1985-1990

Country	Not employed/ Mother not married	Agriculture	Blue collar	Sales/ Service	Professional/ Technical/ Clerical	Total percent	Number of births
SUB-SAHARAN AFRICA							
Mali	1	71	7	4	16	100.0	6,925
Liberia	U	U	U	U	U	U	9,568
Senegal	6	46	22	15	11	100.0	8,284
Uganda	4	56	3	27	10	100.0	9,178
Ghana	3	53	23	8	13	100.0	7,703
Togo	6	59	21	5	9	100.0	6,005
Ondo State, Nigeria	1	51	23	10	15	100.0	5,671
Burundi	2	80	9	7	2	100.0	7,268
Sudan (North)	1	36	18	32	13	100.0	13,150
Kenya	8	36	16	22	17	100.0	13,874
Zimbabwe	6	26	36	19	12	100.0	6,601
Botswana	39	11	37	6	7	100.0	6,323
NEAR EAST/ NORTH AFRICA							
Morocco	16	40	16	17	10	100.0	12,487
Egypt	3	32	28	23	14	100.0	16,757
Tunisia	3	17	53	13	15	100.0	8,766
ASIA							
Indonesia	1	45	25	18	11	100.0	17,769
Thailand	3	61	21	10	5	100.0	7,854
Sri Lanka	6	34	48	0	12	100.0	8,348
LATIN AMERICA/ CARIBBEAN							
Bolivia	5	39	28	15	13	100.0	11,706
Peru	3	40	29	14	15	100.0	6,368
Guatemala	2	61	18	12	7	100.0	8,944
Dominican Republic	3	32	24	29	12	100.0	8,614
El Salvador	U	U	U	U	U	U	5,866
Brazil	7	29	31	19	15	100.0	6,828
Ecuador	11	34	29	13	14	100.0	6,150
Mexico	U	U	U	U	U	U	11,209
Colombia	4	34	35	17	9	100.0	5,442
Trinidad & Tobago	21	6	43	17	13	100.0	3,762

U = Unknown (not available)

Table 4.13 Infant and child mortality by father's occupation

Infant and child mortality by father's occupation, Demographic and Health Surveys, 1985-1990

Country	Neonatal mortality				Postneonatal mortality				Infant mortality				Child mortality				Under-five mortality			
	Agri-cul-ture	Blue collar	Sales/ Service	Prof./ Tech./ Clerical	Agri-cul-ture	Blue collar	Sales/ Service	Prof./ Tech./ Clerical	Agri-cul-ture	Blue collar	Sales/ Service	Prof./ Tech./ Clerical	Agri-cul-ture	Blue collar	Sales/ Service	Prof./ Tech./ Clerical	Agri-cul-ture	Blue collar	Sales/ Service	Prof./ Tech./ Clerical
SUB-SAHARAN AFRICA																				
Mali	74	38	*	*	65	38	*	*	139	75	*	*	175	139	*	*	290	203	*	*
Liberia	75	60	(51)	*	88	83	*	50	163	143	*	113	95	107	*	72	242	235	*	176
Senegal	51	(51)	(20)	62	45	(25)	(38)	(23)	96	(76)	(58)	(51)	144	(89)	(69)	(25)	226	(158)	(123)	(75)
Uganda	48	48	47	(28)	66	56	37	31	115	105	84	86	90	101	(78)	50	195	195	(156)	(132)
Ghana	47	50	45	55	40	42	16	(31)	87	91	62	(80)	96	68	64	*	175	153	122	*
Togo	44	52	(46)	(50)	44	31	(22)	(13)	88	84	(68)	(54)	89	79	*	*	170	156	*	*
Ondo State, Nigeria	30	36	24	(42)	27	38	23	40	57	74	47	63	56	(71)	(42)	(35)	110	(139)	(88)	(96)
Burundi	39	40	(32)	22	49	43	*	(19)	88	83	*	(33)	113	74	*	*	191	151	*	*
Sudan (North)	45	39	46	(14)	37	30	28	30	82	69	75	63	76	42	(35)	23	152	108	(107)	84
Kenya	27	25	25	33	45	33	25	22	72	59	50	42	40	38	25	24	109	95	73	65
Zimbabwe	34	32	29	21	43	26	17	16	77	58	46	38	48	31	23	8	122	86	69	46
Botswana	23	17	27	22	21	17	11	15	44	34	38	37	19	16	22	9	62	49	59	46
NEAR EAST/ NORTH AFRICA																				
Morocco	47	26	(37)	42	39	28	(14)	21	86	54	(51)	62	43	15	(5)	(0)	125	69	(55)	(62)
Egypt	55	42	37	24	57	45	30	13	112	88	67	38	55	37	22	11	161	122	88	48
Tunisia	33	28	17	23	29	28	23	12	62	57	40	34	24	13	11	5	84	69	51	39
ASIA																				
Indonesia	41	39	33	17	60	43	29	19	101	82	62	36	48	50	27	12	144	128	88	48
Thailand	34	25	(13)	11	21	15	(3)	7	55	40	(16)	19	22	11	*	2	76	50	*	21
Sri Lanka	25	20	19	21	27	12	18	7	52	33	37	28	20	10	8	9	71	43	44	36
LATIN AMERICA/ CARIBBEAN																				
Bolivia	57	45	29	22	59	58	30	28	116	103	59	50	71	66	49	21	179	162	106	70
Peru	60	34	27	23	59	62	46	18	119	96	73	42	57	57	32	11	169	148	103	53
Guatemala	37	38	30	31	46	47	28	11	83	85	58	42	59	35	19	(2)	137	117	76	(44)
Dominican Republic	53	40	46	33	43	33	(31)	15	96	73	(77)	48	46	24	(16)	14	137	96	(92)	61
El Salvador	57	30	*	12	43	35	*	12	100	64	*	25	30	14	*	(5)	127	77	*	(30)
Brazil	48	36	(38)	20	66	56	(10)	3	115	93	(49)	23	26	13	(9)	4	138	104	(57)	27
Ecuador	61	46	31	22	43	30	28	17	105	75	59	39	61	35	13	10	159	107	71	49
Mexico	42	34	23	18	41	31	23	10	83	64	46	28	34	19	5	1	114	82	51	29
Colombia	28	23	23	13	21	21	13	15	49	44	36	29	23	17	4	2	72	61	39	31
Trinidad & Tobago	*	14	19	32	*	10	6	6	*	24	25	39	*	5	3	2	*	29	28	40

