SOCIO-ECONOMIC DIFFERENTIALS IN CHILD MORTALITY IN DEVELOPING COUNTRIES

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Department of
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PREFACE

The significant economic and social inequality in the face of mortality has been an important unsolved problem in many nations. It is thus recommended in the World Population Plan of Action that "reduction or, if possible, elimination of differential morbidity and mortality within countries, particularly with regard to differentials between regions, urban and rural areas, social and ethnic groups, and the sexes" (para. 24(c)) be achieved.1/

In order to achieve this goal, it is important to improve the understanding of socio-economic mortality differentials. Therefore the United Nations system, in co-operation with a number of other international and national organizations, convened a meeting in 1979 in Mexico City on socio-economic determinants and consequences of mortality.2/ This meeting provided valuable groundwork for international comparative research in mortality differentials. The Population Commission also recommended, at its twentieth session, that a report be prepared by the Population Division of the Department of International Economic and Social Affairs of the United Nations Secretariat on social class differentials in mortality around the world.3/

A research project was therefore developed by the United Nations in co-operation with the World Health Organization as part of their joint programme of mortality funded by the United Nations Fund for Population Activities (INT/80/P09). Since a large-scale international comparative study of socio-economic mortality differentials was under way through a project at the Population Studies Center of the University of Pennsylvania, supported by the Ford Foundation, it was decided that the recommendations of the Population Commission would be best served by joining the United Nations efforts with those of the Center to conduct the present research.

In this study, census and survey data on child mortality differentials in 15 selected countries from Africa, Asia and Latin America are analysed. The investigation is confined to developing countries, where the mortality level tends to be substantially higher than that of developed countries. The focus is on the mortality of children for the following reasons. First, children's deaths share a very large proportion of deaths in developing countries so that children are considered the major target group for reducing mortality levels and differentials. Second, child mortality reflects economic and social conditions in a more sensitive way than mortality of adults, which is strongly affected by bio-medical factors, in particular, physiological deterioration that proceeds with age, and in general less preventable than child mortality. Finally, significantly more data are available on mortality differentials of children in developing countries than those of adults.

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Notes

1/ Report of the United Nations World Population Conference, 1974, Bucharest, 19-30 August 1974 (United Nations publication, Sales No. E.75.XIII.3), chap. I.

2/ Proceedings of the Meeting on Socio-economic Determinants and Consequences of Mortality, Mexico City, 19-25 June 1979 (New York and Geneva, United Nations and World Health Organization, 1980).

3/ See, Official Records of the Economic and Social Council, 1979, Supplement No. 2 (E/1979/22).

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EXPLANATORY NOTES

The following symbols have been used in the tables throughout this publication:

Two dots (..) to indicate that data are not available or are not separately reported, or that the item is not applicable.

A point (.) is used to indicate decimals.

I. INTRODUCTION

Although mortality declined considerably in developing countries after the Second World War, there remain significant differences in mortality among population groups in nearly all countries. Appropriate policy measures for reducing these differentials need to be developed and implemented.

Studies of mortality differentials are useful in at least three ways. First, such studies provide information for assessing inequalities among people with respect to longevity and health. Second, data on mortality differentials help to identify those underprivileged segments of the population who experience higher mortality levels. These groups are an appropriate target of policies and programmes for improving health conditions and survival chances. Finally, studies of mortality differentials improve our understanding of determinants of mortality and their interrelationships, on the basis of which proper policy measures for reducing mortality are developed, selected and improved.

The present study of child mortality differentials is a comparative investigation of data from 15 developing countries. Its major purpose is to establish a solid core of empirical generalizations about the factors associated with child mortality that can be used to provide guidance for policy and programme formulation and to orient future research on the subject. More emphasis, therefore, will be placed on identification of patterns of mortality differentials that are widely observed among different countries than on understanding peculiar patterns of mortality variation within the context of idiosyncratic social structures of the countries. Results of such country case studies in which factors affecting mortality are analysed intensively in view of particular political, economic, social, cultural and ecological conditions of the countries are presented in another United Nations publication (<u>Determinants of Mortality Change and Differentials in Developing Countries: The Five Country Case Study Project</u>).

<u>Analytical framework</u>

Although interrelationships among mortality determinants are very complicated, these determinants can be roughly divided into socio-economic factors and biomedical factors. Because death is a biological process, factors affecting child mortality in the most direct manner are biomedical. For example, Mosley (1984) groups those variables into five categories: maternal fertility factors, environmental contamination with infectious agents, availability of nutrients to the fetus and infant, injuries and personal disease control factors.

On the other hand, the effects of social, economic, cultural and geographical variables are indirect in the sense that they operate through the above-mentioned biomedical factors. Thus, the biomedical variables that exert direct influences on child mortality can be called intervening variables since they intervene between social, economic, cultural and geographical conditions and the event of death.

Unfortunately, available data that can be used for studies of mortality differentials provide very little information on these intervening variables; the data available relate mainly to socio-economic variables. What this volume principally accomplishes, therefore, is a demonstration of whether these unobserved biomedical characteristics are clustered principally within groups defined by, say, ethnic affiliation, urban-rural residence, mother's education or father's occupation. While the intervening biomedical variables are not themselves identified to any important extent, their social clustering provides important clues to their nature and defines the distribution of their most salient elements. Much can be learned about the etiology of ill health and premature death even without direct information on the biomedical intervening variables.

Although information on intervening biomedical variables is largely absent, it is possible and desirable to recognize the hierarchical nature of the variables that are present in the available data sets. Certain of those variables are established in the distant past and are reasonably viewed as causally, as well as temporally, prior to other variables. Among these are the parental background variables widely available in our data sets: education of mothers, education of fathers, place of mother's childhood residence (urban vs. rural), ethnicity and religion. These variables are in turn influential in determining the value of subsequent variables such as current income, occupational, activity and employment status, and current urban/rural residence of parents, which in turn affect mortality of their children through unmeasured biomedical variables.

This analytic scheme clarifies the distinction on the conceptual level between the effects on child mortality of parental background variables that operate through subsequent socio-economic variables and the effects that do not. For example, it may be hypothesized that higher education leads to occupations of higher income, which guarantee greater capability to provide children with a sufficient amount of nutritious food, which in turn reduces the risk of their death. On the other hand, higher education may imply better hygiene practices, which reduce the chances of environmental exposure of their children to infectious agents. This example clarifies that some effects on child mortality of parental education operate through subsequent variables pertaining to current socio-economic conditions of parents (e.g. income and occupation), and others are more directly associated with biomedical factors determining mortality of their children.

As described later in more detail, a multivariate method is adopted in this research for investigating effects on child mortality of a number of variables simultaneously. The multivariate analysis is designed in such a way that the variables are introduced at two different stages, following the distinction in the analytical framework between the characteristics of parents established mostly in their own childhood (parents' education, place of mother's childhood residence, ethnicity and religion) and those established in later years (region of residence, characteristics of housing, occupation, income, marital status, health care).

Data

In selecting data sets for the project, attention was paid to the following three points. First, as this project is an international comparative study, countries should be selected from the different less developed regions of the world. Second, the selected countries should represent a wide range of mortality levels. Meeting these two conditions makes it possible to investigate whether patterns of international mortality differentials differ among Africa, Asia and Latin America and whether the patterns vary systematically with the mortality level of countries. Finally, it is desirable to examine data sets that are well constituted for child mortality analysis but had not been previously used for this purpose.

Seven countries from Africa, five countries from Asia and three countries from Latin America (including the Caribbean) have been selected, as shown in table I.1. The regional distribution of the data sets is inversely related to the regional distribution of previous studies on this subject. A series of studies of child mortality differentials in Latin American countries have been conducted by Behm and his colleagues,[1/] but knowledge is less systematic for Asian countries and very little is known about the dimension of mortality variation in Africa. Therefore, more attention has been given to Africa and Asia in this study.

The level of mortality varies considerably among the study countries. Estimates of the infant mortality rate and expectation of life at birth as reported in the 1982 assessment of the Population Division of the United Nations are shown in table I.1. It is clear from table I.1 that the data sets cover a broad spectrum of mortality levels, ranging from Sierra Leone, where the infant mortality rate (IMR) and the expectation of life at birth (e_0) in 1975-1980 are 215 and 32, respectively, to Jamaica, where IMR and e_0 in 1970-1975 are 42 and 68.

The most salient features of the data sets used in the project are displayed in table I.2. Information on child mortality is supplied by women reporting the number of children ever born to them and the number of children still surviving at the time of census or survey. Women with missing information on either children ever born or children surviving were excluded from the analysis. As described later in more detail, mortality experiences of children of women are standardized for marital duration or age of women. When marital duration is used to index exposure to mortality, women with missing information on marital duration are excluded; when age was used, women with missing age data were excluded. Missing information on other variables was normally handled by creating a "missing" category in order to avoid having to delete the observation; results for the missing categories are normally not presented here.

Table I.3 presents a synopsis of the types of variables available on these data sets. It is clear that the conventional socio-economic variables related to residence, occupation, education, and ethnicity are represented in the large majority of data sets. Income and wealth variables, far more difficult to measure, are much less well represented. Information on type of water supply, toilet facility, housing, and access to health care - variables that because of their bio-physical connotations seem more proximate to the event of death - are available in about a third of the data sets.

Data sets provide relatively little information on the bio-medical variables that invariably intervene between economic, social and cultural conditions and the event of death. This limitation of the data sets examined here is partly attributable to the fact that all of the data sets but one (Sierra Leone) were not specifically developed for purposes of studying mortality conditions.

In addition to the limited availability of pertinent variables, the data sets have other limitations that should be taken into consideration when results of the analysis are interpreted. Those problems include accuracy, validity, comparability and representativeness.

As is often the case for data from developing countries, the data sets examined in the present study may not be sufficiently accurate in some aspects. Sources of errors include misunderstanding by respondents of the meaning of questions, incorrect knowledge and memory of respondents about the subjects queried, reluctance of respondents to provide outsiders with some kinds of information, mistakes by interviewers in asking questions and recording responses, deviations by interviewers from given instructions, inappropriately phrased questions and vaguely defined response categories, and mistakes in coding responses in the questionnaire into machine-readable forms. It should be noted that errors occurring randomly tend to weaken or mask the true relationships by introducing anomalies into observed results, whereas systematic errors tend to distort the true relationships, possibly resulting in some patterns that would not be observed otherwise. For example, one of the major errors in retrospective data on child survivorship is the omission of children who died, particularly a long time ago. If this tendency is stronger among social and geographic groups of higher mortality, observed results, ceteris paribus, will underestimate mortality differentials.

Validity refers to the extent to which theoretical concepts and their operational measures are matched. The most important validity problems probably occur with two variables in the data set: education and occupation. In most of the data sets examined, education is measured by the number of completed years of schooling, so that variation in quality and type of education within the same grade is not reflected. Occupations are classified into very broad categories, so that important occupational differences within a category, e.g., the difference between highly professional white collar jobs and relatively simple clerical jobs, are not measured.

Two validity problems in the data sets merit special attention. The first one concerns the timing of events. In this study, the index of child mortality for mothers is tabulated by characteristics of parents at the time of census or survey, and observed relationships in the tables are often interpreted as reflecting the impact of those characteristics on children's survival chances. However, the parental characteristics might have been different during the life and at the time of death of their children. For example, parents might have changed their occupations after the death of their children. In such a case, it may be meaningless to discuss the impact of current occupation of those parents on the mortality of their children. Causal influence may even be reversed. Although the data analysis in this study is based on the assumption that characteristics of parents remain the same for a sufficiently long period of time in the past, the assumption is wrong for some parents. As a consequence, some of the observed patterns or absence of patterns could be produced by violations of that assumption.

It should be noted that the term "father" in this study pertains to the current husband of the mother. Data on survivorship of children of women are related to characteristics of husbands of the women, and analysed as mortality differentials by characteristics of fathers. It is not really known if those husbands are stepfathers or biological fathers. In fact, they may be neither, if they married the women after the death of the children. Characteristics of fathers are approximated here by characteristics of current husbands of mothers.2/

Turning to the issue of representativeness, it should be emphasized that three of the 15 data sets used are not nationally representative. The Nigeria data set pertains only to the western region; the Sierra Leone sample achieves broad geographic coverage but its regions were selected on the basis of their having either very high or very low mortality; the Sudan sample is the smallest and most restrictive, pertaining only to the Gezira agricultural scheme.3/ Results for Sudan should be interpreted in the light of the highly specialized character of this sample.

National representativeness of data can be undermined by self selection of respondents. There are a high proportion of non-responses to some questions. If true mortality differentials by a factor are significantly different between those who responded to the question and those who did not, the observed pattern may not be nationally representative.

The international comparability of results can also be undermined in many ways. Questions on the same subject may be asked in different ways in different countries. Even when questions are asked in very similar ways, their meaning in different social and cultural contexts may differ substantially. The same number of years of schooling may have different meanings in different school systems. The roles and functions of marriage as a social institution vary among societies. In addition, the list of response categories to the same question differs among countries, and definitions of the same response categories are not always the same. For example, the definitions of rural and urban areas vary among data sets, as will be described later in chapter XI.

Even when categories have the same definitions, differences in the distribution among categories could pose a problem of comparability. Do mortality differentials by marital status have the same meaning in a country where most women are legally married and in a country where consensual unions are very popular? The differential distribution with respect to factors affecting mortality should be taken into consideration.

Another comparability problem arises from the fact that the variables that are available in this study differ among data sets. This problem undermines the comparability of results of multivariate analysis in which effects of many factors on mortality are estimated simultaneously. The number of independent variables that are introduced and therefore "controlled" in the multivariate regression equation is not the same for all of the countries studied here.

Finally, although the data examined here cover a considerable number of developing countries in different parts of the world, they are only a small part of the developing world, so that generalizations on the basis of the results should be made cautiously. This is true particularly with respect to the variables for which data are available in only about a half or third of the study countries.

In spite of these limitations, results of the study provide useful information on mortality differentials. If similar patterns of mortality differentials are observed in a number of the study countries, it is quite plausible that there is some underlying causal mechanism producing the observed relationships and that these mechanisms operate in a wide range of different demographic, economic, social, cultural and ecological settings. It is very important to discuss these underlying relationships and to pursue policy and programme measures to affect the causal chains.[4/] Where results differ from country to country, they point to the importance of various cultural and ecological features as conditioning variables and shed light on determinants of child mortality in their broadest sense.

Measurement of child mortality

Available data on child mortality differentials in developing countries are usually drawn from censuses or surveys. Death registration is unreliable in many developing countries, and even when reliable, death registration records include very little information on characteristics of decedents and their households. Censuses and surveys can readily and inexpensively include retrospective questions on mortality of children of respondents which can be analysed in light of questions on individual and household characteristics that are included in surveys. The most widely available type of data on child mortality, therefore, is reports by mothers on the numbers of children ever born to them and children still surviving.

Trussell and Preston (1982) have developed and tested a method for analysing mortality differentials from such child survivorship data. This method is employed in this study. The essential feature is to construct an index of child mortality for women and compare the values of the index among different groups of women.

A note is needed about the definition of "children" in the present study. The word "children" has two meanings: either very young persons or the offspring of someone, regardless of age. The substantive focus of this study is on persons in infancy and early childhood, for whom high death rates are observed in many developing countries. However, the data analysed are on the survival of all children of women in reproductive ages; many of these children could be in early adulthood at the time of the survey. This apparent difficulty, however, is not a serious problem, for several reasons. First, the majority of children of women in reproductive ages are very young; the data analysed do not include information on very old women, whose children are usually in their adulthood. Second, because of the age pattern of mortality risks universally observed, the vast majority of deaths recorded to children will have occurred at young ages. About three quarters of all deaths to persons under age 30 can be expected to occur under age 5. For these reasons, the data analysed in the present study are deemed to reflect mostly mortality during infancy and early childhood.

The principle of the index construction rests on the idea that the proportion of children who have died can be used as a measure of the mortality of children of women after adjusting for the effect of marital duration or age of the women. Adjustment is necessary because, if mothers are old or have been married for a long time, their children are older and are thus exposed to the risk of mortality for a longer period of time, resulting in a higher proportion of children who have died.

The index of child mortality for a woman of a certain marital duration (or age) is constructed as the ratio of the actual proportion of her children who have died to the proportion expected for an "average" woman in the population of the same marital duration (or age). Implementation of this basic idea is described below more precisely.

For each woman, an index of her children's mortality is created. The index is equal to the number of her dead children (children ever born minus children surviving) divided by the expected number of dead children. This latter quantity is derived by multiplying her number of births by the expected proportion of children dead. This expected proportion dead in turn is based upon general mortality conditions in the population as well as upon the distribution of exposure times of her children to the risk of mortality, as measured by the mother's marital duration or age. When information on both marital duration and age was available, marital duration was used because it was believed to provide a more precise index of exposure. In societies where childbearing is essentially confined to marriage, variation among women with respect to age at marriage introduces a source of variation that woman's age cannot account for. It is possible that this variation is not random among the population but is correlated with a woman's characteristics (e.g., better-educated women may marry later and hence their children exposed to mortality for a shorter time), which would lead to biases in the estimated impact of a characteristic on mortality. This type of problem is less acute when exposure is measured by duration of marriage.

The index of child mortality for woman i of marital duration j, M_{ij}, is thus

$$M_{ij} = \frac{D_i}{N_i \cdot EPD_j}, \text{ where}$$

D_i = number of dead children for woman i,
N_i = number of births to woman i,
EPD_j = expected proportion dead for a woman of marital duration category j.

When marital duration categories are not available, j refers to a woman's age group rather than to her marital duration. The marital duration categories used are 0-4 years, 5-9 years, ..., 30-34 years and the age categories are 15-19, 20-24, ..., 45-49. Women above age 49 and of marital durations above 34 are excluded from this analysis because their births and child deaths occurred relatively far in the past.

To derive EPD_j the mortality estimation procedure originally developed by Brass (1968) is turned upside down. Brass developed a system of equations, based on simulation, for converting an observed proportion dead among women in category j into a life-table measure of mortality. The equations are of the form:

$$q(a) = d(j)\, G(j), \text{ where}$$

$q(a)$ = probability that a child will die before exact age a,
$d(j)$ = proportion dead among children ever born to women in marital duration category j,
$G(j)$ = multiplier suitable for women in marital duration category j.

The (a, j) correspondences suitable for mothers in marital duration category j are (2, 0-4), (3, 5-9), (5, 10-14), (10, 15-19) ..., the (a, j) correspondences when j refers to age group of mother are (1, 15-19), (2, 20-24), (3, 25-29), (5, 30-34), (10, 35-39) ...

The multiplier G(j) is a function of the pattern of marital fertility in the population as indexed by ratios of cumulative parities for women in different marital duration groups. Equations for the multipliers used in this work are those derived by Trussell (United Nations, 1983). To put the above equation to work on the problem at hand, we impose a "standard" mortality function, $q_s(a)$, and convert that standard into an expected proportion dead by rewriting the previous equation for q(a) as

$$EPD_j = q_s(a)/G(j)$$

Where does $q_s(a)$ come from? First, a family of model life tables is chosen that is believed to be as accurate as possible for the country in question. The "North" and "West" model life table systems of Coale and Demeny were most frequently employed. Second, a model life table with that system was found such that, for the population as a whole, actual child deaths were equal to expected child deaths.[5] The $q_8(a)$ comes from this life table.

The final form of the child mortality index for woman i of marital duration j is thus

$$M_{ij} = \frac{D_i}{N_i \cdot q_8(a)/G(j)}$$

The index of child mortality will be referred to as the child mortality ratio throughout this volume, because it is the ratio of observed deaths to expected deaths. The index is a standardized mortality ratio, because it is standardized with respect to marital duration or age of mothers.

Methods of analysis

For a given variable of research interest, data analysis is conducted following three major steps: univariate analysis, bivariate analysis and multivariate analysis. (Note that these names reflect the number of independent variables, but do not include the dependent variable, i.e., the child mortality ratio.)

In the univariate analysis, the child mortality ratio is calculated for each category of the variable. Namely, for all women in category K we simply sum the number of dead children, sum the number of expected dead children, and compute the ratio of the two. Ratios for different categories are then compared with each other.

On occasion, indices are used to characterize the amount of inequality in the distribution of child mortality among classes. One index employed for mother's and father's education is simply the slope of a line fitted by least squares procedures to the relation between the child mortality ratio and the education variable. This slope indicates the proportionate change in child mortality corresponding to a unit increment in education. (This procedure is also applied to the multivariate coefficients.) Comparisons across countries or rural and urban areas allows an assessment of whether a mother's or father's education has the largest effect on child mortality.

A second measure used is the index of dissimilarity (I.D.). As used in this volume, I.D. is a measure of the dissimilarity in the class distributions of deaths and expected deaths:

$$I.D. = \frac{1}{2} \sum_j \left| \frac{D_j}{D} - \frac{ED_j}{ED} \right| \text{, where}$$

D_j = actual child deaths in class j
D = total child deaths
ED_j = expected child deaths in class j
ED = total expected deaths

The value of ED_j takes account, of course, of the number of births in class j as well as of the duration of exposure of those births to the risk of death. The range of the index of dissimilarity is from 0 to 1.00. If the class distribution of observed deaths is identical to the class distribution of expected deaths, then $D_j/D = ED_j/ED$ for all j and I.D. = 0. A useful benchmark value of I.D. occurs when there are two classes in toto, each of which constitutes half of the population, and one of which has double the death rate of the other. In this case, I.D. would equal 0.167.

It should be kept in mind that the index of dissimilarity is affected by the size of variation in the population with respect to the independent variable as well as the size of mortality differentials by the independent variable. This characteristic limits the usefulness of the index of dissimilarity as an indicator of mortality differentials if the distribution of the value of the factor varies significantly among study populations.

The second step of data analysis is bivariate analysis, in which the mortality ratio is cross-tabulated by the variable of interest and another variable. Its major purposes are to investigate whether the pattern and size of mortality differentials by the variable of interest vary systematically with the value of another variable (interaction effect) and to examine whether the apparent association between the factor and child mortality is attributable to another factor that is related to both.

Finally, results from multivariate analyses are examined in order to estimate mortality differentials by the variable of interest when some other variables are controlled. The method employed for this purpose is the ordinary least squares (OLS) multiple regression analysis. The dependent variable of the regression is the child mortality ratio.

In all regressions, univariate differences are presented to determine how much a coefficient changes when other variables are included. These are simply transformations of the univariate tabulations (the child mortality ratios) with the coefficient for the reference category set equal to zero and the coefficients for the other categories measured as deviations from the reference category. Given that these coefficients or differences were calculated indirectly, statistical significance was not determined.

A two-stage multivariate scheme of analysis is pursued in the present research. In Stage I, child mortality is regressed on all variables whose values are established during the parent's childhood. In Stage II, all other variables are added to those included in Stage I. The coefficients of the parental childhood variables in Stage II thus represent the "direct" effects of parental childhood variables on the mortality of the next generation of children. Usually, these effects will be smaller than the equivalent coefficients in Stage I, reflecting the fact that some of the parental childhood variables are "working through" other socio-economic variables established later in life.

Because of the possibility that the structure of relations between mortality and the independent variables differs between rural and urban areas, the sample is partitioned into separate rural and urban subsamples and the Stage II estimation is done for both subsamples. This strategy was previously used to good effect by Schultz (1979). The resulting equations are referred to as pertaining to Stage IIIR (rural) and IIIU (urban).[6/] Several of the determinants of mortality are shown to have systematically different effects in the two areas, a result which sheds considerable light on the mechanisms through which these determinants operate.

The form of the regression equation is

$$M_{ij} = A + \sum_K B_K X_{iK} + E \quad \text{where}$$

X_{iK} = value of Kth variable for woman i
B_K = coefficient of variable K
A = constant term
E = error term, assumed normally distributed (after weighting by number of births) with mean of zero

The variables, X_{iK}, are members of a set of dummy variables.[7/] Within a set (e.g., father's occupation), one category (e.g., professional) is assigned the value zero and a separate variable is constructed for each of the other occupations. The variable for "sales," for example, takes on the value of one if the father is a sales worker and zero otherwise. A situation of zeros on all occupational variables denotes that the father is a professional. Such a category denoted by all zeros is termed a reference category. The value of B_K for sales occupation thus indicates by how much the index of child mortality is raised (or lowered if B_K is negative) for offspring of sales workers relative to offspring of professional workers. If $B_K = +.10$, it implies that offspring of sales workers have 10 per cent higher mortality than offspring of professional workers, controlling all other variables (all other X_{iK}). The significance level of a coefficient thus refers to the significance of the difference in child mortality between the category to which the coefficient pertains and the reference category. Had another reference category been chosen, the coefficient and significance level of a particular category would almost certainly have been different, although differences among coefficients of categories would remain the same.[8/]

Organization of the volume

In this volume, results will be presented variable-by-variable rather than country-by-country. Each of the following chapters pertains to a particular variable or closely related set of variables. This approach capitalizes on the advantages of comparative research. It is immediately possible to examine the degree to which a research result reported for one country can be generalized to others. One finding in this volume, for example, is that mortality relations in Sri Lanka - probably the most frequently and closely studied developing country because of its good data and the early and widespread availability of the Sri Lanka World Fertility Survey - are quite anomalous with regard to certain key variables. A second advantage of comparative analysis is that it enables the researcher to identify certain conditioning factors that seem to influence the effect of particular variables on mortality. In this volume, surprisingly few of these conditioning factors are encountered. Mortality relations appear to be relatively similar for high and low mortality countries, for Africa, Asia and Latin America, and for countries at different levels of development. One exception is that levels of inequality in mortality (as measured, for example, by I.D.) appear to be unusually high in Latin America, just as levels of income inequality are unusually high in the region. But there are too few Latin American countries represented to attach much confidence to this result. Doubtless the most important conditioning factor uncovered is not national-level but sub-national: mortality relations appear to be systematically different in urban and in rural areas, even though urban-rural residence itself does not appear to be related to mortality levels. For example, ethnicity seems to have much more important mortality effects in rural than in urban areas, whereas fathers' education appears to be a more important influence in urban than in rural areas.

Each chapter begins with a review of previous findings and hypotheses regarding the effect of a particular variable on mortality. The review is not exhaustive but aims to uncover the major previous studies relating to a particular variable. The chapter then presents simple tabulations of mortality differences according to that variable in each of the 15 countries. Selected cross-tabulations are then presented. The aim of these is to examine possible interactions between variables in their influence on mortality, as well as to examine whether one variable seems to dominate another in its mortality effects. A more precise approach to the latter issue follows in the regression analysis. As noted above, Stage I regressions examine the influence of parents' background variables - those established before adulthood - on their children's mortality. These variables include maternal and paternal education, ethnicity and religion, and place of birth. They aim at identifying the "total" effect of these variables on mortality. Stage II regressions add all other variables to those used in Stage I for the subsample of women matched to their husbands. Stage III regressions repeat Stage II for subsamples of women divided into urban and rural residents. A brief summary of results concludes each chapter.

The core of the volume has been organized to present firstly the variables established mostly in the parent's childhood (chapters II to V): maternal and paternal education, ethnicity, religion, mother's childhood residence and lifetime migration. Personal characteristics established mainly in adulthood and household characteristics are discussed next (chapters VI to X): father's occupation, economic activity of the mother, income and wealth, marital status, household structure and characteristics of housing, including lavatory and water supply facilities. Lastly, community characteristics are presented in chapters XI to XIII: rural-urban residence, region of residence and health care. The last chapter (XIV) is devoted to the overview of the results.

Annexes I and II to this report examine two technical issues that are relevant to the research design of the present study. First, the ordinary least squares (OLS) regression is employed for multivariate data analysis throughout this project. Since there are more costly but more elaborated and sophisticated techniques that can be used in place of the OLS procedure, a question arises concerning the validity of the methodological decision: to what extent would multivariate results obtained in the present study be different from outcomes of more methodologically appropriate techniques? This issue is examined in annex I.

Second, factors analysed in the present research do not include breastfeeding, which is considered to be a very important determinant of child mortality. Annex II considers to what extent the inclusion of breastfeeding would change the multivariate results presented in this volume.

Finally, annex III gives detailed occupational codes for countries which did not use international classification schemes, and annex IV provides definitions of the urban population in the various countries.

Notes

1/ See detailed bibliography at the end.

2/ In the case of Liberia, no matching of husbands and wives was possible because the sample unit was an individual rather than a household.

3/ The Gezira scheme was established in 1925 and is the largest employer in Sudan, employing on a permanent basis about 100,000 tenants and on a seasonal basis up to 500,000 workers. For a related treatment with broader geographic coverage, see A. A. Farah and S. H. Preston, "Child mortality differentials in Sudan", Population and Development Review, vol. 8, No. 2, 1982.

4/ Implications of some of the data problems discussed here for studying mortality differentials have been previously discussed in more depth by Palloni (1981).

5/ In order to reduce the number of iterations required, a margin of error of up to 1.5 per cent between expected and actual deaths was tolerated.

6/ It should further be noted that the regression analyses in Stages II and III are based upon sub-samples of women whose husband's characteristics are known. In the tabulations and Stage I regression, unmarried women or women whose husband's characteristics are unknown could be included simply by constructing a category "no husband or missing information". But as soon as two or more husbands' charateristics are to be included, the "no husband or missing information" category for two different characteristics become highly or perfectly correlated, making regression analysis inefficient or impossible. Hence, at Stages II and III the analysis is limited to women whose husband's characteristics are known. In the case of many WFS surveys, these women often included those who were widowed, divorced, or separated, in which case the husband's information pertains to the ex-husband or absent husband. For other data sets, this analysis had to be limited to currently married women with husbands present. This is clearly a group that is likely to have lower-than-average child mortality levels. However, because a large majority of women 15-49 years had husbands present, the overall country results would change little if all women were included.

7/ Because of the problem of heteroscedasticity - higher variance in M_{ij} for women with fewer births - each M_{ij} observation is weighted by the woman's number of births, N_j.

8/ The form of the regression equation implies that the amount by which M_{ij} is raised or lowered as a result of an increment in X_{iK} is independent of j, the woman's marital duration or age. This implies in turn that the factor by which the $q_s(a)$ function is reaised or lowered for children in a particular group is independent of the child's age, a. In other words, the q(a) function is assumed to be scaled upwards or downwards proportionally by an increment in X_K. If this assumption were not tenable, it would be necessary to add a long series of terms involving interactions between duration category of mother and all other covariates. This procedure would multiply the number of independent variables by the number of categories of j.

One empirical justification for the proportionate assumption is that q(a) functions in existing systems of model life tables are, to a very close approximation, related to one another by a constant of multiplication (see Trussell and Preston (1982) for a graphical demonstration). In fact, the proportionality is so close that the assumption of proportionality has been used by previous analysts in deriving the multipliers, G(j). The fact that q(a) functions drawn from different populations tend to be highly proportional does not, of course, mean that q(a) functions of different subgroups in the same population are proportional. But the assumption appears to be reasonable. Some additional evidence of its suitability is derived from several studies that examine the closely-related assumption that the age-specific death rate functions of different sub-groups in the same population are proportional. In the most detailed study to date of age-covariate interactions, Trussell and Hammarslough (1983) report for Sri Lanka "a decided lack of conformity with our a priori expectations that effects of education, place of residence, and type of toilet facility should become more evident in later childhood ages." Studying the Philippines, Indonesia and Pakistan, Martin et al. conclude that adding age-covariate effects results in "a significant increase in explanatory power ... However, most of the interaction effect estimates themselves are not significantly different from zero, and many of those that are significant are quantitatively small or difficult to interpret" (Martin and others, 1983). Similar conclusions are drawn for Peru in annex I to this report. It does not appear at this stage that a great deal of information is being sacrificed as a result of the assumption that the multiplicative effects of covariates on child mortality are independent of the child's age.

Using World Fertility Survey data for Republic of Korea and Sri Lanka, Trussell and Preston (1982) show that the estimation procedure just described yields a set of coefficients, B_K, that is extremely similar in magnitude and significance level to estimates of the coefficients via hazards - models that take advantage of the data available on dates of birth and child death.

Table I.1. Mortality estimates for the countries in the study

Country and region	Year of census or survey	United Nations estimates		
		Year[a/]	Infant mortality rate	Expectation of life for both sexes
Africa				
Ghana	1971	1965-70	127	46.0
Kenya	1977/78	1970-75	117	47.9
Lesotho	1977	1970-75	130	45.3
Liberia	1974	1965-70	143	45.0
Nigeria	1972	1965-70	146	42.5
Sierra Leone	1980	1975-80	215	32.0
Sudan	1981	1975-80	131	45.1
Asia				
Indonesia	1971	1965-70	130	45.1
Nepal	1971	1965-70	178	40.6
Republic of Korea	1976	1970-75	43	60.6
Sri Lanka	1975	1970-75	56	63.0
Thailand	1975	1970-75	65	59.6
Latin America				
Chile	1970	1965-70	95	60.6
Jamaica	1976	1970-75	42	67.8
Peru	1977/78	1970-75	110	55.5

Source: *World Population Prospects: Estimates and Projections as Assessed in 1982* (United Nations publication, Sales No. E.83.XIII.5).

a/ Quinquennial periods that are slightly before the dates of census or survey in the respective countries are chosen here because mortality experiences reflected in the retrospective data used in this research are centered around a few years before the date of data collection.

Table I.2. Characteristics of data sets used in this analysis

Country and region	Name of data set	Year of census or survey	Number of women	Number of women matched to husbands	Model life table system and level used for standard a/	Index of child's exposure to mortality	Additional sample limitations
Africa							
Ghana	Post-enumeration Survey	1971	76,074	15,214 b/	West 12	Marital duration	Ever-married women
Kenya	Kenya Fertility Survey (WFS)	1977/78	6,113	5,738	North 14.5	Age	
Lesotho	Lesotho Fertility Survey (WFS)	1977	3,603	3,178	West 15	Age	Ever-married women
Liberia	Liberia Census Public Use Sample	1974	29,615	0 c/	North 12.0	Age	Women 15-44
Nigeria	Fertility and Family Planning Survey	1972	2,957	2,907	North 11.5	Marital duration	Western Nigeria only
Sierra Leone	National Correlates of Mortality Project	1980	1,657	1,571	North 5	Age	Ever-married women. Not nationally representative d/
Sudan	Fertility and Mortality Survey of Gezira Scheme	1981	536	331 e/	North 12	Marital duration	Ever-married women. Not nationally representative f/
Asia							
Indonesia	Census Public Use Sample	1971	95,563	78,304 g/	South 13	Age	Ever-married women
Nepal	Nepal Fertility Survey (WFS)	1976	4,800	4,800	South 12	Marital duration	Ever-married women
Republic of Korea	Fertility-Abortion Survey	1971	5,355	4,909	West 19.72 h/	Marital duration	Ever-married women
Sri Lanka	Sri Lanka Fertility Survey (WFS)	1975	6,185	6,185	West 18	Marital duration	Ever-married women
Thailand	Thailand Fertility Survey (WFS)	1975	3,513	2,799	North 16.8	Marital duration	Ever-married women
Latin America and Caribbean							
Chile	Census Public Use Sample	1970	17,440	11,334 e/	East 17.5	Age	Limited to women 15-29
Jamaica	Jamaica Fertility Survey (WFS)	1976	2,425	2,425	West 19.5	Marital duration	Ever-married women
Peru	Peru Fertility Survey (WFS)	1977/78	5,357	5,357	West 14	Marital duration	Ever-married women

a/ Ansley J. Coale and Paul Demeny, Regional Model Life Tables and Stable Populations (Princeton University Press, Princeton, New Jersey, 1966).
b/ For regression analyses, a 20 per cent random sample of women was drawn. Women matched to husbands are limited to wives of head of household.
c/ Linkage of husbands and wives not possible.
d/ A household sample of chiefdom headquarters in 5 districts wih lowest mortality according to 1974 Census. All chiefdom headquarters were less than 2000 in population so sample is essentially all rural.
e/ Wives of heads only.
f/ Pertains only to four villages in large Gezira agricultural scheme.
g/ A 20 per cent random sample of these 78,304 women were used for regression analysis.
h/ Because of the rapid mortality decline in Republic of Korea, it was necessary to introduce a standard that accounted for this trend. Since the children of women married for longer periods were exposed to higher mortality conditions, this standard was developed by splicing together various "West" model life tables starting with level 12.25 and progressing to level 19.72 over a period of 30 years.

Table I.3. Explanatory variables available by country

Explanatory variables (parent's characteristics)	AFRICA							ASIA					LATIN AMERICA		
	Ghana	Kenya	Lesotho	Liberia	Nigeria	Sierra Leone	Sudan	Indonesia	Nepal	Republic of Korea	Sri Lanka	Thailand	Chile	Jamaica	Peru
I. Established mostly in childhood															
Mother's education	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Father's education	√	√	√		√	√	√	√	√	√	√	√	√	√	√
Place of mother's childhood residence (rural-urban)	√	√	√						√	√	√	√		√	√
Ethnicity	√	√		√	√	√	√	√	√		√	√			√
Religion	√	√	√		√	√		√	√	√	√	√		√	
II. Established in later years															
Region of residence	√	√	√	√		√		√	√	√	√	√	√	√	√
Rural-urban residence	√	√	√	√	√	a/	a/	√	√	√	√	√	√	√	√
Mother's activity and employment status	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Access to and use of health care services					√										√
Water supply	√				√	√	√				√			√	
Lavatory facility	√				√	√	√				√				
Access to electricity					√						√				
Type of housing	√					√	√				√				
Mother's age	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Father's occupation	√	√	√		√		√	√	√	√	√	√	√	√	
Household income					√						√	√		√	
Household wealth						√				√	√				
Marital status	√	√	√	√	√	√			√		√	√		√	√
Household type	√			√						√		√			

Note: √ = variable available for the country.

a/ Rural samples only.

Chapter II

MATERNAL EDUCATION

Recent studies have suggested that child mortality in developing countries is associated more closely with maternal education than with any other socio-economic factor (Behm, 1980; Caldwell, 1979; Cochrane, 1980). It is not unexpected that, in the absence of other variables, a child's probability of dying is inversely related to the mother's years of schooling. What has impressed many analysts is the strength and persistence of the association when other socio-economic, as well as more proximate variables are controlled.

Although the importance of maternal education is now widely recognized, questions remain concerning the magnitude and nature of its effect in different settings. This chapter re-examines the relationship between the mother's years of schooling and child mortality. One aim is to determine the degree to which the maternal-education effect works through other socio-economic variables whose values are established later in life. For example, much of the importance of the mother's education could result from the ability of a better educated woman to attract a husband who earns more, a factor that appears to operate in Bangladesh, where men have recently begun to recognize the desirability of having an educated wife (Lindenbaum and others, 1983).

In order to shed light on the mechanisms through which education operates, the discussion also considers whether the strength of the education-mortality relationship is altered by variations in such conditions as rural or urban residence and mortality level. If education has a greater effect in rural areas or high-mortality countries than in urban areas or lower mortality countries where modern health facilities are concentrated, it would suggest that education may act as a substitute for health care services. Knowledge of basic preventive and curative procedures may be more readily acquired in areas or countries where health care systems are better developed. However, if clinics and hospitals are uncommon, then education could fill the gap by providing information on health and personal hygiene (Rosenzweig and Schultz, 1981).

Formal education, on the other hand, may facilitate knowledge and use of the available health care facilities. In this case, education and health facilities are complementary; and education effects might be expected to be stronger in low-mortality areas. Even if education is found to promote utilization of health services, an important question remains: whether educated women seek out modern medical treatment because they can afford it or because schooling undermines their belief in traditional remedies. The difference, as Ware argues, "is between seeing poverty and deprivation as the cause of the underutilization of medical services by the illiterate or attributing their [medical services] absence to ignorance" (1983).

If, as some have asserted (e.g. Mosley, 1983), existing health services are basically immaterial for mortality levels, then one might expect that health care availability would not affect the education-mortality relationship; and, correspondingly, that the education effect would not vary across countries or regions with different degrees of health services. (These issues are discussed more fully in chapter XIII.)

Previous evidence on the effect of rural versus urban environment on the mortality-education relation is inconclusive (Cochrane, 1980; Farah and Preston, 1982). In urban and rural Mexico, similar infant mortality was reported (García y Garma, 1983) for children born to women with no education, but there were more rapid declines in urban areas as education increased. In two regions of Brazil, urban mortality was significantly lower than rural only for children born to mothers in the highest educational group (Sawyer and Soares, 1983). A summary (Baum and Arriaga, 1981) of the results of a series of studies on mortality differentials in Latin American countries conducted by Behm and others in 1977 and 1978 shows that among mothers with no education, survival probabilities to age 2 were approximately the same for urban and rural residents in Chile, Colombia, the Dominican Republic, Ecuador, Guatemala, Honduras, Nicaragua and Paraguay, but significantly lower for urban residents in Bolivia and Peru. The latter result is found for Costa Rica in another study (Behm, 1976). Baum and Arriaga (1981) also show that as education increased, mortality rates dropped slightly faster for children born to urban residents. Other factors were not controlled in this study. Presumably, educated women who live in rural areas differ from educated women in urban areas in other respects than merely residence (see Mosley, 1983). Recognition of these differences might produce a sharply different view of rural/urban differences in the mortality-education relation.

A recent finding is that maternal education retains significance even in the presence of income, husband's education and other wealth status variables, such as housing structure and possession of consumer durables (Caldwell, 1979; Caldwell and McDonald, 1981; Cochrane, 1980; Farah and Preston, 1982; Rosenzweig and Schultz, 1981). This discovery led Caldwell (1979) to conclude that the mother's education is not a proxy for nor a reflection of a household's standard of living, but has an important independent effect. He suggests that education enhances a mother's ability to provide adequate child care by challenging her traditional notions of disease and by altering familial relationships. An educated mother is said to be less fatalistic, better able to deal with the modern world and more aware of simple hygienic measures. She is more inclined to shift the allocation of food, previously biased in favour of adults, to children.

In one of the few attempts to test Caldwell's theory, it was found that maternal education did indeed provide psychological and health benefits (Lindenbaum and others, 1983). In this anthropological examination of Bangladeshi villagers, it was found that in a society where the position of women differs markedly from that of men, an educated woman had higher status within both her own family and her husband's family. Educated women were more autonomous and more capable of dealing with outsiders. They were more likely to take advantage of modern medicine. Given that textbooks and teachers stressed the importance of hygiene and sanitation -- washing hands before eating, burying garbage etc. -- school children were immediately recognizable in their villages because of their cleanliness. The girls were particularly conscious of personal hygiene, possibly because the textbooks emphasize female cleanliness. Furthermore, the lavatory at school was used by girls but not by boys. Surprisingly, although education affected the treatment and prevention of disease, it did not alter ideas concerning its origin. Rarely was the germ theory of disease mentioned in discussions concerning the causes of illness.

Economists, in contrast to anthropologists and others, have tended to stress the notion that maternal education operates through the allocation of maternal time to market and non-market activities. By enhancing a woman's potential returns from work, increased education can stimulate labour force participation. In turn, the working mother has less time to devote to child care but increases the family's economic resources, which might have a favourable impact on child health. Thus, it is possible to distinguish between a substitution effect, with a negative impact on child health, and an income effect with a positive impact. The likelihood that both of these effects are triggered by labour force participation grows with a woman's education. (This issue is considered in chapter VII.)

Education both facilitates participation in the modern sector and protects women and children from gruelling agricultural work. If a girl is sent to school, she spends less time labouring in the fields. Parents, having invested in a daughter's education, may also single her out among their children for special treatment. Thus, the educated girl may grow up to be better nourished and more likely to produce an infant of an adequate birth weight (Lindenbaum and others, 1983; Ware, 1983). The link between education and the birth weight of offspring may also arise from the mother's receiving better care and more adequate food during pregnancy. Rejecting taboos, the woman may be more inclined to eat high-protein foods -- such as chicken and eggs -- which are often prohibited during pregnancy in traditional societies (Ware, 1983).

Measurement

In 12 of the studied countries, data on education of mother was obtained by asking the respondent the highest level or grade, or the total years of schooling she had completed. Exceptions are Ghana, Sierra Leone and the Republic of Korea, where the highest level or grade attained (in Ghana) or attended (in Sierra Leone and Republic of Korea) was asked. This difference limits the comparability of educational mortality differentials between these three countries and the others. Furthermore, differences in school systems may jeopardize the international comparability of educational mortality differentials.

It should also be noted that some important educational differentials within countries are not measured by the "number of completed years of education". The variable does not reflect variation in the type of education: education at some schools are academic, some are vocational, and other are religious. Quality of education may be substantially different among schools of the same level. In addition, the curricula may not be the same. For example, some programmes may be strongly oriented towards humanities, others toward sciences. Results presented in this chapter and the next chapter should be viewed with these considerations in mind.

Statistics compiled by the United Nations Educational, Scientific and Cultural Organization (UNESCO) provide an overall picture of the variation in the educational levels of the countries under review. The proportion of those aged 15 years or over who are illiterate and the proportion of those aged 25 years or over who had some schooling are shown for those countries in tables II.1 and II.2, respectively. Statistics are presented for a date closest to that of the mortality analysis.

Despite limitations due to differing definitions, the tables are useful for grouping the countries with respect to educational level. There appears to be considerable variation among them. The largest proportion of those with some schooling and the smallest proportion of illiterates are found in Jamaica. Following Jamaica, the countries where more than half of the adult men and women had some schooling and were literate at the time of data collection consist of Chile, Peru, the Republic of Korea, Sri Lanka and Thailand. At the other end of the spectrum are Liberia, Nepal, Sierra Leone and the Sudan, where it was found that more than 80 per cent of the adult men and women have no schooling and more than 60 per cent were illiterate. Countries positioned between these high- and low-level groups are Ghana, Indonesia, Kenya, Lesotho and Nigeria.

As expected, the ranking of the countries according to the proportion of those aged 25 years or over who had some schooling is highly correlated to the proportion of illiterates aged 15 years or over. Rankings of the countries with respect to the educational levels of males and females are also highly correlated for each of the two indicators. As a rule, males are significantly more educated than females, according to both of the indicators, except in Jamaica and Lesotho. The sex differentials are very small in Jamaica. Lesotho exhibits a significantly higher educational achievement of females. In certain extreme cases, Liberia and the Sudan, the percentage of educated men is more than double that of women.

Univariate results

Table II.3, which presents ratios of observed to expected deaths by the mother's completed years of schooling for the 15 countries, indicates that child mortality decreases as maternal education rises. Where the relationship is not monotonic - for example in Kenya, women with 12+ years of education have a slightly larger ratio than women with 10-11 years - deviation from the expected pattern is negligible. These deviations may be a reflection of problems in data quality such as inaccurate reporting of years of schooling and different definitions of schooling among subpopulations or they may reflect sampling variation. There is also a possibility that the deviations may not be statistical anomalies but instead indicative of a true behavioural phenomenon. Women who have only partially fulfilled the requirements for a particular certificate or degree and thus who terminate their education at a non-standard time, may do so for reasons (e.g., unplanned pregnancy, illness, economic stress), which correlate with increased child mortality.

There appears to be no universal threshold at which the effect of an increment in education changes. The lack of any such threshold is consistent with recent findings (Cochrane, 1980; Hobcraft and others, 1982; and Martin and others, 1982). Caldwell and McDonald (1981) observed, however, that the move from primary to secondary school was somewhat more important for child mortality than the move from no education to primary education. Table II.3 shows no such dominant pattern. In fact, in several African countries, the step from no education to 1-3 years makes a somewhat greater difference for child mortality than that from 4-6 to 7-9 years.

There does appear to be a weak regional pattern in the univariate results. As education increases, the mortality ratios decline less in the African countries, where mortality levels are generally higher, than in the other two regions. Thus, at this level, there is some support, albeit weak, for the hypothesis that maternal schooling has a greater impact on child mortality in lower mortality regions, a pattern also observed in another cross-national study (Hobcraft and others, 1981). The fact that the structure of mortality differs in high- and low-mortality regions may account for the varying effect of maternal education. A greater fraction of deaths in high-mortality regions appears to be attributable to diseases that can be prevented through vaccination programmes and insecticide treatment. In lower mortality regions, deaths are primarily due to diseases borne by water, food and feces, for which prevention appears to be responsive to improved personal hygiene and thus to increased female education.

An alternative and more quantitative way of comparing educational differentials in mortality is to use the index of dissimilarity. The index can be interpreted as the proportion of observed deaths that would have to be redistributed in order to make the distributions of observed and expected deaths equal across social groups. The degree of educational inequality in mortality is seen in table II.4 to be somewhat dependent upon the level of mortality and region. Chile and Peru, the two Latin American countries, have the largest indices, indicative of the most inequality in the distribution of mortality. Four high-mortality countries, Lesotho, Liberia, Nepal and Sierra Leone have the lowest indices. In these countries, relatively few persons have received much schooling (with the possible exception of Lesotho) and the results simply reflect this. It is tempting to say that the lower mortality countries have achieved that status precisely because they have a relatively large middle group that has escaped the poorest conditions, a circumstance that necessarily entails a relatively high index of dissimilarity. Peru, on the other hand, combines this condition with extremely large mortality differentials by education (table II.3), thus making it preeminent among the studied countries in the inequality of mortality.

The association between type of schooling - religious or formal - and child mortality is shown in table II.5 for Nigeria, the only country in which there are sufficient numbers of women listed as attending religious school.

That women who attend Koranic schools have higher child mortality than those who have not received any education whatsoever may give some support to the view that traditional attitudes towards disease and health practices are adhered to more closely by those who attend religious school (Ware, 1983). Without controlling for other variables, however, it is not possible to determine the effect of religious schooling on child mortality. (For a discussion of the effect of religion on child mortality, see chapter IV.)

Bivariate results

Cross-tabulations reveal the extent to which the effect of maternal education on mortality both depends upon, and/or is reduced by, a third factor. Table II.6 cross-classifies mortality ratios by mother's education and father's education. For most countries, paternal-education effects are smaller within categories of maternal education than are maternal effects within paternal categories. This pattern is perhaps most clearly observed in Indonesia, one of the few countries in which there are no empty cells in discrepant categories, particularly when the mother has more education than the father.

It is evident that the maternal-education effect observed at the univariate level is not simply the result of better educated women marrying better educated men. Even when fathers have received little or no education, increasing amounts of mother's education improve child mortality.

Examination of the joint effect of mother's education and urban or rural residence shows that maternal education remains a strong predictor (table II.7). In fact, the urban mortality advantage, often mentioned in the demographic literature, does not appear to be substantial once education is controlled except, to some degree, in Ghana, Peru, Sri Lanka and Thailand. Even Sri Lanka would follow the common pattern of small residential differences within educational categories were it not for the estates inhabited almost exclusively by Indian Tamils.

In three countries, Chile, Indonesia and the Republic of Korea, there appears to be an interaction between education and residence. The uneducated in the rural areas have slightly lower mortality than their counterparts in capital cities; and, for Chile and Indonesia, than uneducated residents in smaller cities as well. In these countries, living in an urban area is beneficial only for the children of the better educated, who perhaps are more capable of taking advantage of the ostensible benefits of city residence. They may be more knowledgeable about health facilities and more equipped to pay for the necessary care. However, the absence of an obvious interaction elsewhere indicates that, in general, the responsiveness of child health to female education does not vary by urban or rural location.

The indices of dissimilarity in the social-class distribution of death, calculated separately by urban and rural residence, reveal that educational inequality in mortality is greater in cities than in the countryside and greater in capital cities than in other urban areas (table II.8). It would appear that this pattern cannot be attributed to a greater effect of education on mortality in urban areas given, as discussed earlier, the absence of an interaction between the three variables in most countries. Undoubtedly, larger urban indices of dissimilarity reflect a greater unevenness in the distribution of education in urban than rural areas. Frequently, inequality in the capital city is more than double that in rural areas. The rural indices of dissimilarity are uniformly low, ranging from 0.003 to 0.070, suggesting that there is relatively little scope to lower rural mortality rates simply on the basis of bringing up the most disadvantaged groups to the rural average. Substantial improvement will have to come through changing the entire distribution of rural educational attainment or mortality-education relations. In urban areas, however, there is much greater scope for programmes directed to the most disadvantaged and uneducated sector.

Cross-tabulation of mother's education with the water-supply variable shows that in the six countries for which information is available, the effect of schooling is strongly maintained within categories of that variable (table II.9). It could be argued that uneducated women would benefit more from a relatively clean water-supply than would educated women because awareness of basic hygienic practices, gained through schooling, offsets deficient water facilities. If this were the case, an interaction between education and water-supply would be present. In three countries, Jamaica, Sierra Leone and Sri Lanka, there is no evidence of an interaction. In Ghana, the effect of water-supply is somewhat greater for the uneducated, suggesting that schooling there partially compensates for inadequate sanitation facilities.

The strong effect of mother's education is generally maintained within the categories of the lavatory and housing variables as well (tables II.10 and II.11). Evidence that education substitutes for deficient lavatory and housing facilities is observed only for the Sudan, where schooling has no impact on child mortality for women with the most modern lavatory facilities but has a large impact on the mortality of those with no access to such facilities. (These results, however, should be viewed with caution because only a small number of educated women in the Sudanese sample have deficient lavatory facilities.) In no country is the advantage of modern lavatory and housing facilities, small though it apparently is, realized only by those who have been educated.

Multivariate results

Given the strength of the maternal-education effect observed at the univariate and bivariate levels, it is of particular interest to determine whether the coefficients for the mother's schooling remain large at the multivariate level. It is clear from table II.12 that the effect of mother's education on child mortality is large and is statistically significant, even after many other variables are introduced. At Stage I, when only those parental characteristics determined in early life are controlled, 41 out of 59 regression coefficients are statistically significant, and at Stage II, when all other variables are also controlled, 33 are significant. (The significance of variables pertains to the difference between child mortality for women in a particular schooling category and that for women with no schooling.) All but three countries, Jamaica, Nepal and the Sudan, have at least one significant coefficient at this stage. Furthermore, the results are very consistent; only two of 59 coefficients are positive. The size of the coefficients in the Stage I and Stage II regressions suggests that to the degree that important socio-economic and proximate variables have been adequately measured and accounted for, much of the education effect can be considered "direct". That is to say, it does not work exclusively through other variables included in the analysis, such as the economic status of the father or the sanitation facilities of the household.

Because the maternal-education variable has many categories and the categories vary among the countries, comparison between countries is tedious and difficult. For ease of analysis, an average coefficient, or slope, was calculated for each country, representing the proportionate effect on child mortality of a one-year increment in the mother's years of schooling. Slopes were estimated at the zero-order stage by fitting a line to the univariate ratios. This stage was included in order to determine the extent to which the maternal-education effect is attenuated upon subsequent introduction of other covariates. At Stages II, IIIR and IIIU, slopes were estimated by fitting a line to the appropriate dummy variable coefficients given in table II.12. In computing the slope, the coefficient in a particular cell was weighted by the number of observations in that cell. Justification for the linear form adopted was based on the univariate tabulation, which indeed shows few significant departures from linearity.

The slopes for maternal education are reported in table II.13. Crude regional averages and an overall average are provided so that deviations from the norm can be detected. At the univariate stage, slopes range from approximately -0.02 to -0.12. When no other variables are controlled, one additional year of maternal schooling reduces child mortality by, on average, about 7 per cent. When all other variables are controlled at Stage II, the effect of maternal education is reduced by about half. Only in Sierra Leone does the inclusion of the other variables increase the effect of maternal education. In the univariate relations, Sierra Leone was among the countries that showed the smallest effect of education on mortality. The result peculiar to Sierra Leone may be indicative of an overlay of some set of suppressor variables or suggestive of some problems in data quality.

A regional pattern worth mentioning is that the effect of the mother's education corresponds, although weakly, to the mortality level. Africa, with the highest level of mortality, has the smallest, while Latin America, with the lowest level of mortality, has the largest slope. However, there are anomalies that make this association far from perfect. The Republic of Korea and Sri Lanka have small slopes despite superior mortality conditions.

The impact of maternal education does not appear to depend upon urban or rural residence. In exactly half the countries, where rural/urban differences can be examined, the slope of the mother's education is more strongly negative in rural areas, and in the other half, maternal education has a larger negative effect on child mortality in urban areas. The mean value of the urban coefficient is somewhat larger than that of the rural coefficient in Africa and Asia, whereas the reverse is the case in Latin America.

That the effect of maternal education on child mortality does not consistently vary with residence is particularly interesting in the light of the rural/urban slopes for the father's education presented in chapter III. In urban areas, the effect of the father's education (while not as large as that for the mother) is much greater than the effect in rural areas. Rural mortality is strongly associated with the mother's education but not with that of the father. This finding indicates that maternal and paternal education may work through different channels, a finding also suggested by the bivariate analysis. Paternal education appears to complement rather than substitute for a health environment. It is likely that in the countryside, a given increment in paternal education produces less income than it does in the city. Moreover, even when income is relatively high in rural areas, there is less opportunity to purchase such items as health services or electricity, due to urban biases in the distribution of those services. There is, however, also the possibility that the strict sexual division of labour breaks down in urban areas where fathers may be more involved in daily child care.

Conclusion

While this chapter does not provide direct evidence to support Caldwell's (1979) claims concerning maternal education, the finding here that it appears equally important in explaining rural and urban mortality differentials is consistent with his theory. If education undermines traditional attitudes and practices inimical to good child health and alters the role and status of women in the family, the expectation is that this effect will be obtained in both urban and rural areas.

Given the undeniably crucial role that the mother's education plays in lowering child mortality, future research should attempt to identify exactly how schooling alters a woman's outlook and her health and child care practices. Intensive case studies, where the differential quality of education and the meaning of women's education within the social context are analysed in relation to child care practices, would be an important adjunct to quantitative large-scale international comparisons.

Table II.1 Percentage of population 15 years of age and over that is illiterate

Region and country	Year of census or survey	Percentage of illiterates	
		Male	Female
Africa			
Ghana	1970	56.9	81.6
Kenya	1979	40.0	65.2
Lesotho	1966	56.0	32.4
Liberia[a/]	1974	70.4	87.8
Nigeria	1980	54.4	77.0
Sierra Leone	1963	90.4	96.1
Sudan	1956	74.7	96.3
Asia			
Indonesia	1971	30.5	55.4
Nepal	1971	66.6	95.0
Republic of Korea	1975	5.6	19.0
Sri Lanka	1971	14.0	31.5
Thailand	1970	12.8	29.7
Latin America			
Chile	1970	10.1	11.8
Jamaica	1970	4.4	3.5
Peru	1972	16.7	38.2

Source: UNESCO, Statistical Yearbook, 1956, 1981, 1982 and 1983.

a/ Age group is 10 years and over.

Table II.2 Percentage of population 25 years of age and over with some schooling

Region and country	Year of census or survey	Percentage of population with some schooling	
		Male	Female
Africa			
Ghana	1970	33.6	12.0
Kenya	1979	56.6	27.2
Lesotho	1966	47.6	65.6
Liberia	1962	11.9	3.5
Nigeria	..	..	..
Sierra Leone	1963	7.6	3.5
Sudan	1956	16.3	1.1
Asia			
Indonesia	1971	60.1	30.3
Nepal	1971	0.7	0.1
Republic of Korea	1975	83.7	66.5
Sri Lanka	1971	73.2	59.1
Thailand	1970	75.7	56.7
Latin America			
Chile	1970	88.6	86.7
Jamaica	1970	94.3	95.4
Peru	1972	77.9	52.5

Source: UNESCO, Statistical Yearbook, 1956, 1981, 1982 and 1983.

Table II.3. Ratio of observed to expected deaths, by maternal education (expected deaths in parentheses)

Maternal[a/] education	Africa							Asia					Latin America		
	Ghana	Kenya	Lesotho	Liberia	Nigeria	Sierra Leone	Sudan	Indonesia	Nepal	Republic of Korea	Sri Lanka	Thailand	Chile	Jamaica	Peru
None	1.070 (63732)	1.105 (2993)	1.196 (186)	1.032 (23451)	1.146 (1641)	1.006 (1146)	.998 (596)	1.074 (61388)	1.015 (4839)	1.103 (1510)	1.224 (822)	1.203 (480)	1.514 (331)	1.867 (14)	1.418 (1994)
1-3 years	0.745 (4063)	0.949 (660)	1.086 (324)	0.699 (157)	0.980 (91)		0.795 (35)	0.986 (18705)	0.871 (42)			0.992 (1426)	1.181 (742)	1.164 (121)	1.021 (183)
						1.045 (177)				0.937 (1169)	1.012 (1180)				
4-6 years	0.536 (4647)	0.783 (830)	0.984 (1213)	0.717 (441)	0.739 (259)		0.645 (33)	0.724 (12413)	0.599 (58)			0.307 (52)	1.052 (1694)	1.042 (500)	0.610 (871)
						0.738 (705)					0.763 (545)				
7-9 years	0.416 (156)	0.726 (451)	0.884 (416)	0.526 (479)	0.746 (202)		b/	0.424 (1966)	0.432 (23)	0.768 (190)			0.770 (662)		0.390 (218)
10-11 years	0.347 (343)	0.322 (106)		0.480 (218)	0.591 (86)			0.308 (696)	0.153 (15)	0.732 (122)	0.441 (142)	0.415 (17)	0.592 (255)	0.607 (67)	0.262 (221)
12+ years		0.339 (44)		0.424 (406)	0.562 (112)			0.208 (51)		0.392 (16)	0.449 (48)		0.438 (219)		0.235 (103)

a/ The figures represent completed years of schooling, except for Ghana in which they represent years attained, and Sierra Leone and the Republic of Korea in which they represent years attended. The categories differ from the standard as follows:

Ghana: None; primary; middle; secondary; higher
Lesotho: None; 1-3 years; 4-6 years; 7 years or more
Sierra Leone: None; primary; secondary or higher
Sudan: None; 1-3 years; 4-6 years; 7 years or more
Indonesia: None; not finished elementary; elementary; junior high school; High school; Academy or University
Nepal: None; 1-3 years; 4-6 years; 7-9 years; 10 years or more
Republic of Korea: None; 1-6 years; 7-9 years; 10-12 years; 13 years or more
Sri Lanka: None; 1-5 years; 6-9 years; 10-11 years; University
Thailand: None; 1-4 years; 5-10 years; 11 years or more
Jamaica: None; 1-3 years; primary; secondary or higher

b/ Fewer than 10 expected deaths.

Table II.4. Index of dissimilarity of child mortality by maternal education

Region and country	Index of dissimilarity
<u>Africa</u>	
Ghana	0.049
Kenya	0.078
Lesotho	0.031
Liberia	0.030
Nigeria	0.088
Sierra Leone	0.013
Sudan	0.036
<u>Asia</u>	
Indonesia	0.054
Nepal	0.010
Republic of Korea	0.053
Sri Lanka	0.083
Thailand	0.040
<u>Latin America</u>	
Chile	0.132
Jamaica	0.040
Peru	0.163

Table II.5. Ratio of observed to expected deaths by mother's type of education: Nigeria (expected deaths in parentheses)

Mother's type of education	Ratio
None	1.142 (1604)
Koranic only	1.564 (47)
Formal only	0.682 (704)
Koranic and formal	1.035 (52)
Unknown	0.964 (64)

Table II.6 Ratio of observed to expected deaths by maternal education and paternal education (expected deaths in parentheses)

Maternal education	Paternal education			
	None	1-3 years	4-9 years	10+ years
		AFRICA		
		Ghana[a/]		
None	1.146 (30947)	0.922 (2321)	0.763 (4195)	0.717 (568)
Primary	0.842 (557)	0.782 (340)	0.654 (825)	0.534 (191)
Middle	0.707 (247)	0.463 (78)	0.507 (1137)	0.387 (702)
Secondary/Higher	b/	b/	0.279 (14)	0.245 (208)
		Kenya		
None	1.172 (1420)	1.204 (314)	0.992 (1096)	1.099 (163)
1-3 years	0.954 (172)	1.068 (59)	0.934 (367)	0.910 (61)
4-9 years	1.001 (134)	1.098 (76)	0.755 (728)	0.612 (343)
10 years or more	b/	b/	0.387 (21)	0.307 (127)
		Lesotho[c/]		
None	1.218 (114)	1.251 (26)	1.175 (35)	0.909 (11)
1-3 years	1.036 (176)	1.204 (61)	1.187 (64)	0.868 (23)
4-6 years	0.993 (482)	1.078 (229)	0.967 (371)	0.831 (130)
7 years or more	1.046 (94)	0.883 (53)	0.865 (113)	0.800 (156)

Table II.6 (continued)

Maternal education	Paternal education			
	None	1-3 years	4-9 years	10+ years
AFRICA (continued)				
Nigeria				
None	1.181 (1099)	1.156 (87)	1.020 (311)	1.064 (91)
1-3 years	1.198 (47)	b/	0.528 (23)	0.994 (17)
4-9 years	0.991 (104)	b/	0.639 (138)	0.700 (195)
10 years or more	0.675 (24)	b/	1.303 (21)	0.459 (135)
Sierra Leone[d/]				
None	0.996 (963)	——— 1.073 (90)	———	1.024 (85)
Primary	1.053 (93)	——— 0.903 (33)	———	1.189 (48)
Secondary/Higher	0.599 (27)	——— b/	———	0.782 (36)
Sudan[e/]				
None	0.925 (203)	——— 0.815 (86)	———	0.978 (154)
1 year or more	b/	——— 0.631 (30)	———	b/

Table II.6 (continued)

Maternal education	Paternal education: None	1-3 years	4-9 years	10+ years
		ASIA		
		Indonesia[f/]		
None	1.052 (29162)	1.070 (14038)	0.976 (6158)	0.821 (396)
Some elementary	1.023 (1926)	1.024 (9145)	0.902 (4675)	0.779 (756)
Finished elementary	0.723 (449)	0.819 (1278)	0.756 (7007)	0.544 (2373)
Junior High or above	0.629 (22)	0.719 (83)	0.500 (406)	0.325 (1931)
		Nepal[g/]		
None	1.046 (3839)	——	0.864 (336) ——	0.912 (663)
1-6 years	1.087 (19)	——	b/ ——	0.629 (69)
7 years or more	b/	——	b/ ——	0.317 (36)
		Republic of Korea[h/]		
None	1.045 (657)	1.040 (537)	0.994 (101)	1.213 (52)
1-6 years	1.027 (67)	0.972 (491)	0.888 (284)	0.769 (250)
7-9 years	b/	b/	0.897 (48)	0.666 (123)
10 years or more	b/	b/	b/	0.618 (120)

Table II.6 (continued)

Maternal education	Paternal education			
	None	1-3 years	4-9 years	10+ years
		ASIA (continued)		
		Sri Lanka[h/]		
None	1.479 (161)	1.244 (471)	0.961 (178)	0.937 (12)
1-5 years	1.429 (101)	1.033 (630)	0.907 (394)	0.676 (51)
6-9 years	0.876 (10)	0.957 (160)	0.727 (268)	0.554 (105)
10 years or more	b/	0.558 (14)	0.549 (61)	0.363 (114)
		Thailand[i/]		
None	1.258 (174)	1.168 (270)	1.157 (16)	b/
1-4 years	1.017 (145)	1.014 (1094)	0.867 (135)	0.358 (20)
5-10 years	b/	0.371 (16)	0.210 (19)	0.151 (13)
11 years or more	b/	b/	b/	0.429 (14)
		LATIN AMERICA		
		Chile		
None	1.530 (79)	1.930 (71)	1.319 (60)	b/
1-3 years	1.366 (70)	1.194 (189)	1.156 (224)	1.103 (12)
4-9 years	1.243 (56)	1.222 (229)	1.023 (1122)	0.726 (226)
10 years or more	b/	b/	0.675 (89)	0.420 (248)

Table II.6 (continued)

Maternal education	Paternal education			
	None	1-3 years	4-9 years	10+ years
		LATIN AMERICA (continued)		
		Jamaica j/		
Less than secondary	———	1.098 (560)	———	0.742 (27)
Secondary or higher	———	0.884 (27)	———	0.335 (36)
		Peru		
None	1.553 (654)	1.418 (891)	1.224 (437)	1.149 (12)
1-3 years	1.399 (86)	1.102 (487)	0.902 (544)	0.923 (68)
4-9 years	b/	0.822 (128)	0.574 (681)	0.422 (273)
10 years or more	b/	b/	0.362 (46)	0.234 (276)

a/ Educational categories for fathers are classified as follows: None; Primary; Middle; and Secondary or higher.

b/ Fewer than 10 expected deaths.

c/ Educational categories for fathers are classified as follows: None; 1-3 years; 4-6 years; and 7 years or more.

d/ Educational categories for fathers are classified as follows: None; Primary; and Secondary or higher.

e/ Educational categories for fathers are classified as follows: None; 1 year or more; and Khalwa.

f/ Educational categories for fathers are classified as follows: None; some elementary; elementary; and junior high or higher.

g/ Educational categories for fathers are classified as follows: None; 1-6 years; and 7 years or more.

h/ Educational categories for fathers are classified as follows: None; 1-6 years; 7-9 years; and 10 years or more.

i/ Educational categories for fathers are classified as follows: None; 1-4 years; 5-10 years; and 11 years or more.

j/ Educational categories for fathers are classified as follows: Less than Secondary; Secondary or higher.