Note: Figures in parentheses are based on 250-500 births.
* Less than 250 births

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5 Summary

5.1 LEVELS AND TRENDS OF MORTALITY

The 28 countries participating in the DHS-I surveys showed a wide variation in mortality levels. Estimates of under-five mortality for the mid-1980s ranged from 247 per 1,000 (Mali) to 32 per 1,000 (Trinidad and Tobago). Variation in the level of infant mortality was less, ranging from 144 (Liberia) to 25 (Sri Lanka). The greatest differences were found in the age interval 1-4 where mortality rates ranged from 159 (Mali) to 9 (Colombia, Sri Lanka, and Thailand) and 4 (Trinidad and Tobago).

Although the estimated rates pertain to only the countries surveyed, they are indicative of regional mortality levels. Between regions there was considerable overlap in mortality rates, but mortality levels were highest in sub-Saharan Africa, substantially lower in the Near East/North Africa region and Latin America and the Caribbean, and lowest in Asia. For the mid-1980s, the average of the under-five mortality rates were 146 per 1,000 for sub-Saharan Africa, 89 and 82 per 1,000 for the Near East/North Africa and Latin America/Caribbean regions, and 59 per 1,000 for Asia.

Because event reporting was probably less complete for periods 10 or more years before a survey than for more recent periods, estimates of mortality decline based on the DHS surveys should be considered minimal estimates. Nevertheless, the surveys documented substantial mortality declines. For all countries combined, the decline in under-five mortality was 29 percent over the 10-year period from the mid-1970s to the mid-1980s. Although the trend was favorable in all regions, the smallest percent declines occurred in sub-Saharan Africa.

For the countries surveyed in the Near East/North Africa region (Egypt, Morocco, and Tunisia), the pace of mortality decline was particularly rapid. In the mid-1970s, under-five mortality in these countries was in excess of 100 per 1,000 and as high as 205 per 1,000 in Egypt. By the mid-1980s, under-five mortality had declined by about 40 percent and mortality in the age interval 1-4 by about 60 percent in all three countries. This represents a major child survival success story.

5.2 AGE PATTERNS OF MORTALITY

The age pattern of childhood mortality in the high mortality countries of sub-Saharan Africa was found to be distinctly different from the age pattern in the other regions and the age patterns contained in the model life table systems. The distinctive pattern is characterized by very high mortality in the age interval 1-4 years relative to infancy.

This pattern of excessive child mortality was found in 8 of the 9 sub-Saharan countries with an under-five mortality rate in excess of 100 per 1,000. Most, although not all, of the WFS surveys in sub-Saharan Africa also found this pattern. Documentation of this mortality pattern as well as identification of the countries in which it does and does not occur may be helpful in identifying its underlying cause(s).