Table II.7 Ratio of observed to expected deaths by maternal education and area of residence (expected deaths in parentheses)

Maternal education	Area of residence: Largest city	Other urban	Rural
AFRICA			
Ghana[a/]			
None	0.698 (4899)	1.004 (8578)	1.117 (50255)
Primary	0.555 (731)	0.703 (670)	0.808 (2661)
Middle	0.410 (1591)	0.534 (1158)	0.642 (1898)
Secondary/Higher	0.317 (281)	0.364 (115)	0.514 (103)
Kenya[b/]			
None	0.964 (172)	1.028 (106)	1.117 (2714)
1-3 years	0.784 (31)	0.920 (29)	0.959 (600)
4-9 years	0.783 (162)	0.802 (119)	0.755 (1000)
10 years or more	0.262 (50)	0.278 (36)	0.405 (64)
Lesotho			
None	c/	c/	1.168 (177)
1-3 years	c/	1.418 (15)	1.065 (306)
4-6 years	1.174 (30)	0.999 (47)	0.978 (1134)
7 years or more	0.668 (25)	0.853 (21)	0.908 (367)

Table II.7 (continued)

Maternal education	Area of residence		
	Largest city	Other urban	Rural
	AFRICA (continued)		
	Liberia		
None	— 0.892 (7038)	—	1.092 (16414)
1-3 years	— 0.726 (65)	—	0.680 (93)
4-9 years	— 0.612 (569)	—	0.647 (281)
10 years or more	— 0.436 (571)	—	0.521 (54)
	Nigeria		
None	— 1.130 (509)	—	1.153 (1132)
1-3 years	— 0.759 (40)	—	1.151 (51)
4-6 years	— 0.726 (149)	—	0.755 (110)
7-9 years	— 0.699 (123)	—	0.813 (79)
10-11 years	— 0.568 (63)	—	0.652 (23)
12 years or more	— 0.574 (89)	—	0.516 (23)

Table II.7 (continued)

<table>
<tr><th rowspan="2">Maternal education</th><th colspan="3">Area of residence</th></tr>
<tr><th>Largest city</th><th>Other urban</th><th>Rural</th></tr>
<tr><td colspan="4">ASIA</td></tr>
<tr><td colspan="4">Indonesia</td></tr>
<tr><td>None</td><td>1.240
(1565)</td><td>1.104
(4738)</td><td>1.067
(55086)</td></tr>
<tr><td>Some elementary</td><td>0.905
(668)</td><td>0.844
(2708)</td><td>1.014
(15330)</td></tr>
<tr><td>Finished elementary</td><td>0.626
(722)</td><td>0.609
(3137)</td><td>0.775
(8555)</td></tr>
<tr><td>Junior High or above</td><td>0.321
(451)</td><td>0.366
(1458)</td><td>0.473
(803)</td></tr>
<tr><td colspan="4">Nepal</td></tr>
<tr><td>None</td><td colspan="2">0.607
(72)</td><td>1.019
(4717)</td></tr>
<tr><td>1-3 years</td><td colspan="2">c/</td><td>0.914
(38)</td></tr>
<tr><td>4-6 years</td><td colspan="2">0.530
(11)</td><td>0.650
(44)</td></tr>
<tr><td>7-9 years</td><td colspan="2">0.409
(10)</td><td>0.443
(11)</td></tr>
<tr><td>10 years or more</td><td colspan="2">0.141
(12)</td><td>c/</td></tr>
<tr><td colspan="4">Republic of Korea</td></tr>
<tr><td>None</td><td>1.181
(77)</td><td>1.088
(205)</td><td>1.101
(1228)</td></tr>
<tr><td>1-6 years</td><td>0.999
(187)</td><td>0.832
(258)</td><td>0.959
(724)</td></tr>
<tr><td>7-9 years</td><td>0.701
(61)</td><td>0.774
(62)</td><td>0.826
(67)</td></tr>
<tr><td>10 years or more</td><td>0.514
(60)</td><td>0.754
(53)</td><td>0.999
(24)</td></tr>
</table>

Table II.7 (continued)

Maternal education	Area of residence			
	Largest city	Other urban	Rural	
	ASIA (continued)			
	Sri Lanka[d/]			
None	0.942 (20)	1.366 (57)	1.087 (606)	1.806 (139)
1-5 years	0.910 (57)	1.052 (113)	0.935 (93)	1.918 (80)
6-9 years	0.740 (59)	0.748 (96)	0.750 (379)	0.400 (10)
10 years or more	0.415 (17)	0.353 (39)	0.484 (131)	c/
	Thailand			
None	——— 0.683 (40) ———		1.251 (441)	
1-4 years	——— 0.728 (164) ———		1.027 (1263)	
5-10 years	——— 0.110 (27) ———		0.522 (25)	
11 years or more	——— 0.184 (11) ———		c/	
	LATIN AMERICA			
	Chile			
None	1.545 (42)	1.592 (104)	1.463 (185)	
1-3 years	1.113 (179)	1.155 (261)	1.245 (303)	
4-9 years	0.919 (855)	0.974 (1079)	1.077 (422)	
10 years or more	0.517 (211)	0.514 (237)	0.616 (26)	

Table II.7 (continued)

<table>
<tr><th rowspan="2">Maternal education</th><th colspan="3">Area of residence</th></tr>
<tr><th>Largest city</th><th>Other urban</th><th>Rural</th></tr>
<tr><td colspan="4">LATIN AMERICA (continued)</td></tr>
<tr><td colspan="4">Jamaica</td></tr>
<tr><td>None</td><td colspan="2">—— c/ ——</td><td>1.267 (13)</td></tr>
<tr><td>Less than 4 years</td><td colspan="2">—— 1.091 (34) ——</td><td>1.187 (88)</td></tr>
<tr><td>4 years or more</td><td colspan="2">—— 0.899 (191) ——</td><td>1.130 (309)</td></tr>
<tr><td>Secondary/Higher</td><td colspan="2">—— 0.656 (49) ——</td><td>0.479 (19)</td></tr>
<tr><td colspan="4">Peru</td></tr>
<tr><td>None</td><td>0.900 (163)</td><td>1.430 (555)</td><td>1.479 (1276)</td></tr>
<tr><td>1-3 years</td><td>0.643 (204)</td><td>1.052 (486)</td><td>1.147 (494)</td></tr>
<tr><td>4-9 years</td><td>0.392 (418)</td><td>0.628 (525)</td><td>0.843 (146)</td></tr>
<tr><td>10 years or more</td><td>0.204 (157)</td><td>0.298 (157)</td><td>c/</td></tr>
</table>

a/ The category "Capital" includes Accra, Kumasi and Sekondi/Takoradi.
b/ The category "Capital" includes Nairobi and Mombasa.
c/ Fewer than 10 expected deaths.
d/ Data for rural residence in Sri Lanka is divided into two categories: "Rural non-estate" and "Rural estate".

Table II.8 Index of dissimilarity of child mortality by maternal education, tabulated by area of residence

<table>
<tr><th>Country</th><th>Largest city</th><th colspan="2">Other urban</th><th>Rural</th></tr>
<tr><td><u>Africa</u></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Ghana</td><td>0.107</td><td>0.007</td><td></td><td>0.003</td></tr>
<tr><td>Kenya</td><td>0.133</td><td>0.126</td><td></td><td>0.070</td></tr>
<tr><td>Lesotho</td><td>0.148</td><td>0.084a/</td><td>0.092b/</td><td>0.028</td></tr>
<tr><td>Liberia</td><td colspan="2">0.018</td><td></td><td>0.004</td></tr>
<tr><td>Nigeria</td><td colspan="2">0.126</td><td></td><td>0.049</td></tr>
<tr><td><u>Asia</u></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Indonesia</td><td>0.160</td><td>0.172</td><td></td><td>0.032</td></tr>
<tr><td>Nepal</td><td>0.270</td><td>0.080</td><td></td><td>0.006</td></tr>
<tr><td>Republic of Korea</td><td>0.130</td><td>0.085</td><td></td><td>0.045</td></tr>
<tr><td>Sri Lanka</td><td>0.084</td><td>0.138</td><td>0.060c/</td><td>0.060</td></tr>
<tr><td>Thailand</td><td colspan="2">0.127</td><td></td><td>0.050</td></tr>
<tr><td><u>Latin America</u></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Chile</td><td>0.112</td><td>0.098</td><td></td><td>0.056</td></tr>
<tr><td>Jamaica</td><td colspan="2">0.060</td><td></td><td>0.024</td></tr>
<tr><td>Peru</td><td>0.198</td><td>0.186a/</td><td>0.150b/</td><td>0.055</td></tr>
</table>

a/ Other large cities.
b/ Small cities.
c/ Rural estate.

Table II.9 Ratio of observed to expected deaths by maternal education and water supply (expected deaths in parentheses)

Maternal education	Water supply: Private pipe	Public pipe	Private well/pump	Common well/pump	River/ stream	Other
			AFRICA			
			Ghana[a/]			
None	0.695 (2221)	0.958 (12355)	—— 1.156 (11433) ——		1.102 (37724)	..
Primary	0.511 (362)	0.651 (1117)	—— 0.798 (531) ——		0.824 (2052)	..
Middle	0.402 (1093)	0.525 (1669)	—— 0.533 (570) ——		0.648 (1314)	..
Secondary/Higher	0.281 (264)	0.443 (133)	—— 0.413 (39) ——		0.548 (64)	..
			Nigeria[b/]			
None	0.780 (180)	————————		1.193 (1434)	————————	
1-3 years	0.521 (12)	————————		1.048 (77)	————————	
4-9 years	0.666 (173)	————————		.781 (279)	————————	
10 years or more	0.492 (132)	————————		.755 (65)	————————	
			Sierra Leone[c/]			
None	1.027 (29)	0.865 (268)	—— 1.155 (346) ——		0.976 (499)	..
Primary	d/	1.076 (31)	—— 1.087 (74) ——		1.070 (66)	..
Secondary/Higher	d/	0.526 (13)	—— 0.664 (21) ——		0.868 (31)	..

Table II.9 (continued)

Maternal education	Water supply					
	Private pipe	Public pipe	Private well/pump	Common well/pump	River/ stream	Other
			AFRICA (continued)			
			Sudan e/			
None	0.984 (445)	0.924 (95)	—	—	1.255 (57)	—
1 year or more	0.669 (61)	d/	—	—	d/	—
			ASIA			
			Sri Lanka			
None	d/	1.707 (162)	0.993 (217)	1.112 (308)	..	1.294 (119)
1-5 years	0.679 (26)	1.510 (135)	0.921 (431)	0.946 (479)	..	1.114 (98)
6-9 years	0.555 (42)	0.589 (64)	0.809 (224)	0.826 (191)	..	0.713 (21)
10 years or more	0.486 (28)	0.229 (14)	0.386 (96)	0.495 (43)	..	d/
			LATIN AMERICA			
			Jamaica f/			
Less than 4 years	1.424 (12)	1.268 (97)	..	..	1.332 (12)	1.066 (11)
4 years or more	0.872 (85)	1.064 (353)	..	..	1.030 (21)	1.412 (30)
Secondary/Higher	0.608 (38)	0.605 (25)	..	..	d/	d/

Table II.9 (continued)

a/ Categories of water supply are classified as follows: private pipe; public pipe; well/pump/rainwater; and river/pond/dam.

b/ Categories of water supply are classified as follows: running water in household; and no running water in household.

c/ Categories of water supply are classified as follows: tap in yard; public tap; well; and stream/river.

d/ Fewer than 10 expected deaths.

e/ Categories of water supply are classified as follows: private pipe; public pipe; and canal.

f/ Categories of water supply are classified as follows: pipe to house; pipe outside house; river/stream; and other.

Table II.10 Ratio of observed to expected deaths by maternal education and lavatory facility (expected deaths in parentheses)

AFRICA

Ghana

Maternal education	Lavatory facility					
	WC	Private pan	Public pan	Private pit	Public pit	Other
None	0.654 (74)	0.762 (4896)	0.923 (9890)	0.892 (4820)	1.023 (26853)	1.395 (16532)
Primary	0.469 (126)	0.650 (778)	0.718 (788)	0.734 (384)	0.804 (1762)	0.882 (226)
Middle	0.378 (482)	0.473 (1738)	0.562 (861)	0.567 (284)	0.649 (1146)	0.710 (137)
Secondary/Higher	0.205 (161)	0.397 (224)	0.548 (38)	0.489 (23)	0.533 (47)	a/

Nigeria

Maternal education	Lavatory facility	
	Inside lavatory	Lavatory not inside
None	1.070 (373)	1.161 (1203)
1-3 years	0.646 (29)	1.114 (59)
4-6 years	0.772 (141)	0.702 (114)
7-9 years	0.624 (117)	0.920 (83)
10-11 years	0.580 (67)	0.635 (16)
12 years or more	0.492 (89)	0.736 (18)

Table II.10 (continued)

AFRICA (continued)

Sierra Leone

Maternal education	Lavatory facility		
	Flush	Pit latrine	Bush/stream/other
None	a/	1.017 (1032)	0.944 (97)
Primary	a/	1.058 (158)	1.188 (15)
Secondary/Higher	a/	0.740 (69)	a/

Sudan

Maternal education	Lavatory facility		
	Outside cesspool	Neighbour	Fields
None	0.654 (234)	1.089 (47)	1.239 (317)
1 year or more	0.675 (52)	a/	0.609 (15)

Table II.10 (continued)

ASIA

Sri Lanka

Maternal education	Lavatory facility				
	Flush	Water seal	Bucket	Cesspit	None
None	0.860 (17)	1.601 (19)	1.604 (54)	1.022 (349)	1.353 (382)
1-5 years	0.746 (34)	1.108 (344	0.689 (151)	0.915 (526)	1.256 (435)
6-9 years	0.794 (38)	0.819 (27)	0.516 (134)	0.783 (233)	0.990 (113)
10 years or more	0.303 (26)	a/	0.441 (67)	0.436 (72)	0.752 (18)

a/ Less than 10 expected deaths.

Table II.11 Ratio of observed to expected deaths by maternal education and type of housing (expected deaths in parentheses)

Maternal education	Type of housing				
	Modern		Intermediate		Traditional
			AFRICA		
			Ghana [a/]		
None	0.817 (9923)	1.043 (92)	0.822 (645)	0.974 (28490)	1.289 (24582)
Primary	0.661 (1236)	b/	0.629 (78)	0.781 (2298)	0.822 (444)
Middle	0.470 (2496)	b/	0.471 (79)	0.617 (1903)	0.591 (168)
Secondary/Higher	0.329 (402)	b/	b/	0.473 (87)	b/
			Sierra Leone		
None	0.601 (50)		1.043 (583)		1.003 (507)
Primary	0.820 (21)		1.097 (97)		1.091 (57)
Secondary/Higher	b/		0.789 (37)		0.769 (25)
			Sudan		
None	0.754 (229)		1.177 (344)		0.780 (24)
1 year or more	0.561 (46)		1.039 (23)		b/

Table II.11 (continued)

Maternal education	Type of housing		
	Modern	Intermediate	Traditional
		ASIA	
		Sri Lanka	
None	1.109 (173)	1.387 (294)	1.145 (354)
1-5 years	0.763 (371)	1.177 (339)	1.089 (471)
6-9 years	0.699 (254)	0.718 (127)	0.897 (164)
10-11 years	0.379 (92)	0.526 (30)	0.599 (20)
University or Higher	0.377 (37)	b/	b/

a/ Type of housing is classified into the following categories: modern; modern with traditional roof; intermediate; other; and traditional.
b/ Fewer than 10 expected deaths.

Table II.12 The effect of maternal education on child mortality: regression coefficients and univariate differences

Maternal education[a/]	Univariate differences[b/]	Stage I	Stage II	Stage IIIR	Stage IIIU
		AFRICA			
		Ghana			
None	0	0	0	0	0
Primary	-0.325	-0.119**	-0.118*	-0.221**	-0.070
Middle	-0.534	-0.244**	-0.138*	-0.145*	-0.147
Secondary	-0.654	-0.304	-0.070	0.097	-0.840
Higher	-0.723	-0.326**	-0.261	-0.165	-0.590
		Kenya			
None	0	0	0	0	0
1-3 years	-0.156	-0.068	-0.059	-0.058	-0.049
4-6 years	-0.322	-0.197**	-0.176**	-0.227**	0.053
7-9 years	-0.379	-0.171**	-0.146*	-0.099	-0.245
10-11 years	-0.783	-0.532**	-0.443**	-0.463**	-0.446*
12 years or more	-0.766	-0.451**	-0.292	0.224	-0.551*
		Lesotho			
None	0	0	0	0	0
1-3 years	0.110	-0.091	-0.121	-0.133	-0.282
4-6 years	-0.212	-0.188*	-0.215**	-0.204**	-0.710*
7 years or more	-0.312	-0.243**	-0.260**	-0.214*	-0.893*
		Liberia			
None	0	0	0	0	0
1-3 years	-0.333	-0.308**	-0.163*	-0.212*	-0.084
4-6 years	-0.315	-0.288**	-0.168**	-0.296**	-0.072
7-9 years	-0.506	-0.479**	-0.352**	-0.335**	-0.342**
10-11 years	-0.552	-0.505**	-0.398**	-0.611**	-0.334**
12 years or more	-0.608	-0.498**	-0.400**	-0.139	-0.403**

Table II.12 (continued)

Maternal education[a/]	Univariate differences[b/]	Stage I	Stage II	Stage IIIR	Stage IIIU
		AFRICA (continued)			
		Nigeria			
None	0	0	0	0	0
1-3 years	-0.166	-0.182	-0.216	-0.097	-0.489**
4-6 years	-0.407	-0.311**	-0.168*	-0.268*	-0.141
7-9 years	-0.400	-0.193*	-0.005	-0.058	0.036
10-11 years	-0.555	-0.352**	-0.138	-0.399	-0.045
12 years or more	-0.584	-0.356**	-0.092	-0.414	0.066
		Sierra Leone			
None	0	0	0	c/	c/
Primary	0.039	-0.009	-0.017	c/	c/
Secondary or higher	-0.268	-0.351**	-0.412**	c/	c/
		Sudan			
None	0	0	0	c/	c/
1-3 years	-0.203	-0.029	0.277	c/	c/
4-6 years	-0.353	-0.225	-0.350	c/	c/
7 years or more	-0.685	-0.388	-0.590	c/	c/
		ASIA			
		Indonesia			
None	0	0	0	0	0
Not finished elementary	-0.088	-0.042*	-0.056*	-0.027	-0.231**
Elementary	-0.350	-0.195**	-0.218**	-0.196**	-0.332**
Junior High	-0.650	-0.381**	-0.423**	-0.482**	-0.470**
High school	-0.766	-0.382**	-0.367**	-0.063	-0.554**
Academy or university	-0.866	-0.321	-0.355	-0.879	-0.430*
		Nepal			
None	0	0	0	c/	c/
1-3 years	-0.144	-0.000	0.057	c/	c/
4-6 years	-0.416	-0.220	-0.145	c/	c/
7-9 years	-0.583	-0.360	-0.302	c/	c/
10 years or more	-0.862	-0.458	-0.323	c/	c/

Table II.12 (continued)

Maternal education[a]	Univariate differences[b]	Stage I	Stage II	Stage IIIR	Stage IIIU
		ASIA (continued)			
		Republic of Korea[d]			
None	0	0	0	0	0
1-6 years	-0.166	-0.125*	-0.114*	-0.081	-0.253*
7-9 years	-0.335	-0.233*	-0.210*	-0.124	-0.356*
10-12 years	-0.371	-0.158	-0.065	0.107	-0.166
13 years or more	-0.721	-0.486	-0.401	0.219	-0.568
		Sri Lanka			
None	0	0	0	0	0
1-5 years	-0.212	-0.084	-0.025	-0.045	0.079
6-9 years	-0.461	-0.187**	-0.071	-0.033	-0.119
10-11 years	-0.783	-0.411**	-0.252*	-0.182	-0.433*
University	-0.775	-0.310	-0.193	-0.133	-0.401
		Thailand			
None	0	0	0	0	0
1-4 years	-0.211	-0.197**	-0.129*	-0.137*	-0.027
5-10 years	-0.896	-0.618**	-0.503**	-0.463*	-0.463*
11 years or more	-0.788	-0.346	-0.382	-0.405	-0.397
		LATIN AMERICA			
		Chile			
None	0	0	0	0	0
1-3 years	-0.333	-0.302**	-0.375**	-0.233*	-0.551**
4-6 years	-0.462	-0.403**	-0.420**	-0.216*	-0.612**
7-9 years	-0.744	-0.626**	-0.620**	-0.443*	-0.808**
10-11 years	-0.922	-0.753**	-0.774**	-0.531	-0.965**
12 years or more	-1.076	-0.859**	-0.828**	-0.639	-1.023**

Table II.12 (continued)

Maternal education[a]	Univariate differences[b]	Stage I	Stage II	Stage IIIR	Stage IIIU
		LATIN AMERICA (continued)			
		Jamaica			
Less than 4 years	0	0	0	0	0
Primary 4+ years	-0.195	-0.200*	-0.092	0.017	-0.341
Secondary or higher	-0.630	-0.376*	-0.160	-0.407	-0.133
		Peru			
None	0	0	0	0	0
1-3 years	-0.397	-0.223**	-0.167**	-0.167**	-0.172**
4-6 years	-0.808	-0.520**	-0.404**	-0.386**	-0.392**
7-9 years	-1.028	-0.670**	-0.540**	-0.480	-0.508**
10-11 years	-1.156	-0.768**	-0.594**	-0.819*	-0.553**
12 years or more	-1.183	-0.801**	-0.664**	-0.785	-0.609**

* Significant at the .05 level.
** Significant at the .01 level.

a/ The numbers represent completed years of schooling.
b/ Statistical significance was not calculated for univariate differences.
c/ Samples are totally or predominantly rural.
d/ Years attended rather than years completed.

Table II.13 Regression coefficients of mortality ratio on mother's completed years of schooling

Region and country	Univariate differences	Stage II	Stage IIIR	Stage IIIU
Africa				
Ghana	-0.063	-0.018	-0.025	-0.017
Kenya	-0.059	-0.028	-0.026	-0.036
Lesotho	-0.034	-0.028	-0.023	-0.104
Liberia	-0.054	-0.036	-0.042	-0.034
Nigeria	-0.052	-0.009	-0.028	0.003
Sierra Leone	-0.023	-0.041	a/	a/
Sudan	-0.078	-0.049	a/	a/
Regional average	-0.052	-0.030	-0.029	-0.038
Asia				
Indonesia	-0.072	-0.043	-0.038	-0.055
Nepal	-0.079	-0.030	a/	a/
Republic of Korea	-0.042	-0.020	-0.013	-0.027
Sri Lanka	-0.066	-0.016	-0.009	-0.038
Thailand	-0.093	-0.051	-0.053	-0.052
Regional average	-0.070	-0.032	-0.028	-0.043
Latin America				
Chile	-0.079	-0.057	-0.040	-0.062
Jamaica	-0.105	-0.027	-0.047	0.007
Peru	-0.118	-0.062	-0.076	-0.054
Regional average	-0.101	-0.049	-0.054	-0.036
Grand average	-0.068	-0.034	-0.035	-0.039

a/ Sample totally or predominantly rural.

Chapter III

PATERNAL EDUCATION

Most studies that have analysed child mortality differentials according to parental education have focused on the mother's rather than the father's schooling (see, for example, Behm, 1980; Caldwell, 1979; Cochrane and others, 1980; Frenzen and Hogan, 1982). Emphasis on the mother's education is based on the premise that the time and effort devoted to child care is greater for women than for men, as well as on suggestive empirical findings concerning its importance. In many societies the sexual division of labour and predominant sex roles discourage men from taking on day-to-day child care duties. Also, given limited job opportunities in local areas, many men in developing countries are forced to seek employment elsewhere, leaving their wives to shoulder the entire burden of child care.

Because roles of men and women differ, the literature has treated paternal education less as an indicator of quality of child-rearing skills than as a predictor of economic status (see, for example, Hobcraft and others, 1982). Increased education of the father, if it raises purchasing power, may improve housing and sanitation facilities and the quality of food and clothing, and enable parents to take better advantage of health care. Although paternal schooling is thought to operate primarily as a proxy for level of living, it may also reflect other aspects of the family's life such as beliefs about the origin and cure of disease. For example, the educated father, although perhaps not directly responsible for child care, might initiate changes in his family's personal hygiene and food preparation procedures. Improved knowledge undoubtedly undermines the traditional beliefs and practices that are detrimental to child health, for the husband as well as the wife, and may well change the sexual division of labour and domestic activities.

Both Cochrane and her associates (1980), and Caldwell and McDonald (1981) have documented the greater importance of the mother's education. Based on several national studies, Cochrane and her colleagues (1982) estimate that for every additional year of maternal schooling, the child mortality rate falls by approximately six per 1,000, whereas for every year of paternal schooling, it is reduced by three per 1,000. However, certain other studies that control for more variables have found that the impact of paternal education is as large as or larger than that of maternal education (Trussell and Hammerslough, 1983; Martin and others, 1983, Trussell and Preston, 1982). The role of paternal education appears to be particularly important in Sri Lanka. One cross-national study has identified a regional pattern with regard to the two education variables, finding that families with the least educated husbands have the highest rates of child mortality in Asia, while families with the least educated wives have the highest rates in Latin America and the Caribbean. The explanation given for this regional difference is that, where education of women is relatively common (as in Latin America and the Caribbean), selectivity factors make the "no education" group particularly susceptible to high child mortality (Hobcraft and others, 1982).

In addition to measuring the magnitude of the paternal-education effect, a number of researchers have attempted to identify mechanisms through which schooling of the father acts to reduce child mortality. By observing changes in the paternal-education variable as other variables are incorporated into regression models, tentative conclusions have been drawn. Both Schultz (1979) for Colombia and Farah and Preston (1982) for the Sudan found that inclusion of father's income did not make the effect of father's education insignificant. Either monthly wages do not accurately reflect permanent income, which Schultz believes is the case for Colombia, or paternal education, at least in the two countries examined, does not operate on mortality solely through market channels. Farah and Preston (1982) suggest that father's education, like that of the mother, has an important "direct" effect because education imparts knowledge about health and undermines traditions that are associated with higher child mortality.[1/]

Schultz (1979) investigated whether the effect of father's education differed in rural and urban settings. Presumably, if father's education does work indirectly through economic variables, its impact should be greater in cities, because the income returns from education are greater in urban areas. Schultz found that when income was not included in the model, the education coefficient for fathers was considerably larger in urban areas, but so was that for mothers, a finding inconsistent with the notion that the father's education alone works through market channels. When education and permanent income - imputed from monthly wages, education, region and a measure of experience - are considered together, the coefficient for the father's education is greater in rural areas than in urban areas and the impact of income on mortality is greater in urban areas (in fact, in rural areas, the coefficient is weakly positive). This suggests that there may be a non-market component in the paternal-schooling effect, which is of greater importance in rural areas, where the market value of education is low.

Both Schultz (1979) and Farah and Preston (1982) each examined only one country. Whether their findings are indicative of a general pattern is of primary interest here.

Measurement

In the countries studied, data on father's education were obtained by asking questions very similar to those concerning mother's education. In Liberia, data on father's characteristics were not collected at all. Two cautionary remarks seem important. First, the number of completed or attended years of schooling was not reported for a large number of fathers in several countries, mainly because women are asked to report the education of their husbands in those countries. In particular, the proportion of the "not stated" category for the father's education is nearly 40 per cent in Ghana and 30 per cent in Sudan. The differentials presented here are limited to children whose father's educational level was reported.

Second, as stated in chapter I, the current or last husbands of mothers of children are recorded; these are not necessarily biological or even stepfathers of the children. Education of the mother's husband is used here as a proxy for the father's education.

Univariate results

Results from the univariate tabulation for the 14 countries with available information confirm previous research that child mortality varies inversely with father's education. In almost all these countries, the ratio of reported to expected dead children declines as educational attainment of the father increases. However, a comparison of tables II.1 and III.1 shows that in the majority of the countries studied, the mortality ratio decreases less steeply with father's education than with mother's. In Kenya and Lesotho, for example, the ratio for fathers with 1-3 years of schooling is greater than that for fathers with no education; and in Ghana and Nepal, the ratio for the highest education groups is greater than that for the group immediately below, whereas in Nigeria, the monotonicity is broken at an intermediate level of education. In Sierra Leone, father's education is positively related to child mortality. The clearer and more consistent relationship of mother's education to the mortality ratio than that of father's appears to reflect the greater impact of maternal education on child survival. Alternatively, it may reflect the fact that some fathers in the data set are just husbands of mothers but not real fathers of the children, or simply the inferior quality of the data on paternal education compared to that on maternal education.

Another measure of mortality differentials is the index of dissimilarity; the larger the index, the greater are educational differences in mortality. For some countries, the index of dissimilarity is consistent with the pattern of mortality differentials by paternal education given in table III.1, as expected. Peru, where the mortality ratio decreases very sharply with the father's educational attainment, has the highest index of dissimilarity; and Sierra Leone, where the paternal education and child mortality appear to be unrelated (table III.1), shows the lowest value of the index. However, the results given in tables III.1 and III.2 are not completely consistent. In spite of quite steep declines of the mortality ratio with the father's completed years of schooling seen for Jamaica and Thailand in table III.1, these countries do not exhibit very high values of the index of dissimilarity, whereas in Nigeria, the relatively less weak and perturbed pattern of mortality differentials by the father's education is associated with a relatively high value. These inconsistencies are mainly attributable to the fact that the index of dissimilarity is affected by the distribution of the father's educational attainment, as well as the mortality differentials by paternal education, and that the order of categories of father's education is not considered in the calculation of the index of dissimilarity.

Bivariate results

Father's education was cross-classified with the mother's education, father's occupation and income to ascertain whether the effect of education diminishes in the presence of these other variables. If father's education is primarily a surrogate for a household's financial resources, then the income and occupation variables, which are expected to be more direct and valid indicators of economic status, would be more likely to capture differences in mortality. A cross-tabulation with rural/urban residence was also performed to see whether the impact of father's schooling was greater in urban areas, as would be expected if education works through economic variables.

The cross-tabulation of ratios of observed to expected deaths by both the mother's and the father's education was presented in the chapter on maternal education (table II.6). The results indicate that although mother's education does not eliminate the effect of father's education, it certainly reduces it. The association between father's education and child mortality is thus partially due to assortative mating. Educated men are more inclined to marry educated women, which is a main reason that father's education is associated with child mortality. In 10 out of 12 countries, the lowest mortality is seen when both parents are in the highest education category. However, in 5 of the 12 countries, the highest mortality occurs when the father has more education than the mother and not when they are both in the lowest education category. Thus, in some countries, when the mother has received little or no education and the father has received somewhat more, mortality is at its peak. Perhaps a woman has less power or control within the family if her husband is more educated and, as a result, has a higher social status (Ware, 1983).

Secondly, child mortality is cross-tabulated by father's education and rural/urban residence (table III.3). It indicates that in many countries the inverse relationship between schooling and mortality appears to be stronger in urban areas. In Peru, for example, the ratio for Lima falls from 1.317 for "no education" to 0.192 for "12+ years", but for the rural areas decreases only from 1.529 for "no education" to 0.943 for "7-9 years" then rises slightly to 1.022 for "12 years or more". Given that the economic value of education is expected to be greater in cities, this interaction is consistent with the view that father's schooling does operate, at least partially, through market channels.

The third type of bivariate analyses considered here relates to the relationship between father's education and occupation. Table VI.5 in the chapter on occupation indicates that within education categories, occupational differences are relatively unimportant. That is, occupation accounts for little of the variation in mortality. In a majority of countries, children of agricultural workers are somewhat disadvantaged; yet even for this group education continues to have a large effect. Inclusion of the father's occupation does little to alter the univariate results on his education, suggesting that paternal education does not appear to be operating through occupation. That the mortality ratios for education are unaffected by occupation may, of course, be attributable to the fact that occupation, as classified according to the very broad categories used here, is an imperfect indicator of income or other economic features.

Lastly, father's education was cross-tabulated with his income (converted into constant 1975 United States dollars) for Nigeria and Thailand, the only countries in which the data were considered adequate. (See chapter VIII for more details about income.) In both countries, including income reduces the effect of paternal education (table III.4). None of the within income class ratios of mortality of the lowest to the highest education groups is as high as that ratio for the entire population in Thailand. In Nigeria, the within income class variations are also lower than those for the national average.

It might be expected that the health returns to income would rise with education because outlays on health-related goods and services and the efficiency with which these expenditures are made would increase as knowledge improves. However, neither in Nigeria nor in Thailand is there an evident interaction between father's education and income such that the effect of income is greater for the highly educated. Instead, the income effects appear to be equally powerful at all education levels.

The results of the income tabulation with the father's education provide some support for the hypothesis that the effect of paternal education works partially through income. Yet, the fact shown later in table VIII.3 that inclusion of income reduces the impact of the mother's education in these two countries as well, although not necessarily to the same degree as does the father's education, leaves unresolved the question of sex differences in the education effect.

Multivariate results

The multivariate analysis shows that father's education remains quite important, although not nearly as important as mother's, when other variables are controlled (table III.5). Close to half (26 of 55) of the coefficients are significant at stage II. As was done with maternal education, the slope of the education category coefficients was calculated as a summary measure (table III.6).[2/]

When no other variables are controlled, one additional year of father's schooling reduces child mortality by, on average, about 5 per cent (table III.6), whereas that of mother's schooling is associated with child mortality that is lower by about 7 per cent. When all other variables are included, the effect of father's education is reduced by approximately 75 per cent, that is, to about 1.2, and that of mother's education is lowered by approximately 50 per cent, to about 3.4. The smaller effect of paternal education is found for 12 of the 14 countries for which the comparison is made, the two exceptions being Jamaica and Sri Lanka. Not only does father's education have less explanatory power than mother's at the univariate stage, its proportionate decline is greater when other variables are included in the analysis, suggesting that paternal education works through other socio-economic statuses to a far greater extent.

Educational differentials in mortality are considerably larger in Latin America and Asia than in Africa. In fact, the effect of father's schooling is positive in Sierra Leone and the Sudan, two countries in which coefficients for the mother's schooling are strongly negative. Perhaps the economic returns from education are greater in countries with more highly developed formal sectors.

Perhaps the most interesting finding, and one that was initially observed in the bivariate analysis, is that in 8 out of 11 countries, father's education is more stongly negative in urban areas. On average, the coefficient of paternal education is three times larger (-0.012 vs. -0.036) in urban areas than in the countryside. The greater influence of the father's education in urban areas results in a sharp reduction in the difference between male and female educational effects there. Whereas the average coefficient for mother's education is nearly three times as strong as that for the father in rural areas, it is less than 10 per cent larger in cities.

The greater effect of paternal education in urban areas is consistent with the notion that it works to a large extent through economic factors since the payoff to male education is expected to be greater in urban areas. However, the failure of occupation to absorb much of the explanatory power of education suggests that other non-economic routes may also be operating. If the sexual division of labour is reduced in urban areas and males play a larger role in child-rearing, then the impact of paternal education on child-rearing practices may be greater there.

Summary and conclusion

Throughout this chapter, as well as the chapter on maternal education, it has been suggested that mother's schooling operates through different channels than does that of father's. The emergence of rural/urban differences in the regression results is the clearest indication that the mechanisms through which education acts to affect child health differ for mothers and fathers, but the evidence here is far from conclusive. If the effect of mother's education is to improve child care skills and alter intra-family allocation of resources, as Caldwell (1979) argues, then this type of effect should be independent of rural or urban residence. The results presented here indicate that it is. As expected, paternal education is more important in cities, where education produces more income and where income, in turn, may more effectively produce health because of availability of basic goods and services, food, clothing, medical care, housing, sanitation and other health-related items.

Notes

1/ Clearly, education does not have a direct impact on child mortality. Because attitudes and practices relating to child care are difficult to measure, however, most researchers are not able to incorporate these intervening behavioural variables into their models. The effects appear to be "direct" because they do not operate indirectly through other variables in the estimation system.

2/ For the univariate differences, slopes were estimated by fitting a line to the ratios from table III.1). At Stages II, IIIR and IIIU, slopes were estimated by fitting a weighted regression line to the appropriate dummy variable coefficients from table III.4, with observations "located" at the mid-point of an educational interval.