5.3 DEMOGRAPHIC DIFFERENTIALS

Mortality was analyzed across demographic subgroups by age of the child. In terms of the sex of children, substantial country-specific variations were observed but, overall, the expected differentials were found. The median excess in male relative to female mortality was 31 percent during the neonatal period, 6 percent during the postneonatal period, and no excess risk during the age interval 1-4 years. In several countries of North Africa and Asia, the 1-4 year age interval was characterized by slightly higher female mortality.

Twins experienced under-five mortality at a rate 2.7 times that of singleton births. As expected, this difference in survival was most pronounced during the neonatal period and diminished with age; the median relative risk was 5.0 during the neonatal period, 2.6 during the postneonatal period, and 1.5 during ages 1-4 years. There was a tendency for the twin/singleton differential to be more pronounced in the lower mortality countries.

Birth order and age of the mother at birth of the child are important determinants of childhood mortality. First births and births to young women (under 20 years) typically experience higher mortality than high order births and births to older women. This analysis however found effects that varied widely by region and by age of child. In sub-Saharan Africa, first birth order and young maternal age were moderately associated with increased mortality risk, while high birth order and older maternal age effects were negligible. The exception to this pattern was found for the neonatal period, where high birth order and older maternal age were associated with higher mortality. In the Latin America/Caribbean region, first births and births to women under 20 years of age carried a much lower relative risk of neonatal mortality than their counterparts in sub-Saharan Africa. Further, during the 1-4 year age period, first births in Latin America and the Caribbean experienced much lower mortality than births of higher order.

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As in previous studies, a strong and consistent relationship between the length of the preceding birth interval and mortality risk was observed. Among all countries studied, the median excess under-five mortality risk associated with short intervals (less than 24 months compared to 24-47 months) was 45 percent: 55 percent during the neonatal period, 53 percent during the postneonatal period, and 27 percent after the first birthday. In sub-Saharan Africa, the short interval effect diminished sharply after the first birthday, while in the lower mortality countries (e.g., Latin America and the Caribbean), short intervals continue to be associated with much higher mortality risk through the 1-4 age period. Long birth intervals (i.e., in excess of 47 months) were associated with a median 25 percent lower mortality.

5.4 SOCIOECONOMIC DIFFERENTIALS

There are many ways to classify respondents and their households by socioeconomic characteristics. In this report mortality differentials were investigated in terms of residence, migration, education and occupational categories. Substantial differentials were found between the categories of characteristics considered. However, because of the high correlation among socioeconomic characteristics, conclusions about causation cannot be drawn in the absence of multivariate analysis. At the same time, it is important to note the wide variation in mortality rates across countries for a given characteristic. While major strides to reduce mortality can be accomplished through socioeconomic development, other factors such as access to and attitudes toward health care and proper child care, and national programs such as immunization and oral rehydration therapy, may be equally crucial for mortality reduction.

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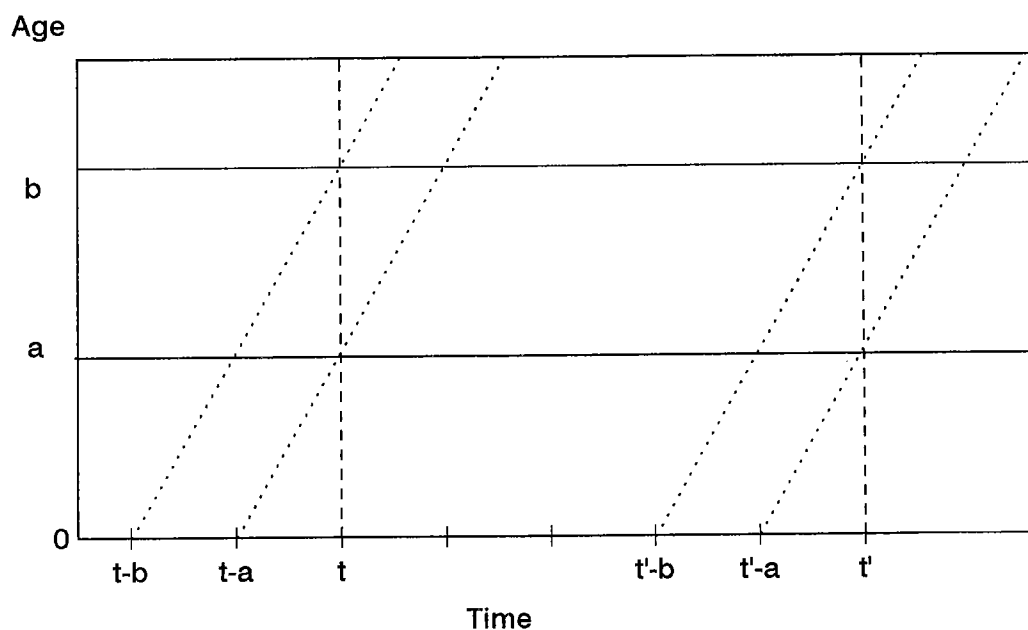
Appendix A