Table III.1. Ratio of observed to expected deaths, by paternal education (expected deaths in parentheses)

Paternal education a/	AFRICA						ASIA					LATIN AMERICA		
	Ghana	Kenya	Lesotho	Nigeria	Sierra Leone	Sudan	Indonesia	Nepal	Republic of Korea	Sri Lanka	Thailand	Chile	Jamaica	Peru
None	1.137 (31755)	1.135 (1730)	1.037 (866)	1.160 (1303)	0.992 (1084)	0.947 (369)	1.045 (31559)	1.046 (3866)	1.038 (728)	1.440 (273)	1.444 (322)	1.390 (220)	1.565 (33)	1.527 (747)
1-3 years	0.891 (2743)	1.168 (449)	1.083 (370)	1.123 (100)		0.834 (25)	1.039 (24543)	0.806 (135)			1.037 (1380)	1.302 (506)	1.171 (138)	1.264 (1508)
					1.026 (132)				1.008 (1041)	1.096 (1275)				
4-6 years	0.698 (6207)	0.956 (1149)	0.984 (583)	1.023 (237)		0.835 (73)	0.862 (18245)	0.902 (212)				1.080 (1064)	1.024 (417)	0.888 (1407)
					1.018 (169)					0.839 (901)	0.849 (172)			
7-9 years	0.440 (668)	0.838 (1064)	0.821 (320)	0.790 (272)		0.479 (15)	0.588 (3309)	0.767 (201)	0.919 (436)			0.913 (451)		0.610 (299)
10-11 years	0.537 (1001)	0.687 (218)		1.000 (135)			0.441 (1783)	0.892 (575)	0.823 (369)	0.540 (199)	0.350 (49)	0.697 (218)	0.510 (63)	0.461 (384)
12 years or more		0.497 (254)		0.589 (324)			0.275 (362)		0.609 (176)	0.451 (82)		0.496 (280)		0.323 (245)
Not stated	0.986 (30566)	0.935 (222)	..	0.929 (101)	..	1.134 (184)	1.128 (15417)	..	1.497 (259)	..	1.013 (53)	0.980 (330)	1.099 (54)	..

a/ The figures represent completed years of schooling, except for Ghana in which they represent years attained, and Sierra Leone and the Republic of Korea in which they represent years attended. The categories differ from the standard as follows:

Ghana: None; primary; middle; secondary; higher level.
Lesotho: None; 1-3 years; 4-6 years; 7 years or more.
Sierra Leone: None; primary; secondary and above.
Sudan: None; 1-3 years; 4-6 years; 7 years or more. "None" includes "Khalwa".
Indonesia: None; some elementary; elementary; junior high and above.
Nepal: None; 1-3 years; 4-6 years; 7-9 years; 10 years or more.
Republic of Korea: None; 1-6 years; 7-9 years; 10-12 years; 13 years or more.
Sri Lanka: None; 1-5 years; 6-9 years; 10-11 years; university; other higher.
Thailand: None; 1-4 years; 5-10 years; 11 years or more.
Jamaica: None; pre-primary/primary under 4 years; primary over 4 years; secondary or higher.

Table III.2. Index of dissimilarity of child mortality by paternal education

Country	Index of dissimilarity
Africa	
Ghana	0.054
Kenya	0.073
Lesotho	0.030
Nigeria	0.083
Sierra Leone	0.005
Sudan	0.053
Asia	
Indonesia	0.053
Nepal	0.032
Republic of Korea	0.056
Sri Lanka	0.098
Thailand	0.032
Latin America	
Chile	0.090
Jamaica	0.054
Peru	0.153

Table III.3 Ratio of observed to expected deaths by paternal education and area of residence of mother (expected deaths in parentheses)

Paternal education	Area of residence of mother		
	Largest city	Other urban	Rural
	AFRICA		
	Ghana		
None	0.776 (772)	1.086 (3800)	1.154 (27183)
Primary	0.592 (220)	0.708 (379)	0.954 (2145)
Middle	0.538 (1091)	0.592 (1802)	0.798 (3313)
Secondary	0.329 (304)	0.450 (205)	0.640 (159)
Higher level	0.332 (277)	0.531 (319)	0.682 (406)
Not stated	0.629 (1899)	0.841 (6958)	1.064 (21709)
	Kenya		
None	1.028 (90)	1.286 (37)	1.138 (1603)
1-3 years	1.145 (20)	1.115 (13)	1.171 (416)
4-6 years	0.934 (72)	1.018 (62)	0.953 (1015)
7-9 years	0.792 (106)	0.615 (85)	0.866 (873)
10-11 years	0.827 (27)	0.586 (29)	0.682 (163)
12 years or more	0.303 (69)	0.547 (46)	0.577 (139)
Not stated	0.662 (32)	1.183 (19)	0.959 (172)

Table III.3 (continued)

Paternal education	Area of residence of mother		
	Largest city	Other urban	Rural
	AFRICA (continued)		
	Lesotho[a/]		
None	1.459 (25)	1.199 (23) b/	1.019 (812)
1-3 years	b/	1.358 (14) b/	1.079 (354)
4-6 years	0.769 (17)	0.768 (20) b/	1.000 (541)
7 years or more	0.828 (19)	0.785 (19) b/	0.813 (277)
	Nigeria		
None	——— 1.132 (391) ———		1.173 (912)
1-3 years	——— 1.052 (32) ———		1.157 (67)
4-6 years	——— 1.043 (116) ———		1.004 (120)
7-9 years	——— 0.696 (122) ———		0.865 (150)
10-11 years	——— 0.756 (83) ———		1.396 (52)
12 years or more	——— 0.545 (220) ———		0.685 (104)
Not stated	——— 0.803 (47) ———		1.040 (54)

Table III.3 (continued)

Paternal education	Area of residence of mother		
	Largest city	Other urban	Rural
	ASIA		
	Indonesia		
None	1.312 (619)	1.118 (1806)	1.035 (29134)
Not finished elementary	1.059 (643)	0.969 (2309)	1.045 (21591)
Elementary school	0.801 (915)	0.735 (3764)	0.901 (13566)
Junior High or above	0.418 (707)	0.447 (2310)	0.617 (2439)
Not stated	1.191 (522)	1.029 (1852)	1.140 (13044)
	Nepal[c/]		
None	b/	0.917 (21)	1.045 (3800)
1-3 years	b/	b/	0.824 (130)
4-6 years	b/	b/	0.900 (204)
7-9 years	b/	b/	0.790 (182)
10 years or more	0.238 (28)	0.577 (24)	0.961 (506)

Table III.3 (continued)

Paternal education	Area of residence of mother			
	Largest city	Other urban	Rural	
	ASIA (continued)			
	Republic of Korea			
None	1.222 (19)	0.995 (46)	1.039 (613)	
1-6 years	0.964 (86)	0.977 (140)	1.019 (815)	
7-9 years	1.071 (86)	0.838 (117)	0.903 (234)	
10-12 years	0.828 (85)	0.683 (113)	0.915 (172)	
13 years or more	0.477 (69)	0.608 (59)	0.805 (47)	
Not stated	1.218 (42)	1.524 (54)	1.560 (162)	
	Sri Lanka[d/]			
None	b/	1.259 (16)	1.299 (214)	2.363 (38)
1-5 years	1.032 (45)	1.353 (100)	0.987 (992)	1.721 (138)
6-9 years	0.742 (66)	0.735 (119)	0.808 (666)	1.645 (49)
10-11 years	0.591 (22)	0.592 (51)	0.522 (120)	b/
University	b/	b/	b/	b/
Other higher	b/	0.548 (15)	0.454 (44)	b/
Not stated	b/	b/	b/	b/

Table III.3 (continued)

Paternal education	Area of residence of mother		
	Largest city	Other urban	Rural
	ASIA (continued)		
	Thailand		
None	______ 0.732 (34) ______		1.193 (288)
1-4 years	______ 0.801 (105) ______		1.056 (1275)
5-10 years	______ 0.555 (52) ______		0.977 (120)
11 years or more	______ 0.161 (31) ______		0.686 (18)
Not stated	______ 0.411 (19) ______		1.359 (34)
	LATIN AMERICA		
	Chile		
None	1.335 (42)	1.303 (104)	1.439 (185)
1-3 years	1.158 (179)	1.268 (261)	1.403 (303)
4-6 years	1.028 (563)	1.122 (754)	1.074 (377)
7-9 years	0.858 (292)	0.957 (324)	0.948 (46)
10-11 years	0.722 (112)	0.677 (128)	0.687 (15)
12 years or more	0.465 (99)	0.499 (109)	0.726 (11)
Not stated	0.861 (197)	1.053 (138)	1.170 (74)

Table III.3 (continued)

Paternal education	Area of residence of mother		
	Largest city	Other urban	Rural
	LATIN AMERICA (continued)		
	Jamaica		
None	——— b/ ———		1.471 (25)
Primary, less than 4 years	——— 1.293 (32) ———		1.134 (107)
Primary, more than 4 years	——— 0.952 (168) ———		1.073 (249)
Secondary or higher	——— 0.378 (42) ———		0.782 (20)
Not stated	——— 0.895 (29) ———		1.341 (25)
	Peru		
None	1.317 (38)	1.566 (178)	1.529 (532)
1-3 years	0.634 (125)	1.248 (479)	1.359 (904)
4-6 years	0.570 (344)	0.907 (637)	1.115 (426)
7-9 years	0.490 (136)	0.668 (138)	0.943 (25)
10-11 years	0.324 (187)	0.524 (169)	1.007 (28)
12 years or more	0.192 (112)	0.468 (551)	1.022 (11)

a/ Data for the category "Other urban" in Lesotho were divided in "other large cities" and "small cities".
b/ Fewer than 10 expected deaths.
c/ Area of residence "not stated" omitted.
d/ "Rural" area of residence for Sri Lanka was divided into two categories: Rural-non Estate and Rural-Estate.

Table III.4 Ratio of observed to expected deaths by paternal education and income, measured in 1975 U.S. dollars (expected deaths in parentheses)

AFRICA

Nigeria

Paternal education	Father's income				
	0-139	140-599	600+	Not stated	All
None	1.175 (656)	1.167 (454)	1.086 (119)	1.115 (74)	1.160 (1303)
1-3 years	1.508 (18)	1.156 (55)	0.884 (15)	0.712 (13)	1.123 (100)
4-6 years	1.220 (46)	1.044 (110)	0.873 (60)	0.912 (21)	1.023 (237)
7-9 years	0.767 (39)	0.841 (95)	0.744 (117)	0.847 (21)	0.790 (272)
10-11 years	1.091 (11)	1.099 (28)	0.947 (86)	1.079 (10)	1.000 (135)
12 years or more	0.748 (29)	0.833 (26)	0.551 (241)	0.521 (27)	0.589 (324)

ASIA

Thailand

Paternal education	Father's income					
	0-69	70-139	140-299	300+	Not stated	All
None	1.302 (171)	0.997 (56)	0.779 (23)	a/	1.035 (67)	1.144 (322)
1-4 years	1.140 (720)	0.913 (307)	0.820 (112)	1.003 (36)	0.983 (205)	1.037 (1380)
5-10 years	1.018 (38)	0.743 (43)	0.639 (41)	a/	1.063 (40)	0.849 (172)
11 years or more	a/	a/	0.154 (13)	a/	0.437 (18)	0.350 (49)

a/ Fewer than 10 expected deaths.

Table III.5. The effect of paternal education on child mortality: Regression coefficients and univariate differences

Paternal education[a/]	Univariate differences[b/]	Stage I	Stage II	Stage IIIR	Stage IIIU
		AFRICA			
		Ghana			
None	0	0	0	0	0
Primary	-0.246	0.032	0.103*	0.072	0.208*
Middle	-0.439	-0.111**	-0.005	0.009	-0.023
Secondary	-0.697	-0.254**	-0.132	-0.023	-0.214
Higher	-0.600	-0.272**	-0.143	-0.045	-0.239*
		Kenya			
None	0	0	0	0	0
1-3 years	0.033	0.036	0.048	0.062	-0.085
4-6 years	-0.180	-0.149**	-0.120**	-0.115**	-0.124
7-9 years	-0.297	-0.207**	-0.173**	-0.136**	-0.349**
10-11 years	-0.448	-0.311*	-0.274**	-0.305**	-0.256
12 years or more	-0.638	-0.444**	-0.381**	-0.414**	-0.381*
		Lesotho			
None	0	0	0	0	0
1-3 years	0.046	0.067	0.091	0.103	0.013
4-6 years	-0.053	-0.016	-0.003	0.029	-0.418*
7 years or more	-0.216	-0.152*	-0.134	-0.121	-0.468*
		Nigeria			
None	0	0	0	0	0
1-3 years	-0.037	-0.048	0.028	0.030	0.036
4-6 years	-0.137	-0.003	0.122	-0.021	0.111
7-9 years	-0.370	-0.279**	-0.083	-0.062	-0.173
10-11 years	-0.160	-0.069	0.209*	0.437	0.023
12 years or more	-0.571	-0.407**	-0.136	-0.028	-0.272*
		Sierra Leone			
None	0	0	0	c/	c/
Primary	0.034	-0.006	0.016	c/	c/
Secondary or Higher	0.026	0.107	0.224*	c/	c/

Table III.5. (continued)

Paternal education[a]	Univariate differences[b]	Stage I	Stage II	Stage IIIR	Stage IIIU
		AFRICA (continued)			
		Sudan			
None	0	0	0	c/	c/
1-3 years	-0.103	-0.043	-0.164	c/	c/
4-6 years	-0.102	-0.055	0.244	c/	c/
7 years or more	-0.457	-0.302	0.014*	c/	c/
Khalwa[d]	0.025	-0.259	-0.088	c/	c/
		ASIA			
		Indonesia			
None	0	0	0	0	0
Not finished elementary	0.006	-0.048*	-0.078**	-0.081*	-0.141**
Elementary	-0.183	-0.120**	-0.161**	-0.160**	-0.206**
Junior high school	-0.457	-0.279**	-0.285**	-0.287**	-0.303**
High school	-0.604	-0.334**	-0.341**	-0.371*	-0.379**
Academy or university	-0.770	-0.472**	-0.436**	-0.440	-0.437**
		Nepal			
None	0	0	0	c/	c/
1-3 years	-0.240	-0.240**	-0.201**	c/	c/
4-6 years	-0.144	-0.113	-0.055	c/	c/
7-9 years	-0.279	-0.191**	-0.105	c/	c/
10 years or more	-0.154	-0.083	-0.009	c/	c/
		Republic of Korea e/			
None	0	0	0	0	0
1-6 years	-0.030	0.030	0.054	0.040	0.157
7-9 years	-0.119	0.004	0.029	-0.046	0.232
10-12 years	-0.215	-0.081	-0.034	-0.044	0.109
13 years or more	-0.429	-0.251*	-0.225	-0.166	-0.126
		Sri Lanka			
None	0	0	0	0	0
1-5 years	-0.344	-0.254**	-0.192**	-0.213**	-0.177
6-9 years	-0.601	-0.428**	-0.307**	-0.265**	-0.476**
10-11 years	-0.900	-0.584**	-0.383**	-0.388**	-0.387
Higher	-0.989	-0.641**	-0.453**	-0.536**	-0.484

Table III.5. (continued)

Paternal education[a/]	Univariate differences[b/]	Stage I	Stage II	Stage IIIR	Stage IIIU
		ASIA (continued)			
		Thailand			
None	0	0	0	0	0
1-4 years	-0.407	-0.081	-0.042	-0.045	0.088
5-10 years	-0.595	-0.171	0.019	0.061	-0.002
11 years or more	-1.094	-0.465**	-0.212	-0.032	-0.301
		LATIN AMERICA			
		Chile			
None	0	0	0	0	0
1-3 years	-0.088	-0.005	0.007	0.006	0.035
4-6 years	-0.310	-0.141*	-0.143*	-0.330**	-0.022
7-9 years	-0.477	-0.193**	-0.190*	-0.361	-0.091
10-11 years	-0.693	-0.343**	-0.328**	-0.567*	-0.220
12 years or more	-0.894	-0.420**	-0.383**	-0.253	-0.303*
		Jamaica			
Under 4 years	0	0	0	0	0
Primary, 4+ years	-0.223	-0.166	-0.026	0.074	-0.294
Secondary or higher	-0.737	-0.525**	-0.250	0.134	-0.752**
		Peru			
None	0	0	0	0	0
1-3 years	-0.263	-0.089*	-0.074	-0.043	-0.161*
4-6 years	-0.639	-0.271**	-0.196**	-0.167*	-0.281**
7-9 years	-0.917	-0.315**	-0.185**	-0.138	-0.272**
10-11 years	-1.066	-0.372**	-0.206**	0.014	-0.315**
12 years or more	-1.204	-0.372**	-0.212*	0.368	-0.354**

* Significant at the .05 level.
** Significant at the .01 level.

a/ The numbers represent completed years of schooling.
b/ Statistical significance was not calculated for univariate differences.
c/ Samples are totally or predominantly rural.
d/ "Khalwa" is Koranic School in the Sudan.
e/ Years attended rather than years completed.

Table III.6. Regression coefficients of mortality ratio on father's completed years of schooling

Region and country	Univariate differences	Stage II	Stage IIIR	Stage IIIU
Africa				
Ghana	-0.051	-0.004	0.001	-0.011
Kenya	-0.038	-0.028	-0.028	-0.032
Lesotho	-0.019	-0.010	-0.007	-0.060
Nigeria	-0.040	-0.005	0.004	-0.018
Sierra Leone	0.004	0.026	a/	a/
Sudan	-0.034	0.032	a/	a/
Regional average	-0.030	0.002	-0.008	-0.030
Asia				
Indonesia	-0.051	-0.033	-0.034	-0.034
Nepal	-0.019	-0.003	a/	a/
Republic of Korea	-0.025	-0.009	-0.007	-0.007
Sri Lanka	-0.073	-0.032	-0.028	-0.038
Thailand	-0.053	-0.006	0.005	-0.027
Regional average	-0.044	-0.017	-0.016	-0.027
Latin America				
Chile	-0.071	-0.033	-0.052	-0.030
Jamaica	-0.122	-0.040	0.027	-0.122
Peru	-0.100	-0.019	-0.015	-0.021
Regional average	-0.098	-0.030	-0.013	-0.058
Grand average	-0.049	-0.012	-0.012	-0.036

a/ Stages omitted because sample was totally or predominantly rural.

Chapter IV

ETHNICITY AND RELIGION

The ethnicity and religion of the mother have rarely been included as explanatory factors in analyses of determinants of infant and child mortality. When considered, the treatment has usually been superficial; and explanations of observed differentials have been largely speculative. It is generally believed that variations in mortality across ethnic and racial groups "probably reflect mainly differences in such factors as socio-economic status and accessibility of health facilities and services, rather than innate differences among the groups themselves" (United Nations, 1973). Some investigators, however, have found that not all differences across ethnic groups can be explained by standard variables (Butz and others, 1983, for Malaysia; Boulier and Paqueo, 1981, for Sri Lanka).

In the United States of America, mortality differentials between blacks and whites have been examined in several studies. One study (Chase, 1965) lists a variety of factors responsible for higher mortality among blacks, including heredity, health care availability and socio-economic characteristics influencing utilization of available services and attitudes towards health care, but it fails to document the linkages. Another report (Reid, 1982) argues that high infant mortality among blacks may be related to the higher probability of low birth weight (under 2,500 grams), which, in turn, is associated with such vital functions as heart rate, breathing reflex and colour. Giles (1982) considers low birth weight to be associated with very young or very old mothers, unmarried mothers and mothers with low income and minimal education. Furthermore, according to Reid, the evidence available suggests that much of the differential between blacks and whites can be explained by the disproportionately small number of black mothers who receive prenatal care.

Several community-level studies of mortality in Asian societies include information on ethnic and religious origin. In examining estimates of the probability of early childhood death in Burma, Williams (1966) found striking differences between the Chinese, Indian and Burmese. He argues that lower Chinese mortality may reflect their higher socio-economic status and a "cultural pattern of cleanliness that promote better health", but this hypothesis was untested. He also notes that omission of dead children may vary across ethnic or religious groups.

Variations in child loss across religious and cultural communities in India have been explored by Ruzicka and Kanitkar (1973) and Gupta and Rao (1976). The former authors found that in Greater Bombay, Christian women had the lowest and Muslim women the highest infant mortality and that these differentials were greater during the post-neonatal than the neonatal period. Differences in education are suggested as possible explanatory factors. Sizeable differences in the child mortality ratio by religion and caste are noted by Gupta and Rao for a rural area in southern Uttar Pradesh. As expected, women from lower caste Hindu backgrounds had the highest ratio of children dead to children born; Muslim women had the lowest. Unfortunately, the measure they employed did not account for group differences in fertility and exposure over time to the risk of death.

At a more general level, there has been a good deal of reflection on the relationship between religion and modernization. Some attitudes and beliefs held by certain religious communities may be at odds with modern rationalism and hinder individual well-being and material progress, but opinions on this subject differ. In an examination of a rural community in Lebanon, no difference was found between Muslims and Christians in their attitudes towards the importance of faith when faced with personal and family difficulties (Fetler, 1964). This author argues that the more important determinants of behaviour are Arab culture in general and a number of concomitants of rural life.

Fernando (1981), examining infant mortality in Sri Lanka, found a positive association between the percentage of India Tamils in a region and the infant mortality rate. Other factors controlled were female education and employment; and although a high correlation was seen between the three factors, ethnicity still accounted for significant variation of infant mortality when multivariate analysis was employed.

Excessive child deaths among Tamils also is disclosed in an individual analysis from the 1975 National Fertility Survey of Sri Lanka (Boulier and Paqueo, 1981). The disparity between survival probabilities of Tamil children and others persisted even after controlling for a number of other factors. Unfortunately, the authors are unable to shed much light on the possible reasons for the variation other than suggesting that differences may be attributed, in part, to "differences in racial characteristics and thus endowments in genetic characteristics influencing mortality".

A detailed study of infant mortality in Malaysia (Butz and others, 1982) identifies significant differences between the three major ethnic groups - Malay, Chinese and Indian - at several different intervals in the first 12 months of life. With a variety of biological and socio-economic factors controlled, child mortality among Chinese mothers was found to be significantly lower than that among Malay mothers in the first weeks after birth, and from the second to the twelfth month. Children of Indian mothers also had lower mortality than the children of Malay mothers in the second half of the first year of life. Interestingly enough, differences between Indian and Malay mothers were increased when birth characteristics were included because Indian babies have lower birth weights and their mothers have shorter pregnancy intervals. Butz and his colleagues conclude that the answer to the enduring significance of ethnicity must lie in "something else, unmeasured or poorly measured in the data".

Higher child mortality of the indigenous population than that of the rest of the population has been reported for Guatemala by Behm and Vargas (1978). They attribute the differential to socio-economic and cultural factors. The differential was negligible for children of non-educated mothers but very significant for children of educated mothers. In Bolivia, where language was taken as a proxy for ethnic group, children of mothers that only spoke indigenous languages were found to have much higher mortality than the Spanish-speaking group (Behm, Hill and Solis, 1977).

Although only a few efforts have been made to examine the relationship between the mother's ethnicity or religion and her child mortality experience, they offer a perspective from which to appraise the findings from the present study. Previous results point to: (a) the presence of differences in infant and child mortality along ethnic or religious lines; (b) the reduction of variation when relevant controls are applied; and (c) an important unexplained, residual effect.

Measurement of ethnicity

In 9 out of 11 countries where data on ethnicity are available, the relevant information was obtained straightforwardly, that is, by asking respondents an open-ended or single-choice question about the ethnic group to which they belonged or by instructing interviewers to record names of tribes that were visited. In Nigeria, both an ethnic group and a sub-ethnic group were asked to obtain detailed information. In Peru and Thailand, on the other hand, data on the language of the respondent were obtained; and language is treated as a proxy of ethnicity in the present analysis for these two countries.

Ethnicity means different things in different countries. In the African countries, the groups are differentiated primarily on the basis of language and culture; however, categorical detail varies from one country to the next. In the Asian countries, ethnic groups identified are internationally recognized categories, such as Chinese and Indian, except in Nepal, where ethnicity denotes tribal or community identification.

Ethnicity: univariate results

The probability of child survival was found to vary with a mother's ethnicity, as is apparent from the results given in table IV.1. In each of the 11 countries for which there is some information on ethnic identification, substantial variation exists in the mortality ratios. At a very crude level of analysis, the disparity in child mortality between the lowest mortality and highest mortality ethnic groups is at least 30 percentage points; in all but Nepal and Peru, the highest ratio is more than double that of the lowest; and in two cases (Indonesia and Thailand), the highest ratio is more than three times that of the lowest.

Caution should be exercised in evaluating the results for Nigeria, Sierra Leone and the Sudan where the surveys were highly localized. In these countries, members of non-indigenous ethnic groups may well be migrants; and their child mortality experiences could not be representative of their ethnic group but instead reflect their marginal status in the larger society. Thus, in the Sudan, the westerners are people who have moved into the Gezira, where the survey was taken; and in Nigeria, eastern and other Nigerian ethnic groups are identified in the largely Yoruba south-western area where the survey was taken.

The maldistribution of infant and child death among different ethnic groups may be measured by the index of dissimilarity. The Sudan, Kenya and Ghana register exceptionally high values, 0.15, 0.12 and 0.11, respectively; and Peru, Ghana and Sierra Leone also are characterized by substantial inequality across ethnic groupings. In the Gezira in the Sudan, Fellata mothers and those from the western provinces of Kordofond and Darfur have much poorer histories of child survival than the wives of the indigenous Arab land owners. The explanation for the relatively high inequality in Kenya may be at least in part ecological. The central Bantus, the majority of whom are ethnic Kikuyus, and the Nilo-Hamitic peoples, their neighbours directly to the west, were found to have much lower child mortality levels than the western Bantus, the Nilotics (adjacent to Lake Victoria) and the coastal Bantus in the south-western area, all of whom live in malarial zones. Ecological or regional disadvantages may be at least partially responsible for the high child mortality among the northern ethnic groups in Ghana, the Indian Tamils in Sri Lanka and the groups speaking indigenous languages in Peru.

The index of dissimilarity is sensitive to the detail with which categories are enumerated; and in countries where the vast majority of the population are in one ethnic group, the measure fails to pick up disparities. Thus, in Indonesia and Thailand, two Asian societies where the small Chinese minorities have substantially lower infant and child mortality than the indigenous population, the indices remain extremely low.

Ethnicity: bivariate results

It has been suggested that the effect of other more relevant factors associated with ethnicity is reponsible for perceived variation in the child mortality ratio. One likely candidate for consideration is the mother's education, which has been shown to be an important determinant of child mortality and may very well vary with ethnicity. Table IV.3 presents the results of a cross-classification of the child mortality ratio by ethnicity and education of the mother for 11 of the countries under study. Different ethnic groups possibly have access to education of different quality; years of schooling may not therefore constitute a proper common denominator to compare the education of various ethnic groups within a country. In general, the findings show that variation across ethnic groupings is diminished but not eliminated. A negative monotonic relationship between education and child mortality surfaces within most ethnic groups; that is, child mortality declines fairly regularly with increasing education, although the slope of the relation varies within societies and across global regions.

The pattern may be illustrated by the findings for Kenya, Sri Lanka and Peru, three countries from different regions of the world with different levels of mortality. In Kenya, mortality ratios for those with no education vary from a high of 1.7 among Nilotic peoples to a low of .6 for Nilo-Hamitics. With education, the ratios decline for all groups except the Nilo-Hamitics, whose pattern is unusual enough to cause concern that poorly educated mothers may be failing to report a high fraction of dead children. For those women with seven or more years of education, all ratios are below unity, but variation across broad ethnic groups remains. Well-educated coastal Bantu mothers exhibit a level of mortality nearly two thirds higher than that for similarly educated central Bantu mothers.

Analysis of Sri Lankan data is limited by the fact that there are too few well-educated Indian Tamil and Moorish mothers for reliable estimation of their child mortality. None the less, even with a truncated analysis, results parallel those from Kenya. Uneducated mothers, irrespective of their ethnicity were found to have higher than average child mortality, but the ethnic variation among them was quite pronounced. For Indian Tamil mothers with no education, the level of child mortality was reported to be 1.7 times higher than that for uneducated Sinhalese mothers. The disadvantaged position of Tamil mothers is further illustrated by the ratios for Sri Lankan Tamils, which exceed those for Sinhalese mothers across educational levels.

Results for the Spanish/Indian dichotomy in Peru are relatively clear and consistent with the previous findings. Child mortality is higher for Indian mothers speaking indigenous languages than Spanish speaking mothers in each of three educational categories; ratios of Indian to Spanish mortality are 1.3 for the uneducated and 1.4 for those with 1-3 or 4-6 years of education.

Ethnicity: multivariate results

Previous research, though sparse, suggests that ethnic differences tend to persist, albeit at a reduced level, when a variety of other factors are considered. The results shown in table IV.4 also show important variations in infant and child mortality even after the introduction of maternal education and several other background variables (Stage I).

In Africa, where the variety of ethnic categories reflects the heterogeneous nature of these societies, the relationship remains relatively strong. The reference group for most countries is the largest or one of the more important ethnic groups. Results for Ghana show that a Ga Adangbe mother has an 18 per cent lower level of infant and child mortality than an Akan mother, controlling for maternal and paternal education, religion and the mother's place of birth. Ewe mothers also have a lower level of mortality, whereas mothers from northern ethnic groups and those belonging to other groups (foreign) have higher levels. In all cases, the results are statistically significant.

Kenyan ethnic groups continue to exhibit large, statistically significant differentials in infant and child mortality. Differences are only slightly reduced or even enlarged from those obtained in the primary associations; this finding suggests that the effect is largely independent of the other background factors. In Liberia and Nigeria, important differences continue to be manifest at this stage of analysis. With respect to the results from Nigeria, it must be remembered that the survey was geographically circumscribed; thus, members of ethnic groups other than Yoruba, Edo and Urhobo may not be indigenous to this region, although the significance of their migrant status is not clear. Being from the Eastern, Edo or Urhobo ethnic groups lowers mortality by 35, 23 and 46 per cent, respectively, in relation to being Yoruba.

Differentials among ethnic groups in Asia and Latin America also remain considerable at this first stage of the regression. In Sri Lanka, the disadvantaged position of Tamil women noted by Fernando (1981), and by Boulier and Paquero (1981) is also evident in the present analysis. The differential for Sri Lankan Moors is substantially increased when background variables are added, the ratio is 66 per cent higher than that for Sinhalese mothers. The mortality of Sri Lankan Tamils also worsens. Exceptionally low levels of child mortality among Chinese communities in Indonesia and Thailand persist at this stage of analysis.

Background factors substantially reduce the disparity in child mortality between Spanish and indigenous-language speaking mothers in Peru. None the less, at this first stage of multivariate analysis, three of four groups of Indian mothers retain significantly higher levels of child mortality in relation to Spanish mothers.

Results for the extended model (Stage II), which adds a group of current status variables, are also shown in table IV.4. In most countries, the variation across ethnic groupings is further reduced, but, surprisingly, there are persistent differentials. This result suggests that there are other important channels through which ethnic identity operates, channels that possibly are linked with more proximate biological and demographic characteristics or that encompass attitudes or behaviour.

Ghana and Kenya offer two slightly different examples of what happens when additional factors are considered. In Ghana, differences between Akan women and Ga Adamgbe and Ewe women are only slightly reduced from their previous levels, although for the latter group the difference is not statistically significant. The strength of the relationship for women from those groups which manifested higher child mortality in relation to Akan women, northern and other foreign and Togo, is greatly reduced, even though the former group retained a significantly higher level. In Kenya, differentials are reduced dramatically for Bantu mothers, but not for Nilotic and Nilo-Hamitic mothers, suggesting that ethnicity may follow different paths for different groups. The relationships between ethnicity and mortality remain fairly stable in Liberia, Nigeria, Sierra Leone and the Sudan, with only a modest reduction or increase in the number of statistically significant coefficients of categories.

In Asia, the child survival advantage that the Chinese manifested in Indonesia and Thailand is maintained when the current socio-economic variables are added (although, largely due to small sample size and collinearity problems, the difference between the Thai and ethnic Chinese is not significant). Similarly, in Sri Lanka, differentials remain sizeable between the two Tamil communities and the Sinhalese.

Separate effects of ethnicity and religion from the multivariate analysis for Sri Lanka are difficult to disentangle because there is a strong association between ethnicity and religion. The Tamils are mostly Hindu; the Sri Lankan Moors are Muslims; and the Sinhalese are Buddhists. Some puzzling results for Sri Lanka seem to be a statistical artifact produced by the strong association of the two factors. For example, table IV.4 appears to suggest that being a Moor in rural Sri Lanka makes child mortality remarkably low, with the mortality ratio lower by 1.499 than that of the Sinhala group. In contrast, table IV.7 shows that being a Muslim in rural Sri Lanka raises child mortality to an extremely high level, with the mortality ratio higher by 1.795 than that of Christians. Given the fact that the ethnic group, Sri Lankan Moors, and the religious group, Muslims, are virtually identical there, it should be realized that the two very strong positive and negative effects cancel each other to a large extent. Namely, the mortality ratio of children of parents who are Sri Lankan Moors and, almost equivalently, Muslims is higher by only 0.296 (1.795 minus 1.499) than that of Christian children who belong to the Sinhala ethnic group, when other variables in the data set are controlled.

Results from this analysis are extremely revealing, for they show that even accounting for a host of important characteristics of the mother, father and locale, ethnicity continues to matter. Thus, it was found that children of Nilotic mothers in Kenya, Tamil mothers in Sri Lanka, and Indian speaking mothers in Peru are much less likely to survive even after the effect of some socio-economic variables is controlled; and children of Urhobo mothers in Nigeria, Yalunka and Fula mothers in Sierra Leone and Chinese mothers in Indonesia retain a considerable survival advantage.

The patterns identified above are more prevalent in rural than in urban areas. In Ghana, Nigeria and Thailand, differentials among ethnic groups are substantially reduced in urban areas. Thus, for example, the advantage that Ga Adangbe women have over Akan women in Ghana is shown to be a largely rural phenomenon, as is also true for the Urhobo in Nigeria in relation to the Yoruba; for the Chinese in Thailand when contrasted with Thai women and the Sinhala in Sri Lanka when contrasted with the Sri Lankan Tamil. The reduction of ethnic differentials in urban areas for these three countries suggests that ethnicity may mean less in cities where modernization and intermarriage encourage assimilation into a larger urban culture.

Separation of the population into urban and rural communities in Kenya and Liberia also produces some interesting reversals. Coastal Bantu women in rural Kenya have about the same infant and child mortality as their central Bantu countrywomen, but in the urban areas they have significantly higher mortality. The advantage that Nilo-Hamitic mothers exhibit is clearly a rural advantage; in the urban areas, these mothers have higher mortality than central Bantu mothers. In Liberia, the advantage that mothers of several ethnic groups held over the Mandingo/Vai in rural areas is transformed into a disadvantage in urban areas. It appears that for some mothers whatever is beneficial to child survival in the rural areas--perhaps factors not measured in the study, such as traditional practices, beliefs or demographic or ecological characteristics--is lost in the urban areas.

Measurement of religion

In all of the countries where data on religion are available, respondents were asked directly about their religion. Most categories of religious affiliation used in the present research are for major religions, such as Buddhist, Christian, Confucian, Hindu and Muslim. Christians are usually subdivided into Catholics and Protestants, although all Christians are grouped together in Thailand, where they constitute only a small proportion of the population. Where Anglican or some other particular Protestant church, such as Baptist Church of God in Jamaica or Lesotho Ecumenical Church, accounts for a significant number of adherents, its name is specified in the tables. The category "traditional" is used for a tribal or local religion of native origin or a group of such religions.

In some countries, the majority of the population are affiliated with a particular religion, whereas in other countries, residents are religiously heterogeneous. Dominant religions include Buddhism in Sri Lanka and Thailand, Hinduism in Nepal and Islam in Indonesia and Sierra Leone. In the Republic of Korea, the majority of respondents stated that they had no religious affiliations.

Religion: univariate results

As may be seen from table IV.5, Muslim mothers have significantly higher infant and child mortality than Christian mothers, including both Catholics and Protestants, in the four countries of Africa for which the comparison can be made. Within the Christian communities, mortality varies only moderately. In Lesotho, where the overwhelming majority of women are Christian, mothers belonging to the indigenous Lesotho Ecumenical Church have a small advantage over those who are Catholic or Anglican. With respect to traditional believers, results from Ghana and Nigeria conflict. Traditional mothers in Ghana were found to experience the highest child mortality of any religious group; but in Nigeria, their level was below average.

Of the Asian countries in the study, Sri Lanka, the Republic of Korea and Thailand are predominantely Buddhist; Nepal is Hindu; and Indonesia, Muslim. Only minor variations are evident across religious groupings in the Republic of Korea and Thailand. Muslim women in Indonesia are the most disadvantaged, but in Sri Lanka and Nepal, the levels of Muslim child mortality are lower than those for Hindus.

Religion: bivariate results

The relation between religious affiliation and mortality is examined within various categories of the mother's education in table IV.6. For this analysis, all Christian communities were combined, and only those countries are included which are religiously heterogeneous in the sense that there is no single dominant religion covering the vast majority of the population. In some countries, it might be safe to conclude that a mother's religious affiliation pre-dated her educational experience and may have in part determined whether she attended school or how much education she received. In other countries, however, the causal link may in fact be reversed, particularly in societies where education is or has been under the auspices of church groups. Thus, for example, conversion to Christianity may be the consequence of attending school.

In Kenya and Nigeria, Muslim mothers have higher child mortality at each of several educational levels; and in Ghana, at the highest levels of education (4 or more years). More education does not appear to eliminate differentials. Traditional believers in Ghana appear to have educational differentials in child mortality that more closely parallel those of Muslims.

The levelling effect of education is more evident in Sri Lanka than in Indonesia. In Sri Lanka, Christian and Hindu women with no education have a much higher child mortality level than that for uneducated Buddhist women, but for women with 10 or more years of schooling, the disparity is substantially reduced. In Indonesia, the relative disparities in child survival that are manifest between the Muslim majority and the religious minorities are maintained for different educational categories; and in the case of Hindu women, the differences are enhanced even as the education level rises. Child survival among Buddhists and Confucian mothers is remarkably high at low levels of education, in accord with findings for Indonesian Chinese. Mortality among uneducated Hindu mothers, by contrast, is close to that of the national average. With formal schooling, however, the level declines sharply so that child survival for those few women with more than a primary education is about equal to that for educated Buddhists and Confucians. These results illustrate the combined ameliorative effects of religion and education in the case of Buddhists and Confucians, and of education alone for Hindus.

Religion: multivariate results

After controlling for one important factor, the mother's education, some variation persists across religious groupings. It is evident, however, from the results given in table IV.7, that when the full complement of socio-economic factors is considered, religious differentials in infant and child mortality are greatly reduced. This finding tends to confirm the largely untested hypothesis that religion stands as a proxy for other socio-economic factors. However, in the African countries examined, Christians continue to have much lower child mortality than members of other religious groups.

In Ghana and Kenya, two of the three African countries where Muslim women were found to have very high child mortality, the introduction of background variables (Stage I) virtually eliminates their disadvantage in relation to the referenced Catholic mothers; this rough equality persists when current factors are added (Stage II) and also in rural areas (Stage IIIR). In the cities, however, Muslim women have lower mortality, although the differences between Catholic and Muslim women are not statistically significant. Child mortality of Muslim mothers is 19 per cent higher than that of Catholic mothers in Nigeria and 17 per cent higher than the rate for Christian mothers in Sierra Leone, even after maternal and paternal education, the mother's ethnicity and the parents' occupations are controlled. However, as is true throughout Africa, none of the coefficients are significant at this stage. Being Muslim resulted in somewhat different experiences in urban and rural areas. The disparity in child mortality in relation to Catholic mothers is enhanced in the rural areas and reduced in urban areas in Nigeria, although in both areas Muslims have the highest levels. In Ghana and Kenya, Muslims have lower mortality than Catholics in urban but not in rural areas.

Religious differentials appear to be more enduring in Asia. Muslim women in Indonesia were found to suffer child loss at roughly 30 per cent higher levels than Catholic mothers, even when other early determinants were considered; a statistically significant disparity persists at all stages of analysis, including the urban stage. In Sri Lanka, the unfavourable position of Muslim mothers increases when other factors are controlled, except in urban areas. High levels of child mortality among Muslims are not characteristic of all Asian societies covered in the study. In Nepal, Muslim women have a 21 per cent lower level than Hindu women when background factors are considered and a slightly lower level when all additional variables are controlled. Buddhist mothers also have a better child mortality experience than Hindus.

Summary and conclusion

Although religious differences in mortality continue to be important in a few settings even after socio-economic factors are controlled, for the most part they are not particularly noteworthy. When the zero-order relation between mortality and religion is strong, it is usually attributable to the associations between religion and other socio-economic factors. Ethnicity, on the other hand, exerts a strong influence on mortality in countries where ethnic groups appear to be sharply differentiated. Most of these groups are unique to a particular country and hence do not admit to generalization. One group, that of Chinese extraction, appears in a sufficient number of countries throughout Asia so that its uniformly low mortality acquires added significance.

Although an interpretation of the large ethnic differences revealed here is beyond the scope of this project, it is reasonable to speculate that ethnicity is associated with sets of child care practices for which it is acting as a proxy. To some extent it may also reflect regional environmental factors, although regional differences are controlled, albeit somewhat crudely, in this study. If this interpretation is correct, then the greater importance of ethnicity than of religion would suggest that child care practices are more closely associated with ethnic identification than with religious adherence. The fact that ethnic differentials are sharply attenuated in urban areas may support this interpretation, because urban areas undoubtedly contain a greater mixture of ethnic groups and hence a greater opportunity to assimilate the ways of others. It is in rural areas, where contact between ethnic group is limited, that ethnicity exerts a powerful impact on child mortality.

Table IV.1 Ratio of observed to expected deaths by mother's ethnicity. (expected deaths in parentheses)

Mother's ethnicity	Ratio
AFRICA	
Ghana	
Akan	0.913 (35035)
Ga Adamgbe	0.679 (5121)
Ewe	0.846 (9077)
Guan	1.030 (2475)
Northern	1.372 (17192)
Foreign and Togo	1.131 (4042)
Kenya	
Central Bantu	0.776 (2343)
West Bantu	1.059 (1147)
Coastal Bantu	1.217 (272)
Nilotic	1.512 (855)
Nilo-Hamitic	0.619 (349)
Other Nilo-Hamitic	0.643 (65)
Other	0.848 (57)

Table IV.1 (continued)

Mother's ethnicity	Ratio
AFRICA (continued)	
Liberia	
Mandingo and Vai	1.051 (1672)
Bassa and Kru	0.963 (5657)
Kpelle	0.933 (5164)
Other W. Mande	1.139 (2073)
E. Mande	0.902 (3978)
West Atlantic	1.311 (2102)
Other Kwa	1.057 (3756)
Other Liberian/African	0.679 (230)
No tribal affiliation	0.581 (523)
Nigeria	
Yoruba	1.061 (1724)
Northern	1.460 (75)
Eastern	0.576 (38)
Edo	0.892 (306)
Urhobo	0.668 (199)

Table IV.1 (continued)

Mother's ethnicity	Ratio
AFRICA (continued)	
Nigeria (continued)	
Other Nigerian/African	1.070 (120)
Unknown	0.657 (11)
Sierra Leone	
Mende	1.133 (629)
Temne	0.949 (243)
Limba	0.722 (19)
Lokko	1.012 (53)
Mandingo	1.036 (37)
Fula	0.686 (86)
Yalunka	0.667 (168)
Vai	1.436 (41)
Susu	0.995 (45)
Other	0.898 (33)

Table IV.1 (continued)

Mother's ethnicity	Ratio
AFRICA (continued)	
Sudan	
Arab	0.686 (367)
Fellata	1.622 (49)
Westerners	1.177 (252)
ASIA	
Indonesia	
Indonesian	0.998 (94435)
Chinese	0.253 (746)
Other	0.604 (39)
Nepal	
Tharu	1.120 (318)
Newar	0.835 (268)
Brahmin	0.828 (501)
Chhetri	0.986 (970)
Magar	1.067 (697)
Other	1.036 (2224)

Table IV.1 (continued)

Mother's ethnicity	Ratio
ASIA (continued)	
Sri Lanka	
Sinhala	0.863 (1948)
Sri Lankan Tamil	1.070 (332)
Indian	1.781 (238)
Sri Lankan Moor	1.097 (200)
Other	1.105 (18)
Thailand	
Thai	1.037 (1822)
Thai Chinese	0.319 (44)
Chinese	0.526 (23)
Other	1.159 (87)
LATIN AMERICA	
Peru	
Spanish	0.909 (3797)
Ancash Quechua	1.439 (144)
Ayacucho Quechua	1.741 (255)
Cuzco Quechua	1.722 (298)
Aymara	1.242 (97)

Table IV.2. Index of dissimilarity of child mortality by ethnicity

Region and country	Index of dissimilarity
AFRICA	
Ghana	0.112
Kenya	0.122
Liberia	0.049
Nigeria	0.050
Sierra Leone	0.076
Sudan	0.146
ASIA	
Indonesia	0.006
Nepal	0.030
Sri Lanka	0.089
Thailand	0.021
LATIN AMERICA	
Peru	0.098

Table IV.3 Ratio of observed to expected deaths by mother's ethnicity and maternal education (expected deaths in parentheses)

Mother's ethnicity	Maternal education			
	None	1-3 years	4-6 years	7 years or more
		AFRICA		
		Ghana[a/]		
Akan	0.962 (29353)	0.812 (2456)	0.563 (2942)	0.424 (285)
Ga Adamgbe	0.747 (3834)	0.575 (462)	0.431 (711)	0.350 (114)
Ewe	0.897 (7675)	0.674 (710)	0.480 (634)	0.169 (59)
Guan	1.082 (2195)	0.614 (106)	0.682 (160)	b/
Northern	1.376 (17059)	1.082 (70)	0.699 (54)	b/
Foreign and Togo	1.200 (3617)	0.571 (259)	0.518 (147)	0.319 (19)
		Kenya		
Central Bantu	0.919 (1261)	0.695 (378)	0.599 (397)	0.523 (304)
Western Bantu	1.154 (664)	1.151 (132)	0.884 (207)	0.780 (143)
Coastal Bantu	1.285 (228)	0.935 (10)	0.836 (23)	0.867 (11)
Nilotic	1.702 (520)	1.657 (100)	1.221 (138)	0.767 (98)
Nilo-Hamitic	0.604 (290)	0.774 (35)	0.646 (54)	0.584 (34)
Other	1.002 (30)	b/	0.624 (11)	b/

Table IV.3 (continued)

Mother's ethnicity	Maternal education			
	None	1-3 years	4-6 years	7 years or more
		AFRICA (continued)		
		Liberia		
Mandingo and Vai	1.095 (1563)	b/	0.334 (30)	0.405 (77)
Kpelle	0.947 (5017)	0.296 (34)	0.527 (42)	0.448 (71)
Other W. Mande	1.169 (1993)	b/	0.308 (10)	0.324 (62)
Eastern Mande	0.913 (3873)	0.567 (25)	0.544 (39)	0.388 (42)
West Atlantic	1.337 (2015)	1.065 (10)	0.786 (23)	0.621 (53)
Bass and Kru	0.991 (5126)	0.923 (36)	0.955 (150)	0.555 (346)
Other Kwa	1.100 (3457)	0.612 (34)	0.616 (102)	0.520 (162)
Other African	0.731 (192)	b/	b/	0.479 (29)
No tribal affiliation	0.693 (215)	b/	0.908 (37)	0.425 (264)
		Nigeria		
Yoruba	1.256 (1058)	1.083 (74)	0.738 (195)	0.656 (340)
Northern	1.474 (70)	b/	b/	b/
Eastern	0.930 (16)	b/	b/	0.448 (11)
Edo	0.955 (230)	b/	0.626 (34)	0.404 (32)
Urhobo	0.708 (174)	b/	0.500 (14)	b/
Other	1.008 (86)	b/	b/	1.023 (17)

Table IV.3 (continued)

<table>
<tr><th rowspan="2">Mother's ethnicity</th><th colspan="4">Maternal education</th></tr>
<tr><th>None</th><th>1-3 years</th><th>4-6 years</th><th>7 years or more</th></tr>
<tr><td colspan="5">AFRICA (continued)</td></tr>
<tr><td colspan="5">Sierra Leone[c]</td></tr>
<tr><td>Mende</td><td>1.135
(493)</td><td colspan="2">——— 1.251 (103) ———</td><td>0.701
(31)</td></tr>
<tr><td>Temne</td><td>0.961
(199)</td><td colspan="2">——— 0.891 (26) ———</td><td>0.898
(19)</td></tr>
<tr><td>Limba</td><td>0.806
(15)</td><td colspan="2">——— b/ ———</td><td>b/</td></tr>
<tr><td>Lokko</td><td>0.989
(43)</td><td colspan="2">——— b/ ———</td><td>b/</td></tr>
<tr><td>Mandinko</td><td>1.184
(30)</td><td colspan="2">——— b/ ———</td><td>b/</td></tr>
<tr><td>Fula</td><td>0.693
(79)</td><td colspan="2">——— b/ ———</td><td>b/</td></tr>
<tr><td>Yalunka</td><td>0.681
(159)</td><td colspan="2">——— b/ ———</td><td>b/</td></tr>
<tr><td>Vai</td><td>1.536
(37)</td><td colspan="2">——— b/ ———</td><td>b/</td></tr>
<tr><td>Susu</td><td>1.111
(37)</td><td colspan="2">——— b/ ———</td><td>b/</td></tr>
<tr><td>Other</td><td>1.004
(17)</td><td colspan="2">——— b/ ———</td><td>0.892
(10)</td></tr>
<tr><td colspan="5">Sudan[d]</td></tr>
<tr><td>Arab</td><td>0.754
(309)</td><td colspan="2">0.667 (29) ———</td><td>0.608 (30) ———</td></tr>
<tr><td>Fellata</td><td>1.622
(49)</td><td colspan="2">b/ ———</td><td>b/ ———</td></tr>
<tr><td>Westerner</td><td>1.186
(239)</td><td colspan="2">b/ ———</td><td>b/ ———</td></tr>
</table>

Table IV.3 (continued)

<table>
<tr><th rowspan="2">Mother's ethnicity</th><th colspan="4">Maternal education</th></tr>
<tr><th>None</th><th>1-3 years</th><th>4-6 years</th><th>7 years or more</th></tr>
<tr><td colspan="5">ASIA</td></tr>
<tr><td colspan="5">Indonesia e/</td></tr>
<tr><td>Indonesian</td><td>1.080 (60910)</td><td>0.992 (18557)</td><td>0.729 (12291)</td><td>0.394 (2677)</td></tr>
<tr><td>Chinese</td><td>0.296 (458)</td><td>0.180 (139)</td><td>0.202 (118)</td><td>0.145 (31)</td></tr>
<tr><td>Other</td><td>0.785 (21)</td><td>0.710 (10)</td><td>b/</td><td>b/</td></tr>
<tr><td colspan="5">Nepal f/</td></tr>
<tr><td>Tharu</td><td>1.131 (312)</td><td colspan="2">——— b/ ———</td><td>b/</td></tr>
<tr><td>Newar</td><td>0.867 (240)</td><td colspan="2">——— 0.461 (10) ———</td><td>b/</td></tr>
<tr><td>Brahmn</td><td>0.843 (463)</td><td colspan="2">——— 0.519 (21) ———</td><td>0.317 (13)</td></tr>
<tr><td>Chhetri</td><td>0.987 (948)</td><td colspan="2">——— 1.184 (17) ———</td><td>b/</td></tr>
<tr><td>Magar</td><td>1.065 (689)</td><td colspan="2">——— b/ ———</td><td>b/</td></tr>
<tr><td>Other</td><td>1.048 (2168)</td><td colspan="2">——— 0.571 (38) ———</td><td>0.438 (11)</td></tr>
</table>

Table IV.3 (continued)

Mother's ethnicity	Maternal education			
	None	1-3 years	4-6 years	7 years or more
		ASIA (continued)		
		Sri Lanka[g]		
Sinhala	1.034 (509)	0.903 (865)	0.728 (421)	0.439 (153)
Tamil	1.336 (71)	1.188 (144)	0.854 (86)	0.518 (32)
Indian Tamil	1.771 (147)	1.902 (84)	b/	b/
Moor	1.352 (92)	0.904 (83)	0.908 (22)	b/
Other	b/	b/	b/	b/
		Thailand[h]		
Thai	1.222 (404)	1.013 (1356)	0.305 (46)	0.453 (15)
Thai Chinese	0.550 (15)	0.236 (25)	b/	b/
Chinese	b/	0.390 (13)	b/	b/
Other	1.314 (53)	0.951 (32)	b/	b/

Table IV.3 (continued)

Mother's ethnicity	Maternal education			
	None	1-3 years	4-6 years	7 years or more
		LATIN AMERICA		
		Peru		
Spanish	1.287 (1364)	0.973 (1043)	0.604 (849)	0.309 (541)
Indian	1.702 (630)	1.377 (140)	0.835 (22)	b/

a/ Educational categories for Ghana are classified as follows: None, Primary, Middle and Secondary or Higher.

b/ Fewer than 10 expected deaths.

c/ Educational categories for Sierra Leone are classified as follows: None, Primary and Secondary or Higher.

d/ Educational categories for the Sudan are classified as follows: None, 1-3 years and 4+ years.

e/ Educational categories for Indonesia are classified as follows: None, Not finished primary, Completed primary and More than primary.

f/ Educational categories for Nepal are classified as follows: None, 1-6 years, 7+ years.

g/ Educational categories for Sri Lanka are classified as follows: None, 1-5 years, 6-9 years, 10+ years.

h/ Educational categories for Thailand are classified as follows: None, 1-4 years, 5-10 years, 11+ years.

Table IV.4. Effect of mother's ethnicity on child mortality: regression coefficients and univariate differences

Mother's ethnicity	Univariate differences[a/]	Stage I	Stage II	Stage IIIR	Stage IIIU
		AFRICA			
		Ghana			
Akan	0	0	0	0	0
Guan	0.117	0.135**	0.060	0.048	0.086*
Ga Adamgbe	-0.234	-0.183**	-0.152**	-0.203**	-0.039
Ewe	-0.067	-0.094**	-0.075	-0.080	-0.014
Northern	0.459	0.378**	0.094*	0.103	0.083
Other foreign and Togo	0.218	0.248**	0.058	0.074	0.084
		Kenya			
Central Bantu	0	0	0	0	0
Nilo-Hamitic	-0.157	-0.218**	-0.144*	-0.161*	0.188
Other	0.072	-0.213	-0.201	-0.224	0.111
West Bantu	0.283	0.284**	0.096	0.134	-0.089
Coastal Bantu	0.441	0.285**	0.083	-0.015	0.215*
Nilotic	0.736	0.742**	0.650**	0.634**	0.461**
		Liberia			
Mandingo Vai	0	0	0	0	0
No tribal affiliation	0.470	-0.105	-0.087	-0.207	0.043
Other Liberian/African	-0.372	-0.271**	-0.223**	-0.112	-0.219*
E. Mande	-0.149	-0.074*	-0.069*	-0.165**	0.104
Kpelle	-0.118	-0.080**	-0.058	-0.156**	0.143*
Bassa Kru	-0.088	-0.091**	-0.068*	-0.157**	0.077
Other Kwa	0.006	0.043	0.048	-0.022	0.106*
W. Mande	0.088	0.008	-0.030	-0.053	0.051
W. Atlantic	0.260	0.230**	0.228**	0.187**	0.222**
		Nigeria			
Yoruba	0	0	0	0	0
Eastern	-0.485	-0.357*	-0.218	-0.392	0.009
Urhobo	-0.393	-0.455**	-0.481**	-0.558**	0.218
Edo	-0.169	-0.227**	-0.265**	-0.228*	-0.106
Other Nigerian/African	0.009	0.099	0.113	0.114	0.084
Northern	0.399	0.232	0.157	0.107	0.194

Table IV.4. (continued)

Mother's ethnicity	Univariate differences[a]	Stage I	Stage II	Stage IIIR	Stage IIIU
	AFRICA (continued)				
	Sierra Leone				
Mende	0	0	0	b/	b/
Yalunka	-0.466	-0.503**	-0.551**	b/	b/
Fula	-0.447	-0.478**	-0.538**	b/	b/
Limba	-0.411	-0.293	-0.418	b/	b/
Other	-0.235	-0.211	-0.284	b/	b/
Temne	-0.184	-0.196**	-0.265*	b/	b/
Susu	-0.138	-0.211	-0.204	b/	b/
Lokko	-0.121	-0.098	-0.178	b/	b/
Mandingo	-0.097	-0.135	-0.083	b/	b/
Vai	0.303	0.280	0.375*	b/	b/
	Sudan				
Arab	0	0	0	b/	b/
Westerner	0.491	0.499**	0.167	b/	b/
Fellata	0.936	1.134**	1.182**	b/	b/
	ASIA				
	Indonesia				
Indonesian	0	0	0	0	0
Chinese	-0.745	-0.553**	-0.518**	-0.515*	-0.413**
Other	-0.394	-0.450	-0.350	-0.298	-0.576
	Nepal				
Other	0	0	0	b/	b/
Brahmin	-0.208	-0.213**	-0.158**	b/	b/
Newar	-0.201	-0.154*	-0.081	b/	b/
Chhetri	-0.050	-0.071	-0.045	b/	b/
Magar	0.031	-0.006	0.039	b/	b/
Tharu	0.084	0.034	0.015	b/	b/

Table IV.4. (continued)

Mother's ethnicity	Univariate differences[a]	Stage I	Stage II	Stage IIIR	Stage IIIU
		ASIA (continued)			
		Sri Lanka			
Sinhala	0	0	0	0	0
Sri Lankan Tamil	0.207	0.331**	0.301*	0.491**	0.057
Sri Lankan Moor	0.234	0.662**	-0.407	-1.499*	-0.188
Indian Tamil	0.918	-0.339	0.446*	0.878**	-0.552
		Thailand			
Thai	0	0	0	0	0
Thai Chinese	-0.718	-0.606**	-0.317	-0.749*	-0.073
Chinese	-0.511	-0.500*	-0.156	-0.480	0.066
Other	0.122	0.116	0.240	0.295	0.306
		LATIN AMERICA			
		Peru			
Spanish	0	0	0	0	0
Aymora	0.252	0.119	-0.056	-0.012	-0.388
Cuzco - Quechua	0.813	0.467**	0.306**	0.302**	0.297*
Ayacucho - Quechua	0.832	0.478**	0.309**	0.255**	.422**
Ancash - Quechua	0.530	0.200*	0.030	0.037	

* Significant at the .05 level.
** Significant at the .01 level.

a/ Statistical significance was not calculated for univariate differences.
b/ Sample totally or predominantly rural.

Table IV.5 Ratio of observed to expected deaths by mother's religion (expected deaths in parentheses)

Mother's religion	Ratio
AFRICA	
Ghana	
Catholic	0.866 (9250)
Protestant	0.816 (26151)
Muslim	1.190 (9528)
Traditional	1.239 (18113)
None	1.086 (9900)
Kenya	
Catholic	1.000 (1762)
Protestant	0.934 (2803)
Muslim	1.189 (204)
Other	1.345 (21)
Lesotho	
Catholic	0.984 (895)
Anglican	0.991 (280)
Lesotho Ecumenical Church	0.945 (551)
Other	1.101 (409)

Table IV.5 (continued)

Mother's religion	Ratio
AFRICA (continued)	
Nigeria	
Catholic	0.774 (129)
Protestant	0.901 (1205)
Muslim	1.250 (750)
Traditional	0.858 (240)
Unknown	0.160 (148)
Sierra Leone	
Catholic	0.885 (88)
Protestant	0.769 (66)
Muslim	1.113 (1236)
Other	a/
ASIA	
Indonesia	
Catholic	0.793 (2161)
Protestant	0.684 (4783)
Muslim	1.026 (84260)
Hindu	0.923 (1701)
Buddhist/Confucian	0.630 (2315)

Table IV.5 (continued)

Mother's religion	Ratio
ASIA (continued)	
Republic of Korea	
Catholic	0.870 (69)
Protestant	0.961 (245)
Buddhist	0.950 (685)
None	1.024 (2009)
Nepal	
Buddhist	0.820 (206)
Hindu	1.018 (4594)
Muslim	0.875 (185)
Sri Lanka	
Christian	0.818 (193)
Hindu	1.392 (502)
Muslim	1.083 (209)
Buddhist	0.877 (1830)

Table IV.5 (continued)

Mother's religion	Ratio
ASIA (continued)	
Thailand	
Buddhist	1.016 (1872)
Muslim	1.091 (84)
Christian	1.155 (10)
Confucian	a/
LATIN AMERICA	
Jamaica	
Catholic/Anglican	0.801 (130)
Baptist Church of God	1.115 (287)
Other	1.094 (239)
None	0.947 (50)

a/ Fewer than 10 expected deaths.

Table IV.6 Ratio of observed to expected deaths by mother's religion and maternal education (expected deaths in parentheses)

Mother's religion	Maternal education			
	None	1-3 years	4-6 years	7 years or more
		AFRICA		
		Ghana[a]		
Christian	0.901 (27015)	0.712 (3485)	0.527 (4418)	0.361 (482)
Muslim	1.199 (9281)	0.934 (121)	0.709 (116)	0.891 (10)
Traditional	1.243 (17872)	0.985 (202)	0.691 (38)	b/
		Kenya		
Christian	1.101 (2519)	0.938 (643)	0.783 (812)	0.622 (587)
Muslim	1.220 (168)	1.368 (13)	0.825 (11)	0.925 (10)
		Nigeria		
Christian	1.083 (686)	0.748 (53)	0.739 (196)	0.626 (348)
Muslim	1.289 (615)	1.502 (29)	0.839 (43)	0.844 (43)
Traditional	0.881 (219)	b/	0.280 (11)	b/

Table IV.6 (continued)

Mother's religion	Maternal education			
	None	1-3 years	4-6 years	7 years or more
		ASIA		
		Indonesia[c]		
Christian	0.789 (2944)	0.820 (1553)	0.649 (1844)	0.321 (603)
Muslim	1.099 (55539)	1.017 (16563)	0.753 (10204)	0.429 (1954)
Hindu	1.012 (1385)	0.753 (164)	0.395 (92)	0.127 (60)
Buddhist/ Confucian	0.456 (788)	0.272 (300)	0.247 (252)	0.150 (92)
		Sri Lanka[d]		
Christian	1.772 (20)	0.856 (75)	0.657 (66)	0.470 (32)
Muslim	1.309 (93)	0.961 (87)	0.804 (26)	b/
Hindu	1.593 (204)	1.551 (195)	0.748 (79)	0.552 (25)
Buddhist	1.039 (505)	0.904 (824)	0.758 (371)	0.426 (130)

Table IV.6 (continued)

Mother's religion	Maternal education			
	None	1-3 years	4-6 years	7 years or more
		LATIN AMERICA		
		Jamaica e/		
Catholic/ Anglican	b/	1.165 (17)	0.794 (84)	0.526 (27)
Baptist Church of God	b/	1.183 (49)	1.089 (214)	0.775 (14)
Other	b/	1.087 (35)	1.148 (174)	0.647 (22)

a/ Educational categories for Ghana are classified as follows: None, Primary, Middle and Secondary or Higher.
b/ Fewer than 10 expected deaths.
c/ Educational categories for Indonesia are classified as follows: None, Not finished primary, Completed primary and More than primary.
d/ Educational categories for Sri Lanka are classified as follows: None, 1-5 years, 6-9 years, 10+ years.
e/ Educational categories for Jamaica are classified as follows: None/Pre-primary, Primary/under 4 years, Primary/over 4 years, Secondary/Higher.

Table IV.7. Effect of mother's religion on child mortality. Regression coefficients and univariate differences.

Mother's religion	Univariate differences[a/]	Stage I	Stage II	Stage IIIR	Stage IIIU
		AFRICA			
		Ghana			
Catholic	0	0	0	0	0
Protestant	-0.051	-0.004	-0.027	0.030	-0.122
Muslim	0.324	-0.008	0.030	0.049	-0.074
Traditional	0.373	0.129**	-0.001	0.056	-0.107
None	0.220	0.034*	0.035	0.080	-0.027
		Kenya			
Catholic	0	0	0	0	0
Protestant	-0.066	-0.038	-0.041	-0.041	-0.078
Muslim	0.189	0.052	-0.016	0.071	-0.098
Other	0.345	0.032	0.012	0.012	-0.184
		Lesotho			
Catholic	0	0	0	0	0
Anglican	0.007	0.013	0.002	-0.005	0.237
Lesotho Ecumenical Church	-.039	-0.016	-0.023	-0.019	..
Other	0.116	0.083	0.072	0.068	-0.087
		Nigeria			
Catholic	0	0	0	0	0
Protestant	0.128	0.159	0.112	0.157	0.088
Muslim	0.477	0.251*	0.191	0.270	0.160
Traditional	0.085	0.158	0.072	0.067	-0.123
		Sierra Leone			
Christian	0	0	0	b/	b/
Muslim	0.148	0.217*	0.166	b/	b/
		ASIA			
		Indonesia			
Catholic	0	0	0	0	0
Protestant	-0.109	-0.113	-0.029	-0.062	0.026
Muslim	0.233	0.284**	0.310**	0.308**	0.202**
Hindu and other	-0.039	0.012	0.004	0.081	-0.252**

Table IV.7. (continued)

Mother's religion	Univariate differences[a]	Stage I	Stage II	Stage IIIR	Stage IIIU
		ASIA (continued)			
		Republic of Korea			
None	0	0	0	0	0
Catholic	-0.154	-0.057	-0.015	-0.176	0.137
Protestant	-0.063	-0.011	0.010	-0.025	0.031
Buddhist	-0.074	-0.061	0.022	-0.024	0.082
		Nepal			
Hindu	0	0	0	b/	b/
Muslim	-0.143	-0.206**	-0.226**	b/	b/
Buddhist	-0.198	-0.226**	-0.175**	b/	b/
		Sri Lanka			
Christian	0	0	0	0	0
Muslim	0.265	0.573	0.638*	1.795*	0.243
Hindu	0.574	0.012	-0.017	-0.158	0.056
Buddhist	0.059	0.064	0.119	0.175	-0.009
		Thailand			
Buddhist	0	0	0	0	0
Muslim	0.075	-0.111	0.022	0.014	-0.161
Christian/Confucian Other	0.110	0.342	0.425	0.202	0.537*
		LATIN AMERICA			
		Jamaica			
Catholic/Anglican	0	0	0	0	0
Protestant	0.314	0.217	0.193	0.178	0.195
Other	0.293	0.215	0.202	0.254	0.081
None	0.146	0.032	0.008	-0.048	-0.040

* Significant at the .05 level.
** Significant at the .01 level.

a/ Statistical significance was not calculated for univariate differences.
b/ Sample totally or predominantly rural.

Chapter V

MOTHER'S CHILDHOOD RESIDENCE AND LIFETIME MIGRATION STATUS

In addition to early formal training, other personal attributes shaped before a mother's childbearing years may affect the survival of her children. The physical, socio-economic and cultural environment of her childhood influences her general health and well-being and contributes to the formation of beliefs, skills and practices that are of central importance during her own childbearing years. Exploration of the effects of maternal childhood residence and socio-economic class on infant and child mortality may provide some indication of the importance of these early influences, even though the available variables are often imperfect indicators of these factors.

The childhood residence of the mother has received little attention in the literature on differentials in infant and child mortality. When it is examined, marked differences often surface. In the early twentieth century, differentials were found between urban and rural residents and between native and foreign born in England and Wales and in the United States of America (Condran and Crimmins, 1980; Preston, Haines and Pamuk, 1981; Rochester, 1923; Woodbury, 1925). More recently, in the Sudan, regional birthplace differences were found to be significant (Farah and Preston, 1982).

A mother's place of birth or childhood residence is considered to exert its influence on her children's mortality indirectly, through other biological, cultural or socio-economic factors that are more proximate to the risk of death. The conceivable ways through which the variable acts are no doubt many and varied; and in the end, multivariate procedures are expected to offer an approach to identifying important channels.

If place of birth and current residence are both introduced into an analysis, it is possible to consider several explanations based on the following hypotheses:

(a) Place of birth is associated with mortality only by virtue of its association with current place of residence. If this hypothesis is valid, then one's place of birth would have no effect after controlling for current residence;

(b) Economic, biological, social or cultural characteristics associated with the place of birth or with a mother's early residence retain their influence in later life. Some of these influences may also be captured by other variables in this study (e.g., educational attainment and ethnicity) but others are not (child-rearing practices). For example, childhood residence may be associated with the distribution of educational facilities. Among the most important of those early influences that are not otherwise represented are the particular disease and health care environment of childhood. A higher prevalence of childhood disease may restrict the normal growth and development of a girl and thus eventually increase the risk of death of her children. Because no other variables included in this analysis can represent these influences, they become an explanation of whatever effects of childhood residence remain after all other variables are introduced;

(c) Some characteristics that are associated with moving itself and with the selectivity of the migrant population influence and are associated with mortality. Information on lifetime migration is obtainable when place of birth and place of current residence are combined. Given that some proportion of lifetime migrants are present in the population and that current residence is controlled, a birthplace effect may be attributable either to characteristics associated with the place of birth or to characteristics associated with migration. The latter factors may include, as positive factors, the youth and general good health of migrants, or, as negative features, the loss of a family support network, substandard housing and sanitation, lack of knowledge of local health care facilities or imposition of other barriers, such as language, to the acquisition of social and health services. It is important to note that each of these factors may also depend upon the duration of current residence and the ease of assimilation.

Studies that have examined the influence of the mother's early residence or place of birth on child mortality suggest that several mechanisms may be at work. Two efforts with different cultural and temporal settings have focused on differences between urban-born and rural-born mothers. Not unexpectedly, it was found (Preston, Haines and Pamuk, 1981) that in the early twentieth century, rural-born women in England and Wales experienced lower child mortality than urban-born, notably excluding London-born women. As for London, although place of birth and residence could not be simultaneously examined, the results show that those born to native Londoners had lower mortality than children born to the other current London residents, suggesting some advantage connected with birthplace. Early application of health and sanitary innovations in London may have accounted for the relatively low infant and child mortality associated with being born there.