Calculation of Synthetic Cohort Probabilities of Death

The procedure for calculating synthetic cohort probabilities of death is based on the procedure first developed by Somoza (1980) and modified by Rustein (1984). By this approach, probabilities of death are built up from probabilities calculated for the age intervals: less than 1 month, 1-2 months, 3-5 months, 6-11 months, 12-23 months, 24-35 months (2 years), 36-47 months (3 years), and 48-59 months (4 years). The probability of death is the result of dividing the number of deaths occurring between the relevant age limits to children who were exposed to death within the calendar period, by the number of children exposed in the same age/calendar period.

Referring to Figure A.1, there are three groups of children who are exposed to death between ages a and b during the time t to t':

(1) children born between t-a (age a at time t) and t'-b (age b at time t'),

(2) children born between t-b and t-a, and

(3) children born between t'-b and t'-a.

Figure A.1 Cohorts used to calculate synthetic rates, Demographic and Health Surveys, 1985-1990

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Children in the first group were exposed during the entire period in question, while children in the latter groups have been exposed only during part of that period. Due to the short length of the intervals used to code age at death, it is safe to assume that in the latter cases one-half of both the deaths and the exposure occurred within the relevant period. The numerator thus becomes the sum of all deaths at ages a to b occurring to children born between t-a and t'-b plus one-half of the deaths to children born between t-b and t'-a, plus one-half of deaths to children born between t'-b and t'-a. Similarly, the denominator becomes the number of children born between t-a and t'-b who survived to age a plus one-half the number of children born between t-b and t'-a who survived to age a, plus one-half the number of children born between t'-b and t'-a who survived to age a.

An exception to the procedure must be made for the period immediately before the survey since all deaths recorded for children exposed during that period must have occurred before the date of the survey. Therefore, all the deaths (rather than one-half) are counted for children born between t'-b and t'-a, although the children have been exposed, on average, for one-half of the time.

In order to obtain the conventional probabilities of death, which are presented in the tables, the authors first calculated the probability of surviving through the subinterval by subtracting the probability of dying (the quotient given above) from one. Then, the subinterval survival probabilities included within the conventional age limits were multiplied together; finally this product was subtracted from one to give the probability of death within the conventional limits:

$$(n)q(x) = 1 - \prod_{i=x}^{i=x+n} (1 - q[i])$$

where $(n)q(x)$ is the conventional probability of dying between ages x and $x+n$ and $q[i]$ are the subinterval probabilities of dying.

The conventional postneonatal mortality rate is defined differently from conventional rates. Although it refers to the age interval between 1 and 11 months (completed), it is not a probability, but rather it is the arithmetic difference between the infant mortality rate (the probability of dying in the first year of life) and the neonatal mortality rate (the probability of dying in the first month of life).

Appendix B

Evaluation of the Effect of Age at Death Misreporting on the Ratio $_4q_1/_5q_0$

The evaluation of the quality of the mortality data in the birth history section of the DHS-I surveys reported an excess of deaths at 12 months of age (Sullivan et al. 1990). The degree to which this "heaping" at 12 months of age is due to rounding down the age at death of children reported to have died at age one, as is argued by Rutstein (1984), or is due to rounding up late infant deaths, as is argued by Goldman et al. (1979) and Thapa and Retherford (1982), is uncertain. No doubt both mechanisms are operative. To the extent that the former factor is predominant, infant and child mortality estimates are hardly affected as few events are transferred across the age boundary separating infant and child mortality. To the extent that upward transference of infant deaths is predominant, infant and child mortality rates are affected and the observed values of $_4q_1/_5q_0$ are positively biased.

The paper presented a model which assigns 25 percent of the excess deaths at 12 months of age to infancy and calculated adjusted infant and child mortality estimates (i.e., increasing the estimates of $_1q_0$ and decreasing the estimates of $_4q_1$). The exercise demonstrated that, at the selected level of reallocation of deaths, the estimates of $_4q_1$ are reduced by approximately 6 percent for most of the countries of sub-Saharan Africa (see Table 4.4 in Sullivan et al., 1990).