Analysis of recent data for persons living at Greater Khartoum (Farah and Preston, 1982) shows a pronounced advantage in child mortality for those born there, who experience mortality levels 26 per cent lower than mothers born in a village. Mothers bred in other urban areas who have moved to Khartoum also experience substantially lower levels than the rural-born. The effects diminish but do not disappear after accounting for other determinants, such as parent's education, type of union, employment, income and the woman's status. An urban birthplace retains a 7-14 per cent advantage over a village birthplace. The authors suggest this effect may work through a greater awareness of and access to social and health services by those more familiar with urban ways or through the enduring effects of a more favourable health environment, which may permanently influence a mother' physique and health status. An additional factor may be the marginal status of rural migrants at Khartoum. Thus, one might expect stronger effects of birthplace on child mortality when analysis is limited to an urban area.

Results from a few studies that consider migration status per se suggest that in a country-wide setting, lifetime non-migrants have lower mortality than migrants. This particular result appears in an analysis of the 1900 census of the United States of America, where interstate migrants and immigrants are compared with non-migrants (Preston, Haines and Pamuk, 1981), and in two other historical studies of the United States, where the child mortality of native and foreign-born women are compared (Condran and Crimmins, 1980; Haines, 1977).

In a more contemporary context, Carvajal and Burgess (1978) found in three Latin American capitals that mothers who were not born in the metropolitan area experience fewer infant deaths, an outcome the authors attribute to the younger and probably healthier status of migrants. However, large differentials in fertility by migration status, and the failure of the study to control for differing number of births among women suggest that fewer children ever-born among migrants may account for their fewer child deaths. Behrman (1979) breaks a Nicaragua sample down into urban and rural components. He finds that non-migrant status in urban areas increases the probability of child mortality, which supports the Carvajal and Burgess findings, but in rural areas, non-migrant status is associated with lower mortality. The definition of a migrant in this study, however, is unclear, and the effects are not statistically significant.

A general survey of the literature on the relationship between migrants and health identifies both positive and negative factors (Barrett and Jozan, 1982). On the plus side, migrants are often young, able and highly motivated, compared with the source or the receiving population. In some situations, they may be more affluent and better able to exert political power than those they left behind. On the minus side of the ledger, migrants are frequently the most deprived segment of the receiving population; they often live in poverty with little knowledge of available health care services and face cultural and linguistic impediments. In some settings, migrants may improve their situation in one way and yet see it deteriorate in other ways. Barrett and Jozan report that in Bolivia, migrants from the highlands to the lowlands showed improvement in their nutritional status but experienced an increase in child mortality.

Two additional studies pertaining to the urban United States in the 1920s, also combine elements of place of birth and international migration (Rochester, 1923; Woodbury, 1925). Both find that the native-born do not consistently show lower child mortality than the foreign-born and that there is extreme variation in child mortality levels within the foreign-born group. This evidence, then, cautions against proposing any simple migrant or non-migrant advantage. Rochester, confining her study to the city of Baltimore, attributes much of the mortality advantage of certain foreign-born groups to their greater proportions of breast-fed babies. Other factors, such as poorer sanitary facilities and congestion in the home, employment of the mother away from home, access to infant welfare activities and length of birth intervals, also play a role.

In summary, analysis of the relationship between the mother's place of birth or early residence, lifetime migration status and her subsequent experience with infant and child mortality is sparse and heavily concentrated in historical studies of developed societies. Several ways in which childhood residence has an effect are suggested in the studies of Khartoum and the

United States urban areas of the 1920s. Studies on lifetime migration have found that non-migrant status tends to be an advantage, but when the focus is the urban area, results are conflicting. Of three Latin American studies, two (Behrman, 1979; Carvajal and Burgess, 1978) found that children of lifetime urban migrants had a higher likelihood of survival, the other (Barrett and Jozan; 1982) identified a lower likelihood. Findings from two historical examinations of native- and foreign-born mothers lead to the conclusion that grouping all immigrants together may obscure the complex relationships that exist between heritage and child mortality.

Measurement

Three factors are examined in this chapter: rural/urban area of childhood residence of the mother; her lifetime migration status; and duration of current residence. Countries that are included in the analysis of mortality differentials according to childhood residence are divided into two groups. In most of the countries for which World Fertility Survey data are used, i.e., Kenya, Lesotho, Nepal, Peru, Sri Lanka and Thailand, the respondent was asked about the area (countryside/town/city or rural/urban) where she lived most of the time up to age 12. The question could be ambiguous to those who moved frequently in their childhood years. A further problem is that the dependence of the answers always depend upon the woman's idea about what is rural or urban and her memory of childhood. In Ghana, Jamaica and the Republic of Korea, the respondent was asked about the area of her birth. Data from these two groups of countries, therefore, are not completely comparable, because the place of birth and the major place of childhood residence could be different for those who moved shortly after birth.

The mother's lifetime migration status was constructed for Ghana and Indonesia in order to compare her place of birth and that of current residence. Although data on rural/urban area of birthplace are available for some other countries, names of localities of the birthplace were available only for these two countries. Ghana is divided into eight regions (Accra, Ashanti, Brong Ahafo, Central, Eastern, Northern, Upper, Volta and Western). A respondent is identified as: (a) a "non-migrant" if she was born and is living in the same town or village; (b) an "intraregional migrant" if her place of birth and that of current residence are different towns or villages in the same region; or (c) an "interregional migrant" if the two localities do not belong to the same region. Indonesia is divided into seven regions (Irian Jaya, Jaya, Kalimantan, Maluku, Nusatenggara, Sumatra and Sulawesi). Definitions of migrant categories in Indonesia are quite similar to those in Ghana except that provinces, instead of towns and villages, are used as the lower level units. Therefore, those who migrated to different towns or villages within the same province are identified as intraregional migrants in Ghana but as non-migrants in Indonesia, which poses some limitations to the comparability of results from these two countries. A validity problem associated with this constructed variable is that the so-called "return migrants", who return to and settle in the place they once left, are mistakenly labelled as "non-migrants".

The third variable in this chapter is the duration of current residence, on which data are available for Ghana and Liberia, where the length of stay in the locality of current residence was asked. Memory errors are possible, as is usually true for all retrospective questions.

Univariate results: childhood residence

Data from the countries analysed in this study are shown in table V.1. For most of the nine countries where data on rural/urban distinction of the mother's childhood residence are obtained, women born or raised in a rural area have higher mortality among their children than do women of urban origin. In three countries, the effect of the mother's childhood residence in smaller, compared with larger cities can be examined. In Nepal and Peru, child mortality is substantially lower in larger cities (Peru) or in the capital city (Nepal) than in intermediate towns and rural areas. In contrast, in Kenya, mothers reared at Nairobi and Mombasa show the highest child mortality and those who grew up in smaller cities the lowest. The mortality levels and general characteristics of these two major cities are, however, quite different, and the unexpected pattern seen in Kenya may be attributable in part to the combination of those two cities into one group, as well as to the relatively small sample size of women growing up at Nairobi or Mombasa and the potential inaccuracy in reporting childhood residence.

Bivariate results: childhood residence

Given the differentials shown in table V.1, the first question is whether childhood residence or place of birth serves merely as a proxy for place of current residence. Results from this study indicate that place of birth or childhood residence affects child mortality, quite apart from its association with place of current residence. In most countries where relevant data are available, the hypothesis was limited to a test of whether women born or bred in urban areas maintain an advantage in child mortality over those born or bred in rural areas. The results are decisive. A rural childhood is disadvantageous for survival of one's children in five of the six countries covered in table V.2, regardless of whether current residence is urban or rural. These countries are Lesotho, Nepal, Peru, the Republic of Korea and Thailand; the exception is Sri Lanka, where the normal relation prevails only among those currently living in rural areas. Results for Nepal and Thailand show that the mother's birthplace is slightly more influential among current urban residents than among rural residents. In Lesotho and the Republic of Korea, two of the countries in which it is possible to distinguish residents of capital cities from other urban-dwellers, the childhood residence effect is smaller for women living outside the capital. Child mortality levels in Peru are significantly lower for all mothers reared in urban areas no matter where they reside, but the difference is most striking for those living in small cities, where the ratio fell from about 1.2 for those with a rural background to .6 for women reared in the cities.

Given the variety of interaction between the two variables, it is difficult to make any generalizations other than noting that rural origin almost always remains disadvantageous even after controlling for place of current residence. Is is clear that place of birth is more than a proxy for current residence. It exerts an influence of its own, presumably attributable to characteristics associated with either the place of birth or migration. If migration effects are important, they are clearly not symmetrical; urban-rural migrants maintain an advantage over lifelong rural residents, whereas rural-urban migrants do more poorly than lifelong urbanites. Only in Sri Lanka is there a hint of a migration effect. Women who grew up and were currently living in the same type of locale in Sri Lanka were found to have higher child mortality than those who had moved, but this is the only country where migration appears influential. In most others, rural non-migrants fare the worst and urban non-migrants the best, with migrant women somewhere in between. This relationship appears to suggest simply that the more time a woman spends in an urban area, the more beneficial it is to her maternal experience.

Multivariate results: childhood residence

Results from multivariate analysis limited to several background variables (Stage I) confirm that rural childhood residence of the mother increases the risk of infant and child mortality (table V.3). For all countries except Kenya, child mortality is higher for mothers with rural backgrounds than for those from urban areas, although only in Ghana, Nepal and Thailand are the differences statistically significant. In Jamaica, Lesotho, Peru, the Republic of Korea and Sri Lanka, the attenuation of birthplace effects in table V.3 suggests that the zero-order effect worked primarily through maternal or paternal education, religion or ethnicity. Changes in the size of coefficients from Stage I to Stage II are generally small and unsystematic across countries. This pattern suggests that the bulk of the indirect effects of the mother's childhood residence that can be identified in this study are associated with other variables established in childhood, in particular, with education, ethnicity and religion.

Stages IIIR and IIIU, at which regressions are computed separately for current residents in rural and urban areas, respectively, permit one to examine whether a rural birth confers a greater disadvantage among residents of urban or rural areas. Results, however, give a mixed picture and lack statistical significance, so that generalizations cannot be drawn. Table V.3 shows that the disadvantage of rural birth is greater among current urban residents than among current rural residents in three of eight countries (Ghana, Kenya and Jamaica) where comparison is possible, but the pattern is reversed in the remaining five (Lesotho, Peru, the Republic of Korea, Sri Lanka and Thailand). Moreover, of the 20 birthplace coefficients, only two are significant at Stages IIIR and IIIU.

Results: lifetime migration status

Data from Ghana and Indonesia on lifetime migration status are given in table V.4. In both countries, interregional migrants have lower child mortality ratios than do non-migrants; in Indonesia, intraregional migrants also have an advantage over non-migrants. These results are consistent with those given above because migrants disproportionately consist of current urban residents whereas non-migrants are disporportionately rural.

It is perhaps more informative to focus on one aspect of migration, the influence of assimilation to the place of destination, as measured by duration of current residence (table V.4). In Liberia, longer duration appears to result in slightly lower levels of child mortality among mothers who have ever migrated, although those who have never migrated exhibit highest child mortality. As noted elsewhere, lower child mortality for long-term residents is to be expected of women who are often healthier, more familiar with services the country has to offer and have stronger social and communication networks. In Ghana, however, a comparison of tables V.4 and V.5 shows that the ameliorative effect of long-term residence is evident only after the effect of a variety of other factors have been controlled. Table V.5 shows that non-migrants settled for 10 or more years have significantly lower child mortality than migrants who have been in residence for less than six months. When a full complement of factors is considered at Stage II, the mortality level of the long-term residents is 15 per cent lower than that of the new-comers. Limiting the analysis to either urban or rural areas maintains the coefficients at roughly the same level, but they are no longer statistically significant.

Summary and conclusion

It has been shown that childhood residence of the mother accounts for important variations in child mortality. Regression results suggest that in most countries the disadvantage associated with a rural origin works mainly through other variables established in childhood, such as education, religion and ethnicity. In a few countries, the effect works through more extensive networks, but no common route is evident. In Nepal, an excess mortality of around 20 per cent remains for the children of women born in rural areas even after all other background variables enter the equation.

Results on migration status fail to show consistent significant patterns. As for the impact that duration of residence has on mortality, Ghana exhibited a clear reversal of relationships: when other variables are controlled, apparent higher child mortality of longer time residents in the univariate analysis disappears and the mortality-reducing effect of longer duration of residence is found.

Table V.1 Ratio of observed to expected deaths, by mother's childhood residence or birthplace (expected deaths in parentheses)

Mother's childhood residence	AFRICA			ASIA				LATIN AMERICA	
	Ghana a/	Kenya	Lesotho	Nepal	Republic of Korea a/	Sri Lanka b/	Thailand	Jamaica a/	Peru
Rural	1.068 (53367)	0.979 (4815)	1.003 (2054)	1.020 (4763)	1.023 (2469)	0.932 (2102)	1.060 (1816)	1.063 (618)	1.252 (2314)
Urban	0.808 (16561)	0.923 (258)	0.893 (77)	0.637 (200)	0.879 (510)	0.848 (378)	0.535 (153)	0.832 (76)	0.807 (2276)
(Largest city)	..	1.015 c/ (78)	..	0.412 (47)	..	..	..	..	0.489 (783) d/
(Other urban)	..	0.883 (180)	..	0.706 (153)	..	..	..	..	0.974 (1493)
Other	1.152 e/ (3012)	..	..	..	..	1.624 f/ (254)	..	g/	..

a/ Mother's place of birth.
b/ Respondent's assessment of whether childhood residence was urban, rural or estate.
c/ Includes Nairobi and Mombasa.
d/ Includes Lima and other large cities.
e/ Foreign born.
f/ Born on estates.
g/ Less than 10 expected deaths.

Table V.2 Ratio of observed to expected deaths by mother's childhood residence and current residence (expected deaths in parentheses)

Mother's childhood residence	Current residence: Rural	Urban: Total	Urban: Largest city	Urban: Other urban	Other
		AFRICA			
		Lesotho			
Rural	0.998 (1923)	1.094 (125)	1.160 (51)	1.049 (74)	..
Urban	0.913 (54)	0.844 (24)	0.521 (10)	1.075 (14)	..
		ASIA			
		Nepal			
Rural	1.021 (4667)	0.700 (46)	..	..	..
Urban	0.775 (131)	0.398 (62)	..	..	..
		Republic of Korea			
Rural	1.050 (1886)	0.942 (610)	0.985 (231)	0.915 (379)	..
Urban	0.927 (156)	0.857 (353)	0.803 (154)	0.899 (199)	..
		Sri Lanka[a], [b]			
Estate	1.077 (43)	c/	c/	c/	1.750 (286)
Rural	0.930 (1893)	0.847 (188)	0.605 (36)	0.903 (152)	1.905 (22)
Urban	0.692 (109)	0.901 (264)	0.850 (114)	0.941 (150)	c/

Table V.2 (continued)

Mother's childhood residence	Current residence				
	Rural	Urban			Other
		Total	Largest city	Other urban	
		ASIA			
		Thailand			
Rural	1.083 (1683)	0.781 (133)	..	..	..
Urban	0.771 (47)	0.432 (107)	..	..	..
		LATIN AMERICA			
		Peru[d/]			
Rural	1.390 (1563)	0.728 (364)	0.571 (207)	0.934 (157)	1.191 (388)
Town (Other urban)	1.131 (327)	0.672 (503)	0.632 (333)	0.751 (170)	1.125 (662)
Largest cities[e/]	1.065 (35)	0.427 (604)	0.360 (402)	0.559 (202)	0.609 (144)

a/ Respondent's assessment of whether childhood residence was urban, rural or estate.

b/ "Other" refers to mothers residing in estates.

c/ Fewer than 10 expected deaths.

d/ "Other" refers to mothers residing in small towns; not included in urban category.

e/ Includes Lima and other large cities.

Table V.3. The effect of mother's childhood residence or birthplace[a/] on child mortality: Regression coefficients and univariate differences

Mother's childhood residence	Univariate differences[b/]	Stage I	Stage II	Stage IIIR	Stage IIIU
		AFRICA			
		Ghana			
Urban	0	0	0	0	0
Rural	0.260	0.114**	0.013	-0.037	0.085
Foreign born	0.344	-0.016	-0.029	-0.003	-0.230*
		Kenya			
Urban	0	0	0	0	0
Rural	-0.036	-0.034	-0.040	-0.132	0.032
		Lesotho			
Urban	0	0	0	0	0
Rural	0.110	0.066	0.031	0.076	0.023
		ASIA			
		Nepal			
Urban	0	0	0	c/	c/
Rural	0.383	0.221**	0.229**	c/	c/
		Republic of Korea			
Urban	0	0	0	0	0
Rural	0.144	0.040	.055	0.178	0.009
		Sri Lanka			
Urban	0	0	0	0	0
Rural	0.084	0.017	-0.016	.053	-0.100
Estate	0.776	0.220	0.030	0.087	0.124
		Thailand			
Urban	0	0	0	0	0
Rural	0.525	0.232*	0.121	0.095	0.076
		LATIN AMERICA			
		Jamaica			
Urban	0	0	0	0	0
Rural	0.231	0.040	-0.017	-0.163	0.042
		Peru			
Urban	0	0	0	0	0
Rural	0.445	0.014	-0.038	0.020	-0.072*

* Significant at the .05 level.
** Significant at the .01 level.

a/ Mother's place of birth.
b/ Statistical significance was not calculated for univariate differences.
c/ Sample predominantly rural.

Table V.4 Ratio of observed to expected deaths, child mortality by mother's lifetime migration status and duration of current residence (expected deaths in parenthesis)

Mother's lifetime migration status	Ghana	Indonesia
Non-migrant	0.998 (30244)	0.997 (88553)
Intraregional migrant	1.121 (24423)	0.920 (3606)
Interregional migrant	0.841 (15262)	0.922 (3061)
Foreign born	1.152 (3012)	..

Duration of current residence	Ghana	Liberia
Since birth (non-migrant)	1.005 (26464)	1.014[a/] (22397)
10 years or more	1.078 (22522)	0.847 (979)
5-9 years	0.966 (9279)	0.833 (609)
1-4 years	0.950 (8984)	0.942 (678)
Less than 1 year	0.965 (5691)	0.944 (490)

a/ Includes migrants residing in current locality for 25 years or more.

Table V.5 The effect of mother's duration of current residence on child mortality: regression coefficients and univariate differences: Ghana[a/]

Lenght of current residence	Univariate differences[b/]	Stage II	Stage IIIR	Stage IIIU
Less than 6 months	0	0	0	0
6-11 months	-0.024	-0.027	-0.032	0.024
1-4 years	0.006	-0.095	-0.067	-0.050
5-9 years	-0.010	-0.063	-0.058	-0.049
10 years or more	-0.122	-0.155*	-0.144	-0.165
Since birth (non-migrant)	-0.049	-0.150*	-0.131	-0.201

* Significant at the .05 level.

a/ Additional regression equations were estimated for Ghana in order to produce coefficients for this and other non-standard variables. These additional equations included all the usual variables appropriate to each stage in addition to the non-standard variables.

b/ Statistical significance was not calculated for univariate analysis.

Chapter VI

FATHER'S OCCUPATION

There are many reasons to expect a family's socio-economic position to influence consumption standards among children and thereby affect child health and survival. Socio-economic position affects, for example, the quantity and quality of nutritional input; the adequacy of household technology for cleaning, preparing, storing, and disposing of food and food wastes; the quality of shelter and the use of medical care. Consumption standards, however, are extremely difficult to measure in most developing countries and only a small minority of the data sets used here have even attempted their measurement; results from those few are discussed in chapter VIII. In place of these measures, one must use indicators or proxy variables that one suspects may be highly associated with a household's socio-economic status and wealth. The most promising such variable is the father's occupation, which literally denotes the type of economic activity in which he is engaged. Obviously, the same occupational groups can be associated with different socio-economic status according to the individual's position in relation to other workers; and, similarly, an occupation can denote different socio-economic status in different countries. In most countries, however, the occupational group conveys some information about one's socio-economic status.

It is possible that the father's occupation also has other types of effects on child mortality. For example, an occupation that requires long hours or long physical separation may impair the quality of care available for the child. Rural location of certain occupations may interfere with availability of health services. Occupations that require location in areas of high toxicity may affect child health. It appears likely, however, that in the vast majority of circumstances the socio-economic status effects will outweigh those arising from these sources.

Almost all of the studies that use occupation as an indicator of socio-economic status employ five or fewer occupational categories (Meegama, 1980, is one exception). These studies typically find the father's occupation to have a significant effect on child mortality but to become insignificant when other socio-economic variables are introduced.

Examples of studies showing significant effects of paternal occupation in the absence of controls on other socio-economic variables are Gupta and Rao (1976) in rural Allahabad, India; Hogan and Jivani (1973) in the United Republic of Tanzania; Behm (1980) in Costa Rica; and Taucher (1978) in Chile. Taucher further reports that large educational gradients exist within occupational groupings. Similarly, after controlling for the mother's education in Cuba (Comité Estatal de Estadísticas, Cuba, and Centro Latinoamericano de Demografía, 1982), significant occupational differentials remained in infant mortality. Farah and Preston (1982) eliminate the significant influence of father's occupation in the Sudan by introducing controls on parents' education and income, and Trussell and Preston (1982) find insignificant effects of the father's occupation in a multivariate analysis of the Republic of Korea and Sri Lanka. Frenzen and Hogan (1982) find that paternal occupation remains significant in a multivariate analysis of a rural Thai sample; however, this is the only study that does not include the father's education. Furthermore, the authors caution against extensive generalization because their sample was quite small, consisting of 1,173 rural married women.

Measurement

Table VI.1 summarizes several features of the information on the husband's economic characteristics. As in other chapters taking as independent variables some of the father's characteristics, the information on the mother's husband will be taken as corresponding to the father. For most data sets, the information on the husband's occupation was obtained through a question addressed to his wife. As the wife may or may not be entirely familiar with her husband's work, it can be assumed that the information for those countries is less reliable than for others in which the report was made directly by the person concerned. As for the latter countries, information on husband and wife had to be matched, and as the matching was not always possible (as in the case of divorced and separated women or because for some women it was impossible to identify their husband), the information on fathers only represents a fraction of the information on mothers. The proportion of available information on paternal occupation in relation to information on mother's characteristics for each country is also presented in table VI.1. For most countries, information on fathers represents more than 90 per cent of the cases. For Chile, Ghana, Indonesia, the Sudan and Thailand, however, the data on fathers represent smaller proportions of the total samples, ranging from 20 to 80 per cent.

Diverse approaches were used to obtain the information on economic characteristics. In 8 cases out of 14, the question on occupation was made, as usual, after the question on economic activity status, and only to the economically active persons. In most of these countries, the reference period was either a recent week or the current job or occupation. In the other six countries, however, the first question on economic characteristics was about occupation - skipping the activity status question - implicitly assuming that all husbands (or men) were economically active. This modality of questioning was associated with an undetermined reference period in five out of these six cases (Kenya, Lesotho, Nepal, Peru and Thailand). In the sixth case, Sierra Leone, a question was asked on occupation in each of the six months previous to the survey and the information on the most immediate month was tabulated. A limitation common to all data sets is that the information on the father's occupation cannot be related to any particular time of the child's life, because the person could have held the same occupation since the child's conception to his/her death or current age, or could have changed it one or several times. Furthermore, the person might not be related to the child at all, as when marriage occurred after the child's death.

Various schemes were used to classify occupations. Seven countries used that developed by the World Fertility Survey; three countries used the International Standard Classification of Occupations (ISCO-1968), as revised in 1968 by the International Labour Office. Nigeria, Sierra Leone and the Sudan used their own classification systems, as transcribed in annex III. The Republic of Korea pre-coded occupations in five broad groups (professional, clerical/sales, unskilled labourers, skilled labourers and agricultural workers), omitting service workers. The different classification schemes were rearranged to constitute five comparable groups as presented in table VI.2, the only exception being the Republic of Korea. Unknown occupation, unemployed and not economically active were left out of the analysis. Although the data were originally cross-classified by occupation and employment status (employee/own-account worker/unpaid family worker), this scheme has not proved to be particularly useful in drawing an international picture of child mortality correlates. Attention is therefore confined to averages for the five occupational groups.

Univariate analysis

The results of the univariate analyses are consistent with the empirical generalizations in the literature that child mortality varies with socio-economic status, for which the father's occupation is a common proxy. This relation pertains in all 14 countries with available data, as can be seen in table VI.3. Professional/white-collar occupations are associated with the lowest levels of child mortality in 10 out of 14 countries, the exception being Jamaica, Nepal, the Sudan (whose sample does not contain white-collar workers) and Thailand. In Nepal and the Sudan, the occupational group associated with lowest child mortality is service workers, and in Jamaica and Thailand, sales workers.

Children of agricultural workers have higher than national average mortality in 11 out of 14 countries, and they are also the occupational group with either the highest or the second highest mortality in all countries but Sierra Leone, where the children of production workers and those of service workers are the first and second highest mortality groups, respectively. Children of production workers also present higher than national average mortality in most countries and the highest or second highest mortality in 10 countries.

The patterns are clearest for the three occupational groups presenting the highest and lowest mortality, with greater diversity found among the sales and service worker categories. This fact probably reflects the large variety of socio-economic status associated with sales and service workers among the countries analysed here. Much work remains to be done to specify the relationship further with a clearer understanding of the specificities of each country's socio-economic structure.

Bivariate analysis

Table VI.4 presents a complete set of cross-tabulations of child mortality by father's occupation and urban-rural residence. Occupational distributions clearly vary between urban and rural areas so that it is sometimes hard to compare the same occupation in both areas. Nevertheless, a distinct pattern emerges for professional/white-collar workers: these workers experience lower mortality when residing in urban areas than in rural areas, and, when they can be distinguished, in the largest city than in smaller urban areas. Again, the advantage of professional/white-collar workers in the largest cities could be due to differential composition of this occupational group between urban localities of different sizes: small town white-collar workers may be comprised by a high proportion of clerical workers; their metropolitan counterparts may include a high proportion of administrative workers. However, as the advantage of professional/white-collar occupations is found almost without exception in both urban and rural areas, the distribution of this occupational group by residence does not "explain" the lower mortality experienced by children of professional/white-collar fathers. Urban sales, production and service workers do not consistently exhibit lower mortality than their rural counterparts. And only in Ghana, Nigeria and Peru does every non-agricultural occupational group exhibit lower urban mortality. The pattern is very mixed in all other countries. Since children of agricultural workers present higher mortality than the rural average in 6 out of 10 countries, and as is frequently the case that urban children of agricultural workers present also higher than average urban mortality (see chapter IX), the higher mortality of agricultural workers cannot be explained simply by their location in rural areas; in about half of the countries the reverse is the case: the concentration of agricultural workers in rural areas is what explains higher than average rural mortality.

A cross-tabulation of the father's occupation by paternal education, shown in table VI.5, is equally informative. It shows that in the majority of countries occupational differentials in mortality are relatively small within educational categories except in Chile, Peru and Thailand, where a gradient from professional/white-collar to agricultural occupations remains prominent within most educational categories. In general, however, there is relatively little variation associated with occupation, in comparison with the continued large differentials by education within occupational categories. Increasing amounts of paternal education continue to improve mortality even among children of agricultural workers, except in Nepal, Nigeria and Thailand. Since professional/white-collar workers are usually highly concentrated among the highest educated persons, this could easily "explain" the relatively low mortality experienced by this occupational group. There are a few surprising exceptions to the concentration of this occupational group among the most educated, such as in Jamaica, where they are almost equally distributed among those with 1-6 and 7+ years of educational attainment, and in Nepal, where professional/white-collar workers are surprisingly highly concentrated among those with no education. These results cast doubt on the quality of the information on occupation and/or education for these two countries. They also could "explain" why Jamaica and Nepal were exceptions to the general finding that professional/white-collar workers are the most advantageous group in terms of child mortality.

Multivariate analysis

Table VI.6 presents the coefficients of the father's occupational categories when all other variables have been added to the prediction equation. The professional/white-collar worker category was chosen as the reference category.[1/] Results show that, after controlling for all other variables, the systematic advantage observed for children of professional/white-collar workers at the univariate analysis disappears. The children of professional/white-collar workers are better off than the children with fathers in other occupations in four out of five African countries and in two of the three Latin American countries, but in none of the four Asian countries. Children of service workers have the lowest mortality in Nepal and Sri Lanka, while the privileged group is agricultural workers in Indonesia, Lesotho and the Republic of Korea, and sales workers in Thailand. As for the most disadvantaged group, there also is no clear pattern. Agriculture and sales workers appear to be worst off in an equal number of cases. Children of service workers are never the most disadvantaged group. There are some factors that could be accounting for the absence of patterns. As mentioned before, the data on the father's occupation is subject to many weaknesses. First, the reporting of paternal occupation is probably faulty, as it was done, in most cases, by their spouses. Secondly, for a number of countries (Chile, Ghana, Indonesia, the Sudan and Thailand), the information on the father's occupation represents only a subsample of the total. Thirdly, the information for the Republic of Korea is particularly questionable, because pre-coded alternatives representing only five broad occupational categories and unemployment - not including services - were offered to wives to report on their husband's occupation. Finally, very unusual educational composition of the professional/white-collar group found for Jamaica and Nepal suggest that the broad occupational categories represent different occupations in different countries, which undermine the international comparability of the results.

Summary

The major reason to expect the father's occupation to be associated with child mortality is that it serves as an indicator of household economic circumstances, in particular, the consumption opportunities available to children. Paternal occupation must serve in this role for a majority of these countries because they lack direct information on income or wealth.

The results suggest that when no other variables are controlled, professional/white-collar workers almost always enjoy favourable child mortality and that agricultural and production occupations are relatively disadvantaged.

In bivariate analysis, the professional/white-collar advantage appears to be somewhat greater in urban areas, where these activities are more concentrated, than in rural areas; however, when many additional variables are controlled, this difference disappears. A cross-tabulation of father's occupation by father's education suggests the dominant role of the latter factor. However, agricultural and production workers, have mortality levels that are higher than the professional/white-collar levels within most education categories in most countries. Agricultural workers are also one of the two occupational categories that generally have the highest mortality in multivariate analysis, along with sales workers. The advantage observed for professional/white-collar workers in the univariate analysis, lost in the multivariate, suggest that is not the occupation _per se_ which makes this group the most advantaged in child mortality.

Note

1/ Regression coefficients for this chapter have been calculated as weighed averages from a classification of occupational categories combined with status. As weights for urban and rural areas were not available, coefficients for urban and rural areas ara not presented.

Table VI.1 Some features of the information on husband's economic characteristics of the data sets

Region/country	Source[a/]	Information obtained through: Question to wife	Information obtained through: Matching husband/wife information	Percentage of women matched to husbands[b/]	First question: Economic activity status	First question: Occupation	Reference period	Classification of occupations
Africa								
Ghana	Census		X	20	X		One recent week	ISCO
Kenya	WFS	X		94		X	Undetermined	WFS
Lesotho	WFS	X		88		X	Undetermined	WFS
Liberia[d/]	Census			0				
Nigeria	Survey	X		98	X		Currently working	c/
Sierra Leone	Survey		X	95		X	One recent month	c/
Sudan	Survey		X	62	X		12 recent months	c/
Asia								
Indonesia	Census		X	82	X		One recent week	ISCO
Nepal	WFS	X		100		X	Undetermined	WFS
Republic of Korea	Survey	X		92	X		Currently working	c/, e/
Sri Lanka	WFS	X		100	X		Currently working	WFS
Thailand	WFS	X		80		X	Undetermined	WFS
Latin America								
Chile	Census		X	65	X		One recent week	ISCO
Jamaica	WFS	X		100	X		Currently working[f/]	WFS
Peru	WFS	X		100		X	Undetermined	WFS

a/ Census = either census sample or census post-enumeration survey; WFS = World Fertility Survey; Survey = survey other than World Fertility Survey. See table I.1 for more details.

b/ Calculated from table I.1.

c/ See annex III for details.

d/ Data set contained no information on husbands.

e/ Occupation was pre-coded in the survey questionnaire as follows: 1) farmer, fisherman; 2) labourer (unskilled); 3) labourer (skilled); 4) clerical, sales; 5) professional; 6) long time unemployed.

f/ Current work for current partner, undetermined period for last partner.

Table VI.2 Constitution of occupational groups in terms of several classification schemes

Description	ISCO groups	WFS groups	Nigeria	Sierra Leone (major groups)	Sudan
Professional, technical, administrative executive, managerial, clerical and related workers	0/1, 2, 4-0, 5-0 3 except 3-6, 3-70.30 3-70.40 and 3-70.90	1, 2	01 to 05	1, 2, 3	41, 42, 43, 47, 48, 49 55, 57, 58, 59 73 to 76, 87 to 93
Sales workers	4 except 4-0	3	30, 31	4	01 to 19 96
Agricultural, animal husbandry and forestry workers, fishermen and hunters	6-0, 6-1, 6-2, 6-4	4, 5	10 to 22	5	20 to 30
Service workers	3-6, 3-70.30, 3-70.40, 3-70.90 5 except 5-0	6, 7	70 to 72	9	54, 67 to 72 77 to 86 98
Production and related workers, transport equipment operators and labourers	6-3, 7, 8, 9	8, 9	40 to 62	6, 7, 8	31 to 40 44, 45, 46, 50, 51, 52, 53 61 to 66, 94, 97

Source: International Statistical Institute, World Fertility Survey Central Staff, Editing and Coding Manual, Basic documentation No. 7, London, May 1976, and Annex 3.

Table VI.3 Ratio of observed to expected deaths, by father's occupation (expected deaths in parentheses)

Father's occupational categories	AFRICA						ASIA					LATIN AMERICA		
	Ghana	Kenya	Lesotho	Nigeria	Sierra Leone	Sudan	Indonesia	Nepal	Republic of Korea	Sri Lanka	Thailand	Chile	Jamaica	Peru
Professional/White collar	0.621 (2948)	0.655 (637)	0.743 (66)	0.726 (536)	0.834 (157)	a/	0.789 (11721)	.786 (188)	0.670 (101)	0.556 (225)	0.608 (132)	0.629 (455)	0.669 (45)	0.402 (491)
Sales	0.775 (874)	0.887 (388)	1.360 (36)	0.933 (252)	1.015 (133)	1.062 (22)	1.033 (6850)	0.842 (173)	0.881 (613)	0.863 (243)	0.495 (113)	1.127 (196)	0.634 (51)	0.829 (406)
Service	0.664 (1179)	0.954 (605)	0.984 (85)	0.905 (111)	1.186 (86)	0.500 (26)	1.003 (2402)	0.760 (148)	b/	0.769 (190)	1.011 (83)	0.861 (134)	0.782 (51)	0.730 (209)
Agricultural	1.126 (30446)	1.058 (1946)	1.189 (66)	1.195 (1048)	0.923 (768)	1.066 (274)	1.000 (43467)	1.010 (3884)	0.956 (1266)	1.141 (1288)	1.124 (1378)	1.213 (685)	1.383 214)	1.304 (2197)
Production	0.802 (5081)	1.053 (1164)	1.007 (1706)	1.053 (421)	1.202 (173)	.619 (92)	1.028 (3965)	1.254 (430)	1.088 (491)	0.939 (775)	0.880 (281)	1.057 (1413)	0.992 (319)	0.922 (1242)

a/ Fewer than 10 expected deaths.
b/ Service workers category was not included in the pre-coded question on occupation.