The issue here is whether or not the reduction in $_4q_1$ substantially affects the index $_4q_1/_5q_0$. Table B.1 shows ratios of $_4q_1/_5q_0$ based on observed rates and adjusted rates as well as comparison values from the North Model Life Table at the relevant level of $_5q_0$ for six countries of sub-Saharan Africa with a high concentration of deaths at ages 1 through 4. It is clear that for 5 of the 6 surveys, the value of the ratio $_4q_1/_5q_0$ based on both observed and adjusted rates of $_4q_1$ exceed the comparison values from the North Model Life Tables to a significant degree. The sole exception is Uganda. It was concluded that the high mortality in the ages 1 through 4 is not primarily the result of misreporting of age at death by survey respondents.

Table B.1 Observed and adjusted $_4q_1/_5q_0$ ratios compared with values from North Regional Mortality Tables

Values of the ratio $_4q_1/_5q_0$ calculated from observed and adjusted mortality rates for six DHS-I surveys in sub-Saharan Africa and values from the North Regional Mortality Tables, Demographic and Health Surveys, 1986-1989

| | | Child mortality | | $_4q_1/_5q_0$ ratio | | |
| | | | | | DHS-I surveys | |
Country	Under-five mortality $(_5q_0)$	Observed $(_4q_1)$	Adjusted $(_4q_1)$	NRMT value	Observed $(_4q_1)$	Adjusted $(_4q_1)$
Mali	279.7	169.7	159.6	.488	.60	.57
Senegal	209.5	131.5	125.1	.464	.63	.60
Uganda	186.9	90.6	85.6	.451	.49	.46
Ghana	153.8	78.9	74.0	.425	.51	.48
Togo	158.7	82.3	77.9	.428	.52	.49
Burundi	185.5	107.8	102.7	.450	.58	.55

Note: Rates are for the 10-year period preceding the survey.
NRMT = North Regional Mortality Tables

Appendix C

Percent distribution of births in the 10 years preceding the survey by duration of residence in urban areas, Demographic and Health Surveys, 1985-1990

Country	Urban native	Long-term migrant	Short-term migrant	Rural resident	Total percent	Number of births
SUB-SAHARAN AFRICA						
Mali	14	7	3	76	100.0	6,925
Liberia	38	2	0	60	100.0	9,568
Senegal	22	8	5	65	100.0	8,284
Uganda	3	4	3	91	100.0	9,178
Ghana	22	3	2	73	100.0	7,703
Togo	5	21	0	74	100.0	6,005
Ondo State, Nigeria	25	11	4	60	100.0	5,671
Burundi	2	1	0	97	100.0	7,268
Sudan (North)	24	7	3	66	100.0	13,150
Kenya	7	3	3	87	100.0	13,874
Zimbabwe	2	24	0	73	100.0	6,601
Botswana	U	U	U	U	U	6,323
NEAR EAST/ NORTH AFRICA						
Morocco	18	11	5	66	100.0	12,487
Egypt	34	6	2	58	100.0	16,757
Tunisia	38	8	6	48	100.0	8,766
ASIA						
Indonesia	19	5	3	73	100.0	17,769
Thailand	8	4	3	84	100.0	7,854
Sri Lanka	9	5	0	86	100.0	8,348
LATIN AMERICA/ CARIBBEAN						
Bolivia	38	7	3	51	100.0	11,706
Peru	43	8	2	46	100.0	6,368
Guatemala	21	4	3	72	100.0	8,944
Dominican Republic	31	16	9	43	100.0	8,614
El Salvador	U	U	U	U	U	5,866
Brazil	54	8	4	33	100.0	6,828
Ecuador	23	25	0	52	100.0	6,150
Mexico	52	9	0	39	100.0	11,209
Colombia	45	12	6	38	100.0	5,442
Trinidad & Tobago	U	U	U	U	U	3,762

U = Unknown (not available)

Table C.2 Infant and child mortality by parents' literacy

Infant and child mortality by parents' literacy, Demographic and Health Surveys, 1985-1990