Table VI.4 Ratio of observed to expected deaths by father's occupation and urban-rural residence (expected death in parentheses)

Father's occupational categories	Residence		
	Largest city	Other urban	Rural
	AFRICA		
	Ghana		
Professional/white collar	0.445 (1164)	0.611 (671)	0.798 (1181)
Sales	0.539 (347)	0.896 (195)	0.952 (330)
Service	0.589 (565)	0.721 (275)	0.743 (340)
Agricultural	0.733 (195)	1.184 (2376)	1.123 (27874)
Production	0.619 (1655)	0.781 (1138)	0.945 (2290)
	Kenya		
Professional/white collar	0.396 (91)	0.579 (78)	0.716 (472)
Sales	0.985 (32)	0.711 (39)	0.898 (317)
Service	1.004 (76)	1.216 (44)	0.923 (495)
Agricultural	0.973 (24)	0.720 (13)	1.053 (1908)
Production	0.867 (165)	0.891 (93)	1.103 (906)

Table VI.4 (continued)

Father's occupational categories	Residence		
	Largest city	Other urban	Rural
	AFRICA (continued)		
	Lesotho		
Professional/white collar	—— 1.231 (10) ——		0.633 (54)
Sales	—— a/ ——		1.331 (31)
Service	—— a/ ——		0.982 (77)
Agricultural	—— a/ ——		0.804 (64)
Production	—— 0.978 (113) ——		1.009 (1588)
	Nigeria		
Professional/white collar	—— 0.629 (331) ——		0.872 (211)
Sales	—— 0.799 (125) ——		1.065 (127)
Service	—— 0.859 (73) ——		1.064 (39)
Agricultural	—— 1.241 (207) ——		1.182 (843)
Production	—— 1.000 (237) ——		1.113 (187)

Table VI.4 (continued)

Father's occupational categories	Residence		
	Largest city	Other urban	Rural
	ASIA		
	Indonesia		
Professional/white collar	0.575 (854)	0.568 (3035)	0.898 (7831)
Sales	0.925 (588)	0.802 (1800)	1.141 (4461)
Service	1.087 (281)	1.039 (661)	0.970 (1460)
Agricultural	1.094 (124)	1.000 (1136)	0.999 (42208)
Production	1.095 (449)	0.924 (1373)	1.081 (2143)
	Republic of Korea		
Professional/white collar	0.493 (39)	0.640 (39)	1.070 (23)
Sales	0.778 (144)	0.792 (197)	0.999 (272)
Agricultural	a/	0.995 (63)	0.950 (1165)
Production	1.148 (99)	0.882 (152)	1.193 (240)

Table VI.4 (continued)

Father's occupational categories	Residence			
	Largest city	Other urban	Rural	
	ASIA (continued)			
	Sri Lanka[b/]			
Professional/white collar	0.411 (29)	0.540 (52)	0.577 (135)	a/
Sales	1.058 (25)	0.935 (56)	0.806 (158)	a/
Service	0.649 (13)	0.740 (34)	0.742 (128)	1.209 (14)
Agricultural	a/	0.985 (42)	1.006 (1044)	1.892 (196)
Production	0.878 (82)	1.065 (117)	0.922 (561)	0.835 (12)
	LATIN AMERICA			
	Chile			
Professional/white collar	0.597 (222)	0.653 (205)	0.708 (27)	
Sales	1.125 (93)	1.059 (92)	1.726 (11)	
Service	0.910 (57)	0.859 (66)	0.683 (12)	
Agricultural	1.025 (45)	1.190 (134)	1.235 (507)	
Production	0.965 (600)	1.094 (707)	1.294 (137)	

Table VI.4 (continued)

<table>
<tr><th rowspan="2">Father's occupational categories</th><th colspan="3">Residence</th></tr>
<tr><th>Largest city</th><th>Other urban</th><th>Rural</th></tr>
<tr><td colspan="4">LATIN AMERICA (continued)</td></tr>
<tr><td colspan="4">Jamaica</td></tr>
<tr><td>Professional/white collar</td><td colspan="2">——— 0.615 (28) ———</td><td>0.758 (17)</td></tr>
<tr><td>Sales</td><td colspan="2">——— 0.573 (35) ———</td><td>0.772 (16)</td></tr>
<tr><td>Service</td><td colspan="2">——— 0.841 (30) ———</td><td>0.699 (22)</td></tr>
<tr><td>Agricultural</td><td colspan="2">——— 1.971 (11) ———</td><td>1.351 (203)</td></tr>
<tr><td>Production</td><td colspan="2">——— 0.999 (161) ———</td><td>0.985 (157)</td></tr>
<tr><td colspan="4">Peru</td></tr>
<tr><td>Professional/white collar</td><td>0.228 (217)</td><td>0.510 (241)</td><td>0.744 (34)</td></tr>
<tr><td>Sales</td><td>0.502 (141)</td><td>0.914 (194)</td><td>1.241 (72)</td></tr>
<tr><td>Service</td><td>0.541 (86)</td><td>0.758 (107)</td><td>1.534 (17)</td></tr>
<tr><td>Agricultural</td><td>0.671 (34)</td><td>1.269 (554)</td><td>1.329 (1609)</td></tr>
<tr><td>Production</td><td>0.619 (442)</td><td>0.955 (619)</td><td>1.550 (182)</td></tr>
</table>

a/ Fewer than 10 expected deaths.

b/ Data for rural residence in Sri Lanka is divided into two categories: "Rural non-estate" and "Rural estate".

Table VI.5 Ratio of observed to expected deaths, by father's occupation and paternal education (expected deaths in parentheses)

Father's occupational categories	Paternal education			
	None	1-6 years	7-11 years	12+ years
		AFRICA		
		Ghana[a]/		
Professional/ white collar	1.107 (321)	0.779 (60)	0.619 (1329)	0.490 (1236)
Sales	0.934 (425)	0.833 (49)	0.647 (331)	0.402 (72)
Service	0.824 (505)	0.724 (83)	0.531 (527)	0.421 (64)
Agriculture	1.166 (26354)	0.966 (1817)	0.781 (2181)	0.755 (95)
Production	0.897 (2630)	0.727 (659)	0.710 (1631)	0.492 (161)
		Kenya		
Professional/ white collar	0.746 (37)	1.071 (84)	0.703 (123)	0.420 (179)
Sales	1.001 (83)	0.833 (136)	0.888 (132)	0.821 (38)
Service	1.065 (187)	1.038 (213)	0.721 (176)	1.002 (39)
Agriculture	1.154 (946)	1.002 (666)	0.917 (278)	0.797 (56)
Production	1.207 (350)	1.073 (432)	0.876 (316)	0.951 (66)

Table VI.5 (continued)

<table>
<tr><th rowspan="2">Father's occupational categories</th><th colspan="4">Paternal education</th></tr>
<tr><th>None</th><th>1-6 years</th><th>7-11 years</th><th>12+ years</th></tr>
<tr><td colspan="5">AFRICA (continued)</td></tr>
<tr><td colspan="5">Lesotho[b]</td></tr>
<tr><td>Professional/ white collar</td><td>..</td><td>0.789 (17)</td><td colspan="2">0.727 (50)</td></tr>
<tr><td>Sales</td><td>c/</td><td>1.626 (18)</td><td colspan="2">0.968 (11)</td></tr>
<tr><td>Service</td><td>1.156 (24)</td><td>0.950 (32)</td><td colspan="2">0.882 (30)</td></tr>
<tr><td>Agriculture</td><td>1.056 (30)</td><td>0.805 (21)</td><td colspan="2">0.524 (15)</td></tr>
<tr><td>Production</td><td>1.036 (739)</td><td>1.018 (788)</td><td colspan="2">0.839 (188)</td></tr>
<tr><td colspan="5">Nigeria</td></tr>
<tr><td>Professional/ white collar</td><td>1.045 (91)</td><td>0.884 (41)</td><td>0.837 (144)</td><td>0.537 (237)</td></tr>
<tr><td>Sales</td><td>1.064 (111)</td><td>0.972 (51)</td><td>0.836 (65)</td><td>0.414 (17)</td></tr>
<tr><td>Service</td><td>1.247 (43)</td><td>0.729 (23)</td><td>0.816 (30)</td><td>c/</td></tr>
<tr><td>Agriculture</td><td>1.194 (800)</td><td>1.152 (122)</td><td>1.162 (74)</td><td>0.974 (16)</td></tr>
<tr><td>Production</td><td>1.177 (219)</td><td>1.111 (94)</td><td>0.723 (77)</td><td>0.690 (20)</td></tr>
</table>

Table VI.5 (continued)

Father's occupational categories	Paternal education			
	None	1-6 years	7-11 years	12+ years
		ASIA		
		Indonesia[b/]		
Professional/ white collar	1.143 (1844)	0.859 (6328)	—— 0.480 (3548) ——	
Sales	1.188 (2065)	1.013 (4340)	—— 0.516 (444) ——	
Service	1.121 (849)	0.950 (1473)	—— 0.713 (81) ——	
Agriculture	1.019 (21296)	0.987 (21678)	—— 0.752 (493) ——	
Production	1.147 (1120)	1.021 (2622)	—— 0.512 (223) ——	
		Nepal[b/]		
Professional/ white collar	1.001 (90)	0.8375 (14)	—— 0.536 (83) ——	
Sales	0.987 (90)	0.624 (19)	—— 0.706 (64) ——	
Service	0.986 (46)	0.450 (13)	—— 0.691 (89) ——	
Agriculture	1.023 (3183)	0.900 (264)	—— 0.978 (437) ——	
Production	1.272 (371)	0.704 (18)	—— 1.357 (34) ——	

Table VI.5 (continued)

Father's occupational categories	Paternal education			
	None	1-6 years	7-11 years	12+ years
		ASIA (continued)		
		Republic of Korea[d]		
Professional/ white collar	c/	c/	0.719 (39)	0.664 (57)
Sales	1.157 (45)	1.059 (142)	0.850 (335)	0.582 (91)
Agriculture	0.981 (564)	0.977 (591)	0.829 (161)	0.554 (11)
Production	1.246 (106)	1.086 (201)	1.020 (180)	c/
		Sri Lanka[e]		
Professional/ white collar	c/	1.005 (15)	0.551 (144)	0.424 (64)
Sales	1.782 (11)	0.863 (99)	0.801 (129)	..
Service	0.870 (12)	1.053 (63)	0.597 (112)	c/
Agriculture	1.534 (180)	1.137 (722)	0.964 (374)	c/
Production	1.233 (67)	1.074 (359)	0.739 (336)	c/

Table VI.5 (continued)

Father's occupational categories	Paternal education			
	None	1-6 years	7-11 years	12+ years
		ASIA (continued)		
		Thailand[f]		
Professional/ white collar	c/	0.916 (33)	——— 0.490 (91) ———	
Sales	0.871 (24)	0.519 (52)	——— 0.204 (19) ———	
Service	1.282 (11)	1.073 (40)	——— 0.934 (19) ———	
Agriculture	1.207 (231)	1.091 (1070)	——— 1.292 (49) ———	
Production	1.000 (53)	0.888 (181)	——— 0.796 (41) ———	
		LATIN AMERICA		
		Chile		
Professional/ white collar	c/	0.900 (47)	0.730 (148)	0.466 (195)
Sales	c/	1.326 (86)	1.126 (62)	0.296 (20)
Service	c/	0.985 (64)	0.770 (48)	c/
Agriculture	1.434 (128)	1.199 (464)	0.948 (32)	c/
Production	1.291 (68)	1.131 (851)	0.481 (331)	0.776 (39)

Table VI.5 (continued)

Father's occupational categories	None	1-6 years	7-11 years	12+ years
	LATIN AMERICA (continued)			
	Jamaica[b/]			
Professional/ white collar	..	1.006 (22)	0.369 (22)	
Sales	c/	0.706 (33)	0.310 (13)	
Service	..	0.797 (43)	c/	
Agriculture	1.635 (20)	1.349 (177)	c/	
Production	c/	0.966 (267)	1.047 (17)	
	Peru			
Professional/ white collar	..	0.669 (101)	0.376 (196)	0.289 (194)
Sales	1.380 (32)	0.920 (257)	0.490 (93)	0.415 (23)
Service	0.847 (12)	0.862 (115)	0.533 (78)	c/
Agriculture	1.511 (585)	1.247 (1539)	0.878 (65)	c/
Production	1.743 (110)	0.927 (880)	0.549 (240)	0.445 (12)

Table VI.5 (continued)

a/ Educational categories for Ghana are classified as follows: None; 1-3 years; 4-9 years; and 10 years or more.

b/ Educational categories for Indonesia, Jamaica, Lesotho and Nepal are classified as follows: None; 1-6 years; and 7 years or more.

c/ Fewer than 10 expected deaths.

d/ Educational categories for the Republic of Korea are classified as follows: None; 1-6 years; 7-12 years; and 13 years or more.

e/ Educational categories for Sri Lanka are classified as follows: None; 1-5 years; 6-11 years; and 12 years or more.

f/ Educational categories for Thailand are classified as follows: None; 1-4 years; and 5 years or more.

Table VI.6 The effect of father's occupation on child mortality: regression coefficients[a] and univariate differences.

Occupational categories	Univariate differences	Stage II
	AFRICA[b]	
	Ghana	
Professional/white collar	0	0
Sales	0.154	0.060
Service	0.043	0.020
Agriculture	0.505	0.061
Production	0.181	0.048
	Kenya	
Professional/white collar	0	0
Sales	0.232	0.086
Service	0.299	0.071
Agriculture	0.403	0.110
Production	0.398	0.141
	Lesotho	
Professional/white collar	0	0
Sales	0.617	0.439
Service	0.241	0.159
Agriculture	0.446	-0.037
Production	0.264	0.118
	Nigeria	
Professional/white collar	0	0
Sales	0.207	0.151
Service	0.179	0.117
Agriculture	0.469	-0.162
Production	0.327	0.118
	Sierra Leone	
Professional/white collar	0	0
Sales	0.181	0.159
Service	0.352	0.257
Agriculture	0.089	0.152
Production	0.368	0.312

Table VI.6 (continued)

Occupational categories	Univariate differences	Stage II
	ASIA	
	Indonesia	
Professional/white collar	0	0
Sales	0.244	0.111
Service	0.214	-0.019
Agriculture	0.211	-0.069
Production	0.239	0.059
	Nepal	
Professional/white collar	0	0
Sales	0.056	0.018
Service	-0.026	-0.076
Agriculture	0.224	0.099
Production	0.468	0.292
	Republic of Korea	
Professional/white collar	0	0
Sales	0.211	-0.050
Service	c/	c/
Agriculture	0.286	-0.260
Production	0.418	0.002
	Sri Lanka	
Professional/white collar	0	0
Sales	0.307	0.111
Service	0.213	-0.071
Agriculture	0.585	0.079
Production	0.383	0.040
	Thailand	
Professional/white collar	0	0
Sales	-0.113	-0.024
Service	0.403	0.040
Agriculture	0.516	0.217
Production	0.272	0.153

Table VI.6. (continued)

Occupational categories	Univariate differences	Stage II
	LATIN AMERICA	
	Chile	
Professional/white collar	0	0
Sales	0.498	0.282
Service	0.232	0.038
Agriculture	0.584	0.018
Production	0.428	0.092
	Jamaica	
Professional/white collar	0	0
Sales	-0.035	-0.138
Service	0.113	-0.062
Agriculture	0.714	0.490
Production	0.323	0.155
	Peru	
Professional/white collar	0	0
Sales	0.427	0.083
Service	0.328	0.090
Agriculture	0.902	0.244
Production	0.520	0.146

a/ Regression coefficients are weighed averages of original coefficients for a more detailed classification of occupational categories combined with employment status. Significance has not been calculated. As weights for urban and rural areas were not available, stages IIIR and IIIU are not presented here.

b/ Sudan has been excluded from this analysis because the reference category presented fewer than 10 expected deaths.

c/ The category of service workers was not included among the pre-coded categories in the survey questionnaire.

Chapter VII

ECONOMIC ACTIVITY OF THE MOTHER

The relation between the employment of a mother and the health and well-being of her children is not straightforward. In part, this is because the attitudes towards women's work, the nature of that work and the condition under which the work is conducted vary greatly both among and within societies.

In perhaps the most common conceptualization, a mother's activity status has been regarded as a proxy for maternal time alloted to child-rearing (DaVanzo and Lee, 1978). Those women who participate in the labour market are believed to spend the least amount of time in maternal activities. Those who do not participate at all are assumed to spend the largest amount of maternal time, and women who are engaged in market activities at home are thought to occupy an intermediate position. Reductions in maternal time devoted to child-rearing may be directly related to infant or child mortality through the loss of specific elements in a desirable child care regimen or indirectly related through a deterioration in maternal health (because of long work hours or deficient conditions of the work place).

An early study of infant mortality in eight cities in the United States of America shows infant mortality rates among offspring of mothers who worked away from home during pregnancy to be about twice the rate for those who were not employed during confinement, yet only one sixth higher among the offspring of mothers who worked within the home (Woodbury, 1925). Interestingly, the mortality rate from causes specific to early infancy was lower among children whose mothers worked at home than among those whose mothers did not work at all. Woodbury believes that the group of mothers not in the labour force was biased by the inclusion of women whose ill-health not only kept them out of the labour force but impaired their ability to care for their infants. In this study, mother's employement during pregnancy is highly correlated with the mother's employment during the child's first year of life. Employment away from home during the first year also appeared to place an infant at greater risk. Woodbury suggests that the limited amount of time that could be devoted to breast-feeding, in addition to the more general lack of care that working mothers could give their children, may have been a factor in the higher infant mortality of children of those mothers. In their study of German villages in the nineteenth century, Knodel and Kintner (1977) also mention the possible effect of female labour force participation on breast-feeding habits, especially in urban populations, where presumably children are less likely to accompany mothers to work.

Large negative effects of labour force participation by mothers were also found in an analysis of early twentieth century census data from the United Kingdom of Great Britain and Northern Ireland and the United States of America (Preston and others, 1981). However, for the United States, inclusion of race reduces the mortality differential considerably, leading the authors to conclude that labour force participation among married women is primarily a function of economic circumstances which, in turn, is highly associated with race. Farah and Preston (1981), in their recent study of the Sudan, found that children of working women had higher mortality rates than children of housewives. In cultures that emphasize the importance of the mother's role as full-time caretaker, labour force participation may be symptomatic of economic stress in the household.

In other cultures where a substantial number of middle-class and upper-class women work outside the home, labour force participation might be more strongly associated with relatively higher child mortality among the poorly educated (presumably in low socio-economic classes) than among the well educated (probably in middle and upper classes). For the well-educated women, the benefits that employment may produce through increased income may counteract the disadvantages of the mother being outside the home. On the other hand, as well-educated women usually work in the better paid occupations, they can afford a replacement to take care of their children while they are engaged in economic activities. That is, there might be an interaction between education, activity status and child mortality.

Not only does maternal activity status affect child mortality but the nature of the woman's job is thought to be crucial. DaVanzo and Lee (1978) have developed a model of time allocation for studying the compatibility of child care with labour force participation and non-market activities; however, this approach has not yet been extended to measure the effect on infant and child mortality. In their study based on a Malaysian time-budget survey, they found that, contrary to expectation, agricultural activities appeared less compatible with child care than were sales or production occupations. Perrenoud (1981), in a study of historical Europe, found that peasants had higher child mortality than the landless, possibly because ownership of land entailed more work for the wife.

Some studies have found that the greater the number of younger children in a household (which is in part a function of child mortality), the less likely is the mother to participate in the labour force. The association between age of children and mother's participation in the labour force is found in societies as different as United States (Sweet, 1970) and Malaysia (DaVanzo and Lee, 1978). In Malaysia, it may well be that child mortality affects labour force participation rather than vice versa, as the death of a child may allow a woman to enter the labour market. In attempting to explain why child mortality differentials by activity status are greater when the probability of dying before age 2 rather than age 5 is used as an index of mortality, Preston and his colleagues (1981) suggest that the newly married woman who loses a child and has no other children to care for at home, is free to return to work, while the death of a child to a woman married longer may not directly affect her decision to return to work because of other child care needs within the family.

In summary, the mother's activity status is believed to be indicative of time spent in child-rearing and domestic activities. Thus, maternal participation in the labour market is expected to raise child mortality. However, certain conditions may prevent this result: (a) women are engaged in highly paid jobs that permit them to pay to replace themselves in child care activities; (b) participation in the labour market is done in a context of flexibility that permits the mother herself to take care of the child (for example when the market activities are performed in the home); (c) the mother shares the responsibility of child care activities with other adult members of the extended family; (d) institutional child care services of high quality are available. Therefore, in order to assess the effect of the mother's labour force participation on child mortality, one must take into account other variables, such as conditions of labour market activities (occupation, place of work, flexibility of working hours, pay etc.), household composition and institutional facilities for child care.

The degree to which child mortality differentials are explained by activity and employment status is an issue only recently addressed in the demographic literature. The one cross-cultural study that analysed the effects of work status found that it was rarely significant in multivariate models (Hobcraft and others, 1982).

Measurement

The quality of the information on women's economic characteristics is usually very poor, especially that originating in censuses (Wainerman and Recchini de Lattes, 1981) or surveys not specially designed to gather information on employment. As the principal objectives in creating of the different data sets utilized in this analysis did not concern research on women's participation in the labour force, there is no reason to think that they escape this generalization. Even a rather superficial analysis of the questionnaires raises serious doubts whether the quality of the information is sufficient to measure female economic participation and whether the data are comparable among countries. More specifically, in relation to child mortality, there is no information on whether the mother worked at the time of pregnancy or during each child's earliest years. As indicators of the quality and comparability of the information, table VII.1 presents a summary of several aspects of the census or survey questions intended to obtain information on the mother's labour force participation: the reference period; and key words in the phrasing of the questions.

In several cases, the question or questions on labour force participation addressed to women were different from the questions about the husband's economic characteristics, perhaps acknowledging the specific characteristics of women's labour force participation or just reflecting certain pre-conceptions about women's work. For example, in Nepal, Peru, the Republic of Korea and Sierra Leone, a question referring to work "aside from housework" (or a similar phrase) was introduced. Kenya and Lesotho restricted the definition of female economic participation to work done for wage or salary, and the Republic of Korea to a regular job, thus intentionally omitting both the unpaid family workers and the own-account (self-employed) workers or those with seasonal jobs. Ghana did something similar for both sexes: the census question was about work for pay or profit. As a large proportion of women's economic participation is seasonal or occasional, highly mobile, on a person's own account or as members of a family enterprise (unpaid family workers), these data sets probably account for only a very small proportion of the total contribution of women to economic activity. In other words, many women who are participating in the labour force would not be classified as such.

Several countries used a fixed reference period in inquiring about the participation of women in economic activities. However, the length of the period varied among the different countries from one (recent) week to five years; or was more vaguely stated, referring to activity since marriage or first birth, or was completely undetermined. In most countries where the source of information is a census, the reference period was a week, but one census gathered information referring to the past year. Most World Fertility Survey questionnaires asked about activity since first marriage or birth, but two countries phrased the question in such a way that it is impossible to distinguish between those currently working or those who have "ever" worked. Lastly, data from surveys other than World Fertility Survey have used other reference periods. Taking only the reference period into account, it can be expected that coverage of women's economic participation varies widely from country to country. Again, as female participation is more frequently made in a seasonal or sporadic way, the characteristics of the information on women's work in most data sets severely limit the reliability of the results.

Most data sets include information on status of employment: employee, employer/own-account, unpaid family worker. The only exception is Sierra Leone. In Kenya, the definition of economic activity refers only to work for pay and excludes women working as employer or own-account workers; but surprisingly, the data set lists a small proportion of unpaid family workers. Similarly, tabulations from Lesotho and the Sudan also include unpaid family workers, even if the questions were phrased to include only work for pay. This inconsistency between the question and the information obtained raises serious doubts about the quality of the data on employment status for these countries.

Both the information on the mother's activity status (in the labour force or not in the labour force) and of mother's employment status for those in the labour force are used for the one- and two-way tabulations and for the regression analysis.

Information on work-place, available only for a small number of countries, is divided according to whether the mother was working at or away from home, for agricultural and non-agricultural labourers separately. Analysis of work-place is limited to univariate tabulation because the requisite information is not available for all countries.

The mother's occupation was used in the one-way analysis. Occupational categories are the same as those for husbands: (1) professional/white-collar (including professional, technical, administrative and clerical); (2) sales; (3) service; (4) agriculture; and (5) production and manual labour. It was decided not to further subdivide each occupation by employment status because of sample size considerations. At first glance, these occupational labels seem clear, but conditions of employment and types of jobs included in each category vary from country to country. This variability could be especially strong for the service category.

More specifically related to childcare, the data set has the following limitations:

(a) There is no information on whether the mother worked at the time of pregnancy or during each child's earliest years. If the mother returned to work after the death of a child or after the children entered school, because there were no longer small children in the home requiring her attention, this reverse causality cannot be detected. Two-stage estimation procedures that might be used to address problems of mutual causation were rejected because they require implausible and/or arbitrary identification restrictions;

(b) Information is not available on hours worked, whether part or full time, on the mother's flexibility in scheduling work time or the mother's option to have young children present with her while working;

(c) Alternative providers of child care cannot be identified. If care is provided by other family members or other arrangements, risks of infant and child mortality are expected to be different than if institutional care is used.

In spite of these data problems, the analysis conducted here uncovered a few patterns of the relationships between the mother's activity and employment status and child mortality, and a systematic regional variation in the relationships. Although the limitations described above prevent further investigation of those patterns, the findings still seem to merit attention and will be discussed below.

Univariate results

Table VII.2 provides the ratio of actual to expected deaths by activity status of the mother in all the countries and the employment status in all but Sierra Leone.1/

In eleven countries, the children of mothers not participating in the labour market have below-average mortality levels. Of the four exceptions, Kenya and Chile can be considered as special cases. For Kenya, the definition of labour force is very narrow - including only those paid in cash - and not comparable to that of the other countries. As for Chile, the unpaid family workers (with higher than average mortality in most countries) were included among those not in the labour force. There is also an apparent and unusually high underreporting of own-account workers,2/ a high mortality group that is included among those not in the labour force. That both unpaid family workers and own-account workers, were combined with those not in the labour force could be responsible for the lower mortality of those categorized as economically active in these two countries. Whether the lower mortality among those not in the labour force in the other eleven countries reflects the child health advantages of women's greater availability in the home, the greater ease with which women with a higher number of child deaths can enter the labour force, or the influence of some other variable that is associated both with mortality and labour force participation cannot be inferred from the univariate results. The third of these posibilities is addressed below in the discussion of bivariate and multivariate results.

Among those who have been reported to be in the labour force, there is some evidence of a regional pattern by employment status. In Africa, four out of six countries with available data show that the children of those working as employees have considerably lower mortality than any other group, whether in the labour force or not. This is also the case in two out of the three countries in Latin America. This lower mortality for children of "employees" - a very small fraction of the total number of women in the labour force in most countries where the pattern is observed[3/] - may reflect their higher social status and their greater contribution to the economic well-being of the family. In the remaining African and Latin American cases, children of employees have higher mortality than children of women not in the labour force but lower mortality than children of other economically active mothers. As for the children of unpaid family workers, their mortality is always higher than the national average in Latin America; and, except for Nigeria, also in Africa. Similar results were found for children of own-account workers, except for Ghana and Peru. The notion that a mother who is self-employed or an employer is at an advantage in child-rearing in relation to employees does not appear to be supported in the African and Latin American countries studied here.

The Asian countries present the opposite pattern. In all countries but Nepal, the children of employee mothers record the highest ratio. It is possible that the meaning of being an employee is different in Asia. In Asia, children of women in the labour force, whatever their employment status, show higher than national average mortality, with only a few exceptions. Perhaps in Asian societies, women are encouraged to stay at home during the child-rearing years and hence participation in the labour force may serve as an effective marker of severe economic pressure within the household. This explanation is advanced by Farah and Preston (1982) for the Sudan, a country that, in the present study, also displays a pattern similar to the Asian countries.

The question whether a child is more likely to survive if his mother works in the home is addressed directly for five countries in table VII.3. The children of an economically active mother are better off if she works at home, whether she works in the agricultural or the non-agricultural sector. The only exception are Peru in both sectors, and in Lesotho, outside of agriculture. However, as it is not known if the mother was working at the time that her children died, it is difficult to interpret the results.

Among the mother's occupational groups, professional and white-collar workers are found to have the lowest child mortality - usually well below the national average (table VII.4). Presumably, these professional and white-collar women are highly educated, and they may also have the economic and social resources to compensate for any deleterious effects of reduced child-rearing time. On the other hand, there is no clear pattern indicating which occupations are worse for child mortality. The children of agricultural workers have above average mortality in 11 of 14 countries and are the most vulnerable group in four of seven African countries and two of three Latin American countries. In Asia, in three countries out of four the highest mortality is observed for the children of service workers. Children of production workers also present higher than average mortality in most countries.

Bivariate results

The literature on the mother's labour force participation and infant and child mortality suggests that both positive and negative effects could result from a woman's participation in the labour force. The negative effects are thought to be mainly the consequence of reduction in child-nurturing. On the other hand, there are benefits of increased household income when the mother works for pay outside the home and the possibly enhanced effectiveness and greater contacts and knowledge of a working mother. Nevertheless, results from the univariate tables suggest that children whose mothers participate in labour market activities generally have slightly higher mortality than those whose mothers are not in the labour force. Among those in the labour force, however, the children of professional and white collar workers usually have lower than average mortality and even lower mortality than the children of mothers not in the labour force. The patterns may change when other important variables associated with activity status and infant and child mortality are considered.

It has been noted that the perceived effect of activity status on infant and child mortality may be largely the indirect consequence of systematic variations in mother's education across the status categories. Table VII.5 presents child mortality ratios cross-tabulated by activity status and maternal education. In almost all countries, controlling for education does not consistently alter the relation between activity status and mortality. In all the countries where those who are not in the labour force have lower child mortality than those in the labour force at the univariate level, this pattern is maintained in a majority of educational groups. For example, in Indonesia, the children of women who are not in the labour force retain a small advantage over those in the labour force for all educational groups. An exception is Ghana, which is one of the few cases where mortality of children of women in the labour force is lower than those of mothers not in the labour force. When education is incorporated, it can be seen that this result is mainly due to the majority group: those whose mother have no education. For those whose mothers have some education (between 1 and 6 years), the relation shows the usual reversed pattern of lower mortality for children of mothers not in the labour force, although for those with 7 years or more of schooling the ratio shifts back.

In sum, mother's labour force participation is as important a correlate for the educated, who presumably can provide both better substitute help and health care, as it is for the uneducated. However, as it is not known whether the mothers were working at the time the children died, the underlying mechanisms cannot be easily assigned.

Female economic opportunities and participation vary so greatly between rural and urban areas that it is important to cross-classify residence with activity status; results for 13 countries are given in table VII.6. Differences in the ratios between the mothers in the labour force and those not in the labour force, are by and large retained within residential categories. Among those in the labour force the regional patterns also persist within residential categories. For the African and Latin American cases, the advantage of being children of employees is generally maintained within urban and rural categories. The exceptions are the very few residents of urban areas other than the capital in Lesotho and the rural residents of Nigeria and Peru. As for Asian countries, where the children of unpaid family workers are the most advantaged group at the national level, the pattern is maintained for urban and rural areas in most cases. The notable exceptions are those of urban Nepal, where children of employees are by far the group with lower mortality (similar to the findings for Africa and Latin America) and the residents of the largest cities in the Republic of Korea, where the children of employers and own account workers experience lower mortality.

Separated, divorced or widowed mothers are probably more likely to suffer economic stress than those who are married. The cross-tabulations needed to study this possibility are presented in table VII.7. For some African countries, a distinction is also made between monogamous and polygamous unions. By and large, the rankings of ratios by activity status persist when marital status is controlled. The differential between children of women in polygamous unions disappears in Kenya and changes sign in Lesotho. As mortality is usually higher than average for children of women in polygamous unions, the reversal of the differential probably reflects the socio-economic stress of this group, which could be partially released by economic participation. There is a reversal of the differential for married women in the Republic of Korea; and, in contrast, in Peru and the Sudan the children of women who are separated, divorced or widowed are disadvantaged if their mothers are not in the labour force.

In those countries where employees have lower child mortality than women outside the labour force, their relative advantage is generally retained within marital status categories. In Asian countries, where the child mortality ratio is higher for employees than for women outside the labour force, this tendency remains for each of the marital-status categories.

In summary, diversity of patterns appears, but in no case does the work-status mortality differential appear to be primarily a reflection of differences in marital distributions among the activity and employment status classes.

It has been suggested that economic stress may be an important factor in explaining the higher infant and child mortality for economically active women. Many of those who enter the market may do so because of low family income; therefore, it is suggested that the lower survival rates of the children of these women may in fact be due to basic economic need and not to child neglect. If so, when the husband's occupation is controlled, the disadvantage suffered by women in the labour force may be reduced. In some countries, there might be an interaction. If the husband is in a well-paid occupation, maternal employment could be less detrimental because the mother might be able to afford adequate substitute care. On the other hand, the working mother's contribution to family income might be most valuable when the husband is in a low-status occupation.

Table VII.8 shows the results of cross-tabulating the mother's activity and occupational status by the father's occupation. As noted earlier, occupational categories are broad and include a variety of types of employment encompassing a broad wage scale. Thus, within a particular category there may be those who are relatively affluent and those who are relatively poor. Moreover, in a number of countries in this study, there are so few cases in a particular occupational category that the analysis is severely constrained.

In countries where the overall mortality ratio is higher for children of active women than for women not in the labour force, the direction of the relation is the same for most paternal occupations. However, among the wives of professional/white-collar workers in Nigeria, the Republic of Korea and Sri Lanka, and among the wives of sales workers in Nepal and the Republic of Korea, the ratio for women in the labour force is lower than that for non-workers.

In countries where the overall ratio for the children of active women is lower, the pattern is different in each case. In Ghana the overall relationship is explained by the differential observed for the wives of agricultural workers. As children whose fathers are agricultural workers have above-average mortality ratio, those whose mother work are better off than those whose mothers do not participate in economic activities. Women whose husbands are in non-agricultural occupations present lower mortality ratios if they are not economically active. On the other hand, in Kenya, the overall differential showing lower mortality ratios for the children of mothers participating in economic activities reflects a pattern common to all husbands occupational groups, with the exception of agricultural workers. For the children whose fathers are agricultural workers, the mortality ratio is lower for those whose mothers are not in the labour force. In Chile, the pattern is more mixed, the overall differential reflecting mainly the ratio for wives of professional/white-collar workers and agricultural workers.