Country	Neonatal mortality				Postneonatal mortality				Infant mortality				Child mortality				Under-five mortality			
	Both illit.	Father lit.	Mother lit.	Both lit.	Both illit.	Father lit.	Mother lit.	Both lit.	Both illit.	Father lit.	Mother lit.	Both lit.	Both illit.	Father lit.	Mother lit.	Both lit.	Both illit.	Father lit.	Mother lit.	Both lit.
SUB-SAHARAN AFRICA																				
Mali	67	90	(74)	27	64	67	(43)	40	131	157	(117)	67	185	158	*	(71)	291	290	*	(133)
Liberia	73	74	*	59	89	82	*	62	162	156	*	121	96	96	*	81	243	237	*	192
Senegal	47	51	*	30	52	44	*	30	99	95	*	60	(144)	143	*	54	(229)	224	*	111
Uganda	57	49	(43)	46	73	64	*	47	130	113	*	93	99	98	*	81	216	199	*	166
Ghana	49	41	(38)	51	40	43	(26)	22	89	84	(63)	73	101	81	*	55	181	159	*	124
Togo	(52)	46	*	42	(40)	43	*	25	(92)	88	*	66	*	90	*	57	*	170	*	119
Ondo State, Nigeria	34	31	(35)	21	24	29	(49)	33	58	60	(84)	55	65	55	*	35	119	112	*	88
Burundi	40	39	43	34	53	46	(41)	42	92	85	(84)	76	113	105	(131)	90	195	181	(204)	160
Sudan (North)	44	46	(45)	38	37	38	(30)	28	81	84	(74)	65	77	72	(34)	36	152	149	(106)	99
Kenya	33	26	*	24	20	45	*	28	54	71	*	52	20	44	*	29	73	112	*	80
Zimbabwe	42	30	*	29	49	35	*	21	90	65	*	50	(49)	49	*	22	(135)	110	*	70
Botswana	22	22	(18)	22	20	8	(17)	15	42	30	(35)	37	19	19	(21)	14	61	49	(55)	50
NEAR EAST/ NORTH AFRICA																				
Morocco	48	45	*	32	41	36	*	18	89	81	*	50	51	32	*	5	136	111	*	55
Egypt	57	42	(41)	31	54	54	(47)	18	111	96	(88)	49	54	43	(42)	15	159	135	(126)	64
Tunisia	35	30	(26)	23	32	29	(26)	20	66	59	(52)	43	31	17	(18)	9	95	75	(69)	51
ASIA																				
Indonesia	39	39	45	32	55	56	(63)	32	94	95	(108)	64	52	48	(58)	33	141	139	(160)	95
Thailand	(33)	40	*	21	(21)	26	*	13	(54)	65	*	34	(32)	12	*	9	(85)	77	*	43
Sri Lanka	(32)	22	(21)	20	(20)	24	(10)	9	(52)	46	(31)	29	(5)	21	(12)	9	(57)	67	(43)	38
LATIN AMERICA/ CARIBBEAN																				
Bolivia	65	49	42	32	56	68	45	43	121	117	88	75	76	72	50	45	188	181	134	117
Peru	(52)	50	*	28	(60)	62	*	37	(112)	111	*	65	(54)	58	*	30	(160)	163	*	94
Guatemala	38	39	(21)	35	46	49	(51)	34	84	88	(72)	69	65	52	(54)	24	144	135	(122)	91
Dominican Republic	38	57	48	36	49	39	28	27	87	96	76	62	63	26	33	18	144	119	106	79
El Salvador	41	63	(34)	25	40	40	(53)	28	81	103	(87)	53	20	(33)	*	12	100	(133)	*	64
Brazil	49	49	37	31	100	88	81	26	149	137	118	56	30	21	17	8	174	155	134	64
Ecuador	(41)	66	(39)	32	(41)	43	*	24	(82)	109	*	56	(29)	62	*	19	(109)	164	*	74
Mexico	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Colombia	(28)	(27)	(37)	18	(11)	(34)	(25)	17	(39)	(61)	(61)	34	(12)	(23)	(29)	9	(51)	(82)	(88)	43
Trinidad & Tobago	*	*	*	22	*	*	*	7	*	*	*	29	*	*	*	3	*	*	*	32

Note: Figures in parentheses are based on 250-500 births.
U = Unknown (not available)
* Less than 250 births

Table C.3 Births in the 10 years preceding the survey by parents' literacy

Percent distribution of births in the 10 years preceding the survey by parents' literacy, Demographic and Health Surveys, 1985-1990

Country	Both illiterate	Father literate	Mother literate	Both literate	Total percent	Number of births
SUB-SAHARAN AFRICA						
Mali	69	20	5	7	100.0	6,925
Liberia	52	28	1	19	100.0	9,568
Senegal	7	80	0	12	100.0	8,284
Uganda	16	36	3	44	100.0	9,178
Ghana	31	30	4	35	100.0	7,703
Togo	6	73	0	21	100.0	6,005
Ondo State, Nigeria	28	28	6	38	100.0	5,671
Burundi	38	33	7	22	100.0	7,268
Sudan (North)	32	35	3	31	100.0	13,150
Kenya	7	35	0	58	100.0	13,874
Zimbabwe	9	19	3	69	100.0	6,601
Botswana	46	10	8	36	100.0	6,323
NEAR EAST/ NORTH AFRICA						
Morocco	47	40	2	11	100.0	12,487
Egypt	48	27	3	21	100.0	16,757
Tunisia	26	38	4	32	100.0	8,766
ASIA						
Indonesia	10	19	3	68	100.0	17,769
Thailand	5	11	3	81	100.0	7,854
Sri Lanka	4	13	4	80	100.0	8,348
LATIN AMERICA/ CARIBBEAN						
Bolivia	15	16	12	57	100.0	11,706
Peru	8	21	1	70	100.0	6,368
Guatemala	26	31	5	38	100.0	8,944
Dominican Republic	7	15	9	69	100.0	8,614
El Salvador	21	19	8	53	100.0	5,866
Brazil	13	13	8	66	100.0	6,828
Ecuador	5	13	4	78	100.0	6,150
Mexico	U	U	U	U	U	11,209
Colombia	7	7	8	78	100.0	5,442
Trinidad & Tobago	1	2	2	96	U	3,762

U = Unknown (not available)

Appendix D

Summary of DHS-I and DHS-II Surveys, 1985-1993

Region and Country	Date of Fieldwork		Implementing Organization	Respondents	Sample Size	Male/Husband Survey	Supplemental Studies, Modules, and Additional Questions
SUB-SAHARAN AFRICA							
DHS-I							
Botswana	Aug-Dec	1988	Central Statistics Office	AW 15-49	4,368		AIDS, PC, adolescent fertility
Burundi	Apr-Jul	1987	Département de la Population, Ministère de l'Intérieur	AW 15-49	3,970	542 Husbands	CA, SAI, adult mortality
Ghana	Feb-May	1988	Ghana Statistical Service	AW 15-49	4,488	943 Husbands	CA, SM, WE
Kenya	Dec-May	1988/89	National Council for Population and Development	AW 15-49	7,150	1,133 Husbands	
Liberia	Feb-Jul	1986	Bureau of Statistics, Ministry of Planning and Economic Affairs	AW 15-49	5,239		TBH, employment status
Mali	Mar-Aug	1987	Institut du Sahel, USED/CERPOD	AW 15-49	3,200	970 Men 20-55	CA, VC, childhood physical handicaps
Ondo State, Nigeria	Sep-Jan	1986/87	Ministry of Health, Ondo State	AW 15-49	4,213	.	CA, TBH
Senegal	Apr-Jul	1986	Direction de la Statistique, Ministère de l'Economie et des Finances	AW 15-49	4,415		CA, CD
Sudan	Nov-May	1989/90	Department of Statistics, Ministry of Economic and National Planning	EMW 15-49	5,860		M, MM, female circumcision, family planning services
Togo	Jun-Nov	1988	Unité de Recherche Démographique, Université du Benin	AW 15-49	3,360		CA, SAI, marriage history
Uganda	Sep-Feb	1988/89	Ministry of Health	AW 15-49	4,730		CA, SAI
Zimbabwe	Sep-Jan	1988/89	Central Statistical Office	AW 15-49	4,201		AIDS, CA, PC, SAI, WE
DHS-II							
Burkina Faso	Dec-Mar	1992/93	Institut National de la Statistique et de la Démographie	AW 15-49	6,000	1,845 Men 18+	AIDS, CA, MA, SAI
Cameroon	Apr-Sep	1991	Direction Nationale du Deuxième Recensement Général de la Population et de l'Habitat	AW 15-49	3,871	814 Husbands	CA, CD, SAI
Madagascar	May-Nov	1992	Centre National de Recherches sur l'Environnement	AW 15-49	6,260		CA, MM, SAI
Malawi	Sep-Nov	1992	National Statistical Office	AW 15-49	4,850	1,151 Men 20-54	AIDS, CA, MA, MM, SAI
Namibia	Jul-Nov	1992	Ministry of Health and Social Services, Central Statistical Office	AW 15-49	5,421		CA, CD, MA, MM
Niger	Mar-Jun	1992	Direction de la Statistique et des Comtes Nationaux	AW 15-49	6,503	1,570 Husbands	CA, MA, MM, SAI
Nigeria	Apr-Oct	1990	Federal Office of Statistics	AW 15-49	8,781		CA, SAI
Rwanda	Jun-Oct	1992	Office National de la Population	AW 15-49	6,551	598 Husbands	CA, SAI
Senegal	Nov-Aug	1992/93	Direction de la Prévision et de la Statistique	AW 15-49	6,310	1,436 Men 20+	AIDS, CA, MA, MM, SAI
Tanzania	Oct-Mar	1991/92	Bureau of Statistics, Planning Commission	AW 15-49	9,238	2,114 Men 15-60	AIDS, CA, MA, SAI
Zambia	Jan-May	1992	University of Zambia	AW 15-49	7,060		AIDS, CA, MA
NEAR EAST/NORTH AFRICA							
DHS-I							
Egypt	Oct-Jan	1988/89	National Population Council	EMW 15-49	8,911		CA, CD, MM, PC, SAI, WE, women's status
Morocco	May-Jul	1987	Ministère de la Santé Publique	EMW 15-49	5,982		CA, CD, S
Tunisia	Jun-Oct	1988	Office National de la Famille et de la Population	EMW 15-49	4,184		CA, CD, S, SAI
DHS-II							
Egypt	Nov-Dec	1992	National Population Council	EMW 15-49	9,864	2,406 Husbands	CA, MA, PC, SM
Jordan	Oct-Dec	1990	Department of Statistics, Ministry of Health	EMW 15-49	6,462		CA, SAI
Morocco	Jan-Apr	1992	Ministère de la Santé Publique	AW 15-49	9,256	1,336 Men 20-70	CA, MA, MM, SAI
Yemen	Nov-Jan	1991/92	Central Statistical Organization	EMW 15-49	5,687		CA, CD, SAI

Region and Country	Date of Fieldwork	Implementing Organization	Respondents	Sample Size	Male/Husband Survey	Supplemental Studies, Modules, and Additional Questions
ASIA						
DHS-I						
Indonesia	Sep-Dec 1987	Central Bureau of Statistics, National Family Planning Coordinating Board	EMW 15-49	11,844		PC, SM
Nepal (In-depth)	Feb-Apr 1987	New Era	CMW 15-49	1,623		KAP–gap survey
Sri Lanka	Jan-Mar 1987	Department. of Census and Statistics, Ministry of Plan Implementation	EMW 15-49	5,865		CA, NFP
Thailand	Mar-Jun 1987	Institute of Population Studies, Chulalongkorn University	EMW 15-49	6,775		CA, S, SAI
DHS-II						
Indonesia	May-Jul 1991	Central Bureau of Statistics, National Family Planning Coordinating Board, Ministry of Health	EMW 15-49	22,909		PC, SM
Pakistan	Dec-May 1990/91	National Institute of Population Studies	EMW 15-49	6,611	1,354 Husbands	CA
LATIN AMERICA & CARIBBEAN						
DHS-I						
Bolivia	Mar-Jun 1989	Instituto Nacional de Estadística	AW 15-49	7,923		CA, CD, MM, PC, S, WE
Bolivia (In-depth)	Mar-Jun 1989	Instituto Nacional de Estadística	AW 15-49	7,923		Health
Brazil	May-Aug 1986	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-44	5,892		CA, PC, SM, abortion, young adult use of contraception
Colombia	Oct-Dec 1986	Corporación Centro Regional de Población, Ministerio de Salud	AW 15-49	5,329		CA, PC, SAI, SM
Dominican Republic	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	7,649		NFP, S, SAI, SM family planning communication
Dominican Rep. (Experimental)	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	3,885		
Ecuador	Jan-Mar 1987	Centro de Estudios de Población y Paternidad Responsable	AW 15-49	4,713		CD, SAI, employment
El Salvador	May-Jun 1985	Asociación Demográfica Salvadoreña	AW 15-49	5,207		S, TBH
Guatemala	Oct-Dec 1987	Instituto de Nutrición de Centro América y Panamá	AW 15-44	5,160		S, SAI
Mexico	Feb-May 1987	Dirección General de Planificación Familiar Secretaría de Salud	AW 15-49	9,310		NFP, S, employment
Peru	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	4,999		NFP, employment, cost of family planning
Peru (Experimental)	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	2,534		
Trinidad and Tobago	May-Aug 1987	Family Planning Association of Trinidad and Tobago	AW 15-49	3,806		CA, NFP, breastfeeding
DHS-II						
Brazil (NE)	Sep-Dec 1991	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	6,222	1,266 Husbands	AIDS, PC
Colombia	May-Aug 1990	PROFAMILIA	AW 15-49	8,644		AIDS
Dominican Republic	Jul-Nov 1991	Instituto de Estudios de Población y Desarrollo (PROFAMILIA), Oficina Nacional de Planificación	AW 15-49	7,320		CA, MA, S, SAI
Paraguay	May-Aug 1990	Centro Paraguayo de Estudios de Población	AW 15-49	5,827		CA, SAI
Peru	Oct-Mar 1991/92	Instituto Nacional de Estadística e Informática	AW 15-49	15,882		CA, MA, MM, SAI

AW	all women	AIDS	acquired immune deficiency syndrome	NFP	natural family planning
CMW	currently married women	CA	child anthropometry	PC	pill compliance
EMW	ever-married women	CD	causes of death (verbal reports of symptoms)	S	sterilization
		M	migration	SAI	service availability information
		MA	maternal anthropometry	SM	social marketing
		MM	maternal mortality	TBH	truncated birth history
				VC	value of children