Multivariate analysis

Table VII.9 gives the regression coefficients for 14 countries, with employee as the reference category. The results indicate that the regional pattern observed at the univariate level is practically eliminated when other variables are controlled. In particular, the higher mortality experience of those who are not in the labour force, noted at the univariate level for most

African countries, is no longer present when other variables are controlled. (Compare, in table VII.9, the univariate differences with the Stage II coefficients.) The results for Stage II show that in African countries, the mortality of those not in the labour force is not significantly different from that of employees, except in Nigeria. The Asian pattern noted in the univariate tabulations is also weakened in the multivariate analysis. In only two of five Asian countries, Sri Lanka and Thailand, do those "not in the labour force" exhibit significantly lower mortality than employees, the reference category. This pattern is also observed in Jamaica, where those "not in the labour force" have 24 per cent lower mortality than employees. Peru, in contrast, is the only country where women who are not economically active have significantly higher child mortality than employees at the multivariate level. Family workers in Nigeria and the self-employed in Thailand have significantly lower child mortality than do employees, suggesting that control over one's time or ability to remain close to children while working may be important in these societies or that economic advantages of participating in the labour force more than offset the time constraints imposed by extra-domestic activities on the child-rearing activities of mothers. Both family workers and the self employed are advantaged in relation to employees in Ghana and Nepal, although not significantly, while both are disadvantaged in Chile, Lesotho and Liberia. Among the 14 countries listed in table VII.9, the lowest mortality group is employee only twice (Chile and Liberia), employer/own-account twice (Nepal and Peru), unpaid family worker four times (Ghana, Indonesia, Nigeria and the Republic of Korea), and "not in the labour force" six times. In 10 of 14 countries, therefore, women who do not participate in economic activities or who work within their family enterprises have the lowest level of child mortality.

When urban and rural mothers are studied separately at Stages IIIR and IIIU, few consistent differences emerge. In relation to employees, those "not in the labour force" have a larger advantage (or smaller disadvantage) in urban areas in 9 out of 12 countries; thus, there appears to be less differentiation by the mother's activity and employment status in rural areas.

Summary and conclusion

The female labour force participation categories examined in this project probably had rather different meanings in different countries, thus weakening the comparison among countries. Nevertheless, significant findings emerged from the analysis. In the univariate analysis, several patterns emerged. For most countries, children whose mothers are reported to participate in labour market activities generally have slightly higher mortality than those whose mothers have not been reported in the labour force. A majority of the African countries - Ghana, Kenya, Liberia and Nigeria - showed the children of employees to be at lower risk than the children of women who were not in the labour force. In Asian countries, another pattern was observed: the child mortality ratio for employees was higher than that for those not in the labour force; and, except for Nepal, employees recorded the highest ratio. These may be societies in which female participation in the labour force may denote severe economic stress within the household (or even the death of a child).

The cross-tabulation of child mortality ratios for the mother's employment status with maternal education, urban/rural residence, marital status and father's occupation failed to find a simple variable that explained most of the participation and employment status effects. They also failed to disclose any substantively interesting interactions between participation in the labour force and employment status and these other variables as they jointly influence mortality.

The multivariate results showed that child mortality is frequently related to maternal participation in the labour force and employment status in developing countries, when effects of other variables are controlled (11 of 38 coefficients were significant at Stage II). The regional pattern that was detected at the univariate stage, however, was virtually eliminated at the multivariate stage. After all other variables are entered into the model, women who do not work at all or who work in family enterprises have the lowest child mortality in 10 of the 14 countries examined. This suggests the persistent importance of women's work for child mortality in developing countries, although the lines of causation are by no means clear. As mentioned above, these findings should be viewed cautiously as the quality of data on women's economic participation raises serious doubts. Moreover, as adequate controlling variables were not available in these data sets, mainly those related to absolute and relative incomes and alternative care, a causal relationship cannot be presumed.

Notes

1/ Sierra Leone has no information on employment status although it does have information on occupation. The Republic of Korea has information on employment status but does not provide information on occupation.

2/ In fact, it is very unlikely that there were so few active women in these categories, as the data on table VII.2 show.

3/ Chile and Kenya show large proportions of employees but, as mentioned before, either the definition of labour force is not comparable to other countries or there is severe under-reporting among unpaid family workers or own-account workers.

Table VII.1 Several characteristics of the information on mother's activity status

Region and country	Source[a]	Phrasing of question on activity status		Reference period
		Works	Other	
Africa				
Ghana	Census		Works for pay or profit	One week
Kenya	WFS		Works for wage or salary	Undetermined
Lesotho	WFS		Works for wage or salary[b]	Undetermined[c]
Liberia	Census	X		12 months
Nigeria	Survey	X		One week[d]
Sierra Leone	Survey	X		6 months
Sudan	Survey		Works for pay or outside the house	12 months
Asia				
Indonesia	Census	X[e]		One week
Nepal	WFS	X[f]		Undetermined
Republic of Korea	Survey		Regular job	5 years
Sri Lanka	WFS	X		Undetermined[c]
Thailand	WFS	X		Undetermined[c]
Latin America				
Chile	Census	X		One week
Jamaica	WFS	X		Undetermined[c]
Peru	WFS	X		Undetermined[c]

a/ Census = census sample or census post-enumeration survey; WFS = World Fertility Survey; Survey = other than WFS. (See table I.1 for more details).

b/ Includes paid in kind.

c/ The first question asks for current work. If the answer is negative a second question is asked about work since the day of first marriage or first birth. For the purpose of the analysis, the information on these countries refers either to "present" work or to anytime since first union.

d/ Question refers to "present" work.

e/ Two questions are devoted to activity status.

f/ Question refers to work paid in cash, kind and unpaid work.

Table VII.2 Ratio of observed to expected deaths, by mother's activity and employment status (expected deaths in parentheses)

Mother's activity and employment status	AFRICA							ASIA					LATIN AMERICA		
	Ghana	Kenya	Lesotho	Liberia	Nigeria	Sierra Leone	Sudan	Indonesia	Nepal	Republic of Korea	Sri Lanka	Thailand	Chile	Jamaica	Peru
Not in the labour force	1.152 (17629)	0.998 (4289)	0.965 (1571)	0.946 (17752)	0.849 (351)	1.058 (298)	0.775 (219)	0.954 (59593)	0.955 (1548)	0.982 (2234)	0.841 (1508)	0.623 (136)	1.017 a/ (3808)	0.900 (157)	0.966 (1566)
In the labour force b/	0.968 (55321)	0.868 (714)	1.089 (562)	1.131 (7402)	1.037 (2108)	0.979 (1090)	1.062 (451)	1.055 (35627)	1.026 (3439)	1.050 (772)	1.165 (1230)	1.050 (1840)	0.794 (479)	1.083 (544)	1.065 (3024)
Unpaid family worker	1.073 (13828)	1.090 (80)	1.017 (46)	1.196 (3007)	0.954 (321)	..	1.042 (137)	1.014 (14030)	0.996 (2914)	0.941 (204)	0.993 (375)	1.083 (1320)	..	1.304 (59)	1.346 (1233)
Employer or own account	0.945 (39745)	..	1.250 (170)	1.159 (3745)	1.087 (1621)	..	1.232 (80)	1.075 (13426)	1.236 (83)	1.074 (410)	1.037 (130)	0.830 (258)	1.081 (92)	1.146 (91)	0.922 (1185)
Employee	0.659 (1739)	0.840 (634)	1.019 (346)	0.668 (650)	0.711 (166)	..	1.016 (234)	1.091 (8171)	1.187 (442)	1.126 (158)	1.277 (725)	1.099 (262)	0.726 (387)	1.035 (394)	0.776 (606)

a/ It includes very few cases of unpaid family workers.

b/ Ratios and numbers for this line have been calculated as weighted averages from the next three lines, and consequently they do not include cases of women in the labour force of unknown employment status. Figures for Sierra Leone are calculated, similarly, as weighed averages of the five occupational groups from table VII.4.

Table VII.3 Ratio of observed to expected deaths by mother's workplace since union (expected deaths in parentheses)

Mother's workplace	AFRICA	ASIA		LATIN AMERICA	
	Lesotho	Nepal	Sri Lanka	Jamaica	Peru
<u>Agriculture</u>					
Family farm	0.776 (15)	1.001 (2884)	0.979 (362)	1.355 (51)	1.379 (1120)
Other farm	1.302 (11)	1.162 (302)	1.427 (88)	1.643 (25)	1.272 (187)
<u>Non-agriculture</u>					
At home	1.220 (169)	0.874 (56)	1.039 (116)	0.978 (49)	0.929 (813)
Away from home	1.039 (373)	1.236 (198)	1.254 (663)	1.022 (419)	0.757 (904)
TOTAL	1.089 (562)	1.026 (3439)	1.165 (1230)	1.083 (544)	1.065 (3024)

Table VII.4 Ratio of observed to expected deaths, by mother's occupation (expected deaths in parentheses)

Mother's occupation	AFRICA							ASIA				LATIN AMERICA		
	Ghana	Kenya	Lesotho	Liberia	Nigeria	Sierra Leone	Sudan	Indonesia	Nepal	Sri Lanka	Thailand	Chile	Jamaica	Peru
Professional/ white collar	0.472 (733)	0.431 (220)	0.996 (31)	0.518 (392)	0.542 (138)	0.756 (33)	..	0.935 (3434)	..	0.446 (61)	0.298 (40)	0.590 (151)	0.731 (30)	0.260 (184)
Sales workers	0.875 (12384)	1.071 (64)	1.177 (84)	0.902 (268)	1.046 (1127)	0.986 (272)	0.826 (12)	1.089 (5594)	0.949 (75)	1.060 (48)	0.823 (209)	1.199 (48)	0.912 (113)	0.958 (703)
Service workers	0.748 (561)	1.017 (120)	1.064 (204)	0.705 (95)	0.991 (17)	a/	..	1.131 (827)	..	1.470 (38)	1.151 (30)	0.878 (177)	1.089 (221)	0.807 (238)
Agricultural workers	1.026 (34192)	1.099 (202)	0.992 (26)	1.192 (6272)	1.087 (493)	0.993 (773)	1.056 (409)	1.070 (21468)	1.017 (3192)	1.229 (849)	1.115 (1441)	0.720 (15)	1.422 (79)	1.364 (1307)
Production workers	0.926 (7351)	1.022 (106)	1.136 (209)	1.116 (88)	1.190 (330)	a/	1.319 (25)	..	1.246 (166)	1.092 (232)	0.891 (119)	0.786 (98)	1.070 (99)	0.869 (460)

a/ Fewer than 10 expected deaths.

Table VII.5 Ratio of observed to expected deaths by mother's activity status and mother's education (expected deaths in parentheses)

<table>
<tr><th rowspan="2">Mother's activity status[a]</th><th colspan="5">Mother's education</th></tr>
<tr><th>Total</th><th>None</th><th>1-3 years</th><th>4-6 years</th><th>7+ years</th></tr>
<tr><td colspan="6">AFRICA</td></tr>
<tr><td colspan="6"><u>Ghana</u>[b]</td></tr>
<tr><td>Not in the labour force</td><td>1.152
(17629)</td><td>1.239
(15515)</td><td>0.621
(686)</td><td>0.469
(1322)</td><td>0.415
(106)</td></tr>
<tr><td>In the labour force</td><td>0.968
(5536)</td><td>1.015
(48218)</td><td>0.770
(3377)</td><td>0.562
(3325)</td><td>0.357
(394)</td></tr>
<tr><td colspan="6"><u>Kenya</u></td></tr>
<tr><td>Not in the labour force</td><td>0.998
(4289)</td><td>1.095
(2684)</td><td>0.939
(581)</td><td>0.791
(685)</td><td>0.741
(334)</td></tr>
<tr><td>In the labour force</td><td>0.868
(714)</td><td>1.193
(287)</td><td>1.045
(74)</td><td>0.738
(124)</td><td>0.472
(229)</td></tr>
<tr><td colspan="6"><u>Lesotho</u></td></tr>
<tr><td>Not in the labour force</td><td>0.965
(1571)</td><td>1.197
(156)</td><td>1.035
(241)</td><td>0.956
(906)</td><td>0.802
(271)</td></tr>
<tr><td>In the labour force</td><td>1.089
(562)</td><td>1.189
(32)</td><td>1.236
(84)</td><td>1.066
(303)</td><td>1.030
(144)</td></tr>
<tr><td colspan="6"><u>Liberia</u>[c]</td></tr>
<tr><td>Not in the labour force</td><td>0.946
(17752)</td><td>0.971
(16631)</td><td colspan="2">0.709
(494)</td><td>0.459
(637)</td></tr>
<tr><td>In the labour force</td><td>1.131
(7402)</td><td>1.180
(6820)</td><td colspan="2">0.727
(105)</td><td>0.516
(478)</td></tr>
</table>

Table VII.5 (continued)

Mother's activity status[a]	Mother's education: Total	None	1-3 years	4-6 years	7+ years
		AFRICA (continued)			
		Nigeria			
Not in the labour force	0.849 (351)	1.025 (197)	1.437 (12)	0.650 (49)	0.501 (74)
In the labour force	1.037 (2108)	1.160 (1439)	0.974 (80)	0.760 (210)	0.695 (321)
		Sudan[d]			
Not in the labour force	0.775 (219)	0.801 (172)		0.678 (47)	
In the labour force	1.062 (451)	1.078 (426)		0.764 (24)	
		ASIA			
		Indonesia[e]			
Not in the labour force	0.959 (59593)	1.047 (37006)	0.947 (11811)	0.699 (8881)	0.371 (1896)
In the labour force	1.055 (35637)	1.116 (24383)	1.052 (6894)	0.788 (3532)	0.435 (818)
		Nepal[d]			
Not in the labour force	0.955 (1548)	0.979 (1453)		0.633 (88)	
In the labour force	1.026 (3439)	1.030 (3384)		0.681 (50)	

Table VII.5 (continued)

Mother's activity status[a]	Mother's education				
	Total	None	1-3 years	4-6 years	7+ years
		ASIA (continued)			
		Republic of Korea[c]			
Not in the labour force	0.982 (2234)	1.074 (1140)	0.940 (853)		0.690 (242)
In the labour force	1.049 (772)	1.195 (370)	0.929 (316)		0.865 (86)
		Sri Lanka[f]			
Not in the labour force	0.841 (1508)	1.060 (353)	0.913 (637)	0.662 (405)	0.397 (113)
In the labour force	1.165 (1230)	1.348 (469)	1.127 (543)	1.055 (140)	0.516 (77)
		Thailand[g]			
Not in the labour force	0.623 (136)	0.830 (20)	0.628 (105)		0.197 (10)
In the labour force	1.050 (1840)	1.220 (459)	1.021 (1321)		0.357 (58)
		LATIN AMERICA			
		Chile			
Not in the labour force	1.017 (3808)	1.529 (302)	1.199 (680)	1.055 (1534)	0.681 (940)
In the labour force	0.794 (479)	1.387 (26)	0.958 (59)	0.985 (150	0.592 (189)

Table VII.5 (continued)

<table>
<tr><th rowspan="2">Mother's activity status[a]</th><th colspan="5">Mother's education</th></tr>
<tr><th>Total</th><th>None</th><th>1-3 years</th><th>4-6 years</th><th>7+ years</th></tr>
<tr><td colspan="6">LATIN AMERICA (continued)</td></tr>
<tr><td colspan="6">Jamaica[h]</td></tr>
<tr><td>Not in the labour force</td><td>0.900
(157)</td><td>1.088
(34)</td><td colspan="2">0.869
(112)</td><td>0.645
(11)</td></tr>
<tr><td>In the labour force</td><td>1.083
(544)</td><td>1.299
(101)</td><td colspan="2">1.095
(386)</td><td>0.768
(57)</td></tr>
<tr><td colspan="6">Peru</td></tr>
<tr><td>Not in the labour force</td><td>0.966
(1566)</td><td>1.456
(589</td><td>1.011
(394)</td><td>0.554
(363)</td><td>0.250
(219)</td></tr>
<tr><td>In the labour force</td><td>1.066
(3024)</td><td>1.402
(1405)</td><td>1.026
(789)</td><td>0.651
(507)</td><td>0.348
(324)</td></tr>
</table>

a/ Ratios and numbers for the "In the labour force" category have been calculated as weighed averages from the employment status categories and consequently do not include classes of women in the labour force of unknown employment status.

b/ Categories of mother's education vary as follows: Total, None, Primary, Middle and Secondary or Higher.

c/ Categories of mother's education vary as follows: Total, None, 1-6 years and 7 years or more.

d/ Categories of mother's education vary as follows: Total, None and 1 year or more.

e/ Categories of mother's education vary as follows: Total, None, Not finished elementary, Finished elementary and Junior High or more.

f/ Categories of mother's education vary as follows: Total, None, 1-5 years, 6-9 years and 7 years or more.

g/ Categories of mother's education vary as follows: Total, None, 1-4 years and 5 years or more.

h/ Categories of mother's education vary as follows: Total, None and Primary 1-4 years, Primary over 4 years and Secondary or more.

Table VII.6 Ratio of observed to expected deaths by mother's activity and employment status and current residence (expected deaths in parentheses)

Mother's activity and employment status a/	Current residence		
	Largest city	Other urban	Rural
	AFRICA		
	Ghana		
Not in the labour force	0.554 (1930)	1.023 (2516)	1.263 (13182)
In the labour force	0.628 (5573)	0.900 (8005)	1.028 (41735)
Unpaid family workers	0.607 (109)	1.081 (533)	1.076 (13186)
Employer or own account	0.658 (4771)	0.899 (7070)	1.008 (27904)
Employee	0.423 (693)	0.674 (402)	0.903 (645)
	Kenya		
Not in the labour force	0.828 (281)	0.991 (180)	1.010 (3828)
In the labour force	0.767 (121)	0.530 (96)	0.958 (496)
Unpaid family workers	0.909 (12)	1.001 (10)	1.144 (58)
Employer or own account	..	..	..
Employee	0.751 (109)	0.475 (86)	0.933 (438)

Table VII.6 (continued)

<table>
<tr><th rowspan="2">Mother's activity and employment status a/</th><th colspan="3">Current residence</th></tr>
<tr><th>Largest city</th><th>Other urban</th><th>Rural</th></tr>
<tr><td colspan="4">AFRICA (continued)</td></tr>
<tr><td colspan="4">Lesotho</td></tr>
<tr><td>Not in the labour force</td><td>1.088 (37)</td><td>1.033 (56)</td><td>0.960 (1474)</td></tr>
<tr><td>In the labour force</td><td>0.995 (26)</td><td>1.095 (31)</td><td>0.893 (505)</td></tr>
<tr><td>Unpaid family workers</td><td>b/</td><td>b/</td><td>1.007 (44)</td></tr>
<tr><td>Employer or own account</td><td>b/</td><td>0.915 (12)</td><td>1.304 (149)</td></tr>
<tr><td>Employee</td><td>1.031 (16)</td><td>1.249 (18)</td><td>1.008 (312)</td></tr>
<tr><td colspan="4">Liberia</td></tr>
<tr><td>Not in the labour force</td><td colspan="2">——— 0.823 (6514) ———</td><td>1.017 (11257)</td></tr>
<tr><td>In the labour force</td><td colspan="2">——— 0.893 (1798) ———</td><td>1.207 (5604)</td></tr>
<tr><td>Unpaid family workers</td><td colspan="2">——— 0.991 (465) ———</td><td>1.233 (2542)</td></tr>
<tr><td>Employer or own account</td><td colspan="2">——— 1.012 (832) ———</td><td>1.201 (2913)</td></tr>
<tr><td>Employee</td><td colspan="2">——— 0.603 (501) ———</td><td>0.885 (149)</td></tr>
</table>

Table VII.6 (continued)

<table>
<tr><th rowspan="2">Mother's activity and employment status a/</th><th colspan="3">Current residence</th></tr>
<tr><th>Largest city</th><th>Other urban</th><th>Rural</th></tr>
<tr><td colspan="4">AFRICA (continued)</td></tr>
<tr><td colspan="4">Nigeria</td></tr>
<tr><td>Not in the labour force</td><td colspan="2">0.689
(171)</td><td>1.000
(180)</td></tr>
<tr><td>In the labour force</td><td colspan="2">0.929
(834)</td><td>1.108
(1274)</td></tr>
<tr><td>Unpaid family workers</td><td colspan="2">1.112
(84)</td><td>0.898
(237)</td></tr>
<tr><td>Employer or own account</td><td colspan="2">0.977
(660)</td><td>1.163
(961)</td></tr>
<tr><td>Employee</td><td colspan="2">0.402
(90)</td><td>1.074
(76)</td></tr>
<tr><td colspan="4">ASIA</td></tr>
<tr><td colspan="4">Indonesia</td></tr>
<tr><td>Not in the labour force</td><td>0.886
(2816)</td><td>0.792
(8977)</td><td>0.989
(47800)</td></tr>
<tr><td>In the labour force</td><td>1.097
(590)</td><td>0.932
(3064)</td><td>1.088
(31974)</td></tr>
<tr><td>Unpaid family workers</td><td>1.067
(82)</td><td>0.979
(550)</td><td>1.015
(13399)</td></tr>
<tr><td>Employer or own account</td><td>1.052
(224)</td><td>0.957
(1458)</td><td>1.091
(1744)</td></tr>
<tr><td>Employee</td><td>1.142
(284)</td><td>0.874
(1056)</td><td>1.228
(6831)</td></tr>
</table>

Table VII.6 (continued)

Mother's activity and employment status a/	Current residence		
	Largest city	Other urban	Rural
	ASIA (continued)		
	Nepal		
Not in the labour force	______ 0.511 (78) ______		0.907 (1432)
In the labour force	______ 0.561 (31) ______		1.032 (3390)
Unpaid family workers	______ 0.563 (14) ______		1.000 (2889)
Employer or own account	______ b/ ______		1.246 (74)
Employee	______ 0.320 (10) ______		1.211 (427)
	Republic of Korea		
Not in the labour force	0.907 (275)	0.895 (426)	1.019 (1534)
In the labour force	0.927 (112)	0.952 (152)	1.106 (508)
Unpaid family workers	0.960 (15)	0.802 (26)	0.961 (163)
Employer or own account	0.858 (70)	0.963 (91)	1.175 (249)
Employee	1.086 (27)	1.033 (35)	1.171 (96)

Table VII.6 (continued)

Mother's activity and employment status a/	Current residence			
	Largest city	Other urban	Rural	
ASIA (continued)				
Sri Lanka c/				
Not in the labour force	0.771 (120)	0.874 (228)	0.841 (1147)	0.939 (13)
In the labour force	0.875 (33)	1.079 (77)	1.026 (900)	1.807 (220)
Unpaid family workers	b/	b/	0.969 (98)	b/
Employer or own account	b/	0.908 (26)	1.075 (98)	b/
Employee	0.855 (27)	1.011 (35)	1.064 (96)	1.805 (219)
Thailand				
Not in the labour force	—— 0.405 (54) ——		0.768 (82)	
In the labour force	—— 0.689 (188) ——		1.091 (1651)	
Unpaid family workers	—— 0.746 (30) ——		1.091 (1290)	
Employer or own account	—— 0.633 (93) ——		0.942 (164)	
Employee	—— 0.742 (65) ——		1.216 (197)	

Table VII.6 (continued)

<table>
<tr><th rowspan="2">Mother's activity and employment status a/</th><th colspan="3">Current residence</th></tr>
<tr><th>Largest city</th><th>Other urban</th><th>Rural</th></tr>
<tr><td colspan="4">LATIN AMERICA</td></tr>
<tr><td colspan="4">Chile</td></tr>
<tr><td>Not in the labour force</td><td>0.910
(1253)</td><td>0.986
(1590)</td><td>1.203
(967)</td></tr>
<tr><td>In the labour force</td><td>0.722
(219)</td><td>0.852
(219)</td><td>0.867
(40)</td></tr>
<tr><td>Unpaid family workers</td><td>..</td><td>..</td><td>..</td></tr>
<tr><td>Employer or own account</td><td>1.095
(42)</td><td>1.020
(41)</td><td>b/</td></tr>
<tr><td>Employee</td><td>0.633
(177)</td><td>0.813
(178)</td><td>0.751
(32)</td></tr>
<tr><td colspan="4">Jamaica</td></tr>
<tr><td>Not in the labour force</td><td colspan="2">——— 0.749 (36) ———</td><td>0.945
(121)</td></tr>
<tr><td>In the labour force</td><td colspan="2">——— 0.650 (239) ———</td><td>1.187
(307)</td></tr>
<tr><td>Unpaid family workers</td><td colspan="2">——— b/ ———</td><td>1.366
(55)</td></tr>
<tr><td>Employer or own account</td><td colspan="2">——— 1.094 (36) ———</td><td>1.179
(55)</td></tr>
<tr><td>Employee</td><td colspan="2">——— 0.932 (198) ———</td><td>1.140
(197)</td></tr>
</table>

Table VII.6 (continued)

Mother's activity and employment status a/	Current residence		
	Largest city	Other urban	Rural
	LATIN AMERICA (continued)		
	Peru		
Not in the labour force	0.474 (527)	0.998 (410)	1.356 (629)
In the labour force	0.647 (944)	1.129 (784)	1.352 (1297)
Unpaid family workers	0.889 (43)	1.291 (231)	1.380 (960)
Employer or own account	0.673 (546)	1.102 (388)	1.184 (250)
Employee	0.578 (355)	0.964 (165)	1.229 (87)

a/ Ratios and numbers for the "In the labour force" category have been calculated as weighed averages from the employment status categories and consequently do not include classes of women in the labour force of unknown employment status.

b/ Fewer than 10 expected deaths.

c/ Data for rural residence in Sri Lanka is divided into two categories: "Rural non-estate" and "Rural estate".

Table VII.7 Ratio of observed to expected deaths by mother's activity and employment status and marital status (expected deaths in parentheses)

Mother's activity and employment status a/	Marital status		
	Married		Separated/ Divorced/ Widowed
	Monogamous	Polygamous	
AFRICA			
Ghana			
Not in the labour force	1.008 (9522)	1.291 (6583)	1.453 (1523)
In the labour force	0.894 (26290)	1.140 (6621)	1.084 (8219)
Unpaid family workers	1.010 (7207)	1.123 (6003)	1.310 (618)
Employer or own account	0.865 (18183)	1.094 (327)	1.084 (7184)
Employee	0.565 (900)	1.553 (291)	0.752 (417)
Kenya			
Not in the labour force	0.923 (2238)	1.165 (973)	1.001 (1076)
In the labour force	0.704 (326)	1.166 (117)	0.939 (271)
Unpaid family workers	0.807 (31)	0.904 (14)	1.428 (35)
Employer or own account	..	..	..
Employee	0.693 (295)	1.202 (103)	0.867 (236)

Table VII.7 (continued)

Mother's activity and employment status a/	Marital status		
	Married		Separated/ Divorced/ Widowed
	Monogamous	Polygamous	
	AFRICA (continued)		
	Lesotho		
Not in the labour force	0.923 (1160)	1.160 (109)	1.056 (302)
In the labour force	1.088 (338)	0.954 (39)	1.112 (187)
Unpaid family workers	1.010 (7207)	1.123 (6003)	1.310 (618)
Employer or own account	0.865 (18183)	1.094 (327)	1.084 (7184)
Employee	0.565 (900)	1.553 (291)	0.752 (417)
	Liberia		
Not in the labour force	—— 0.943 (15742) ——		1.217 (1053)
In the labour force	—— 1.144 (6232) ——		1.160 (845)
Unpaid family workers	—— 1.200 (2716) ——		1.340 (191)
Employer or own account	—— 1.174 (3055) ——		1.147 (535)
Employee	—— 0.612 (461) ——		0.931 (119)

Table VII.7 (continued)

Mother's activity and employment status a/	Marital status	
	Married	Separated/ Divorced/ Widowed
	AFRICA (continued)	
	Sudan	
Not in the labour force	0.724 (203)	1.484 (15)
In the labour force	1.045 (389)	1.160 (60)
Unpaid family worker	1.046 (127)	0.993 (10)
Employer or own account	1.229 (55)	1.225 (23)
Employee	0.996 (207)	1.166 (27)
	ASIA	
	Indonesia	
Not in the labour force	0.942 (54957)	1.101 (4636)
In the labour force	1.020 (28189)	1.189 (7440)
Unpaid family workers	1.000 (13084)	1.208 (947)
Employer or own account	1.037 (9356)	1.164 (4070)
Employee	1.036 (5749)	1.223 (2423)

Table VII.7 (continued)

Mother's activity and employment status a/	Marital status	
	Married	Separated/ Divorced/ Widowed
	ASIA (continued)	
	Nepal	
Not in the labour force	0.941 (1458)	1.185 (90)
In the labour force	1.006 (3104)	1.217 (335)
Unpaid family worker	0.982 (2664)	1.145 (250)
Employer or own account	1.096 (69)	1.927 (14)
Employee	1.159 (371)	1.337 (71)
	Republic of Korea	
Not in the labour force	0.960 (2129)	1.410 (106)
In the labour force	0.925 (625)	1.574 (148)
Unpaid family worker	0.920 (187)	1.162 (17)
Employer or own account	0.914 (316)	1.610 (94)
Employee	0.962 (122)	1.673 (37)

Table VII.7 (continued)

Mother's activity and employment status a/	Marital status	
	Married	Separated/ Divorced/ Widowed
	ASIA (continued)	
	Sri Lanka	
Not in the labour force	0.832 (1399)	0.959 (107)
In the labour force	1.131 (1072)	1.400 (157)
Unpaid family workers	0.941 (346)	1.617 (29)
Employer or own account	1.029 (104)	1.069 (26)
Employee	1.253 (622)	1.422 (102)
	Thailand	
Not in the labour force	0.631 (130)	b/
In the labour force	1.041 (1701)	1.161 (138)
Unpaid family workers	1.073 (1339)	1.238 (81)
Employer or own account	0.830 (235)	0.822 (23)
Employee	1.083 (227)	1.208 (34)

Table VII.7 (continued)

Mother's activity and employment status a/	Marital status	
	Married/ consensual unions	Separated/ Divorced/ Widowed
	LATIN AMERICA	
	Chile	
Not in the labour force	1.033 (3497)	0.834 (284)
In the labour force	0.830 (292)	0.741 (183)
Unpaid family workers	..	..
Employer or own account	1.161 (69)	0.868 (23)
Employee	0.729 (223)	0.723 (160)
	Jamaica	
Not in the labour force	0.977 (139)	0.326 (18)
In the labour force	1.100 (452)	1.001 (93)
Unpaid family workers	1.351 (55)	b/
Employer or own account	1.200 (71)	0.953 (20)
Employee	1.036 (326)	1.032 (69)

Table VII.7 (continued)

Mother's activity and employment status a/	Marital status	
	Married/ consensual unions	Separated/ Divorced/ Widowed
	LATIN AMERICA (continued)	
	Peru	
Not in the labour force	0.948 (1503)	1.393 (63)
In the labour force	1.064 (2668)	1.077 (356)
Unpaid family workers	1.343 (1135)	1.380 (99)
Employer or own account	0.906 (1022)	1.024 (162)
Employee	0.761 (511)	0.852 (95)

a/ Ratios and numbers for the "In the labour force" category have been calculated as weighed averages from the employment status categories and consequently do not include clases of women in the labour force of unknown employment status.

b/ Fewer than 10 expected deaths.

Table VII.8 Ratio of observed to expected deaths by mother's activity and employment status and father's occupation[a]
(expected deaths in parentheses)

Mother's activity and employment status[b]	Father's occupation: Professional managerial, clerical	Sales workers	Service workers	Agricultural workers	Production workers
			AFRICA		
			Ghana		
Not in the labour force	0.545 (947)	0.717 (240)	0.624 (580)	1.328 (8746)	0.732 (1297)
In the labour force	0.657 (2001)	0.797 (634)	0.703 (599)	1.044 (21700)	0.826 (3783)
Unpaid family worker	0.989 (94)	0.950 (79)	0.771 (21)	1.070 (10737)	1.004 (184)
Employer or own account	0.692 (1598)	0.779 (529)	0.712 (542)	1.020 (10769)	0.824 (3508)
Employee	0.376 (309)	0.703 (26)	0.523 (36)	0.948 (194)	0.549 (91)
			Kenya		
Not in the labour force	0.735 (456)	0.895 (328)	0.960 (503)	1.048 (1792)	1.061 (995)
In the labour force	0.453 (185)	0.837 (60)	0.923 (112)	1.170 (154)	1.007 (169)
Unpaid family worker	1.064 (12)	0.503 (10)	0.727 (21)	1.354 (21)	1.449 (15)
Employer or own account	..	..	..	..	..
Employee	0.411 (173)	0.904 (50)	0.968 (91)	1.141 (133)	0.959 (154)

Table VII.8 (continued)

Mother's activity and employment status[b/]	Father's occupation				
	Professional managerial, clerical	Sales workers	Service workers	Agricultural workers	Production workers
			AFRICA (continued)		
			Nigeria		
Not in the labour force	0.740 (118)	0.667 (34)	0.754 (31)	1.093 (98)	0.884 (54)
In the labour force	0.710 (419)	0.976 (216)	0.980 (78)	1.204 (950)	1.074 (367)
Unpaid family worker	0.539 (28)	0.810 (49)	c/	1.097 (196)	0.802 (30)
Employer or own account	0.797 (295)	1.029 (158)	1.076 (66)	1.221 (720)	1.106 (328)
Employee	0.491 (96)	c/	c/	1.460 (34)	c/
			ASIA		
			Indonesia		
Not in the labour force	0.780 (9010)	0.999 (4848)	0.982 (1799)	0.986 (25876)	1.022 (3100)
In the labour force	0.818 (2710)	1.115 (2001)	1.062 (603)	1.020 (17592)	1.049 (866)
Unpaid family worker	0.849 (964)	1.075 (706)	1.263 (145)	1.002 (9827)	0.994 (191)
Employer or own account	0.908 (1121)	1.146 (966)	0.990 (244)	1.034 (4755)	1.027 (397)
Employee	0.609 (625)	1.117 (329)	1.008 (214)	1.055 (3010)	1.119 (278)

Table VII.8 (continued)

Mother's activity and employment status b/	Father's occupation				
	Professional managerial, clerical	Sales workers	Service workers	Agricultural workers	Production workers
			ASIA (continued)		
			Nepal		
Not in the labour force	0.543 (69)	0.856 (122)	0.571 (36)	0.956 (1071)	1.297 (183)
In the labour force	0.922 (118)	0.813 (51)	0.823 (111)	1.030 (2813)	1.221 (240)
Unpaid family worker	0.962 (106)	0.729 (32)	0.778 (100)	1.008 (2499)	1.116 (87)
Employer or own account	c/	1.111 (15)	c/	1.267 (33)	1.321 (29)
Employee	0.533 (11)	c/	1.256 (11)	1.194 (286)	1.272 (124)
			Republic of Korea		
Not in the labour force	0.703 (85)	0.893 (436)	..	0.982 (1073)	1.072 (385)
In the labour force	0.577 (16)	0.852 (177)	..	0.815 (194)	1.146 (105)
Unpaid family worker	c/	0.939 (48)	..	0.842 (112)	1.341 (13)
Employer or own account	c/	0.855 (105)	..	0.731 (56)	1.012 (55)
Employee	c/	0.662 (24)	..	0.880 (26)	1.276 (37)

Table VII.8 (continued)

Mother's activity and employment status[b/]	Father's occupation				
	Professional managerial, clerical	Sales workers	Service workers	Agricultural workers	Production workers
			ASIA (continued)		
			Sri Lanka		
Not in the labour force	0.576 (159)	0.806 (177)	0.636 (113)	0.944 (531)	0.871 (513)
In the labour force	0.507 (66)	1.025 (64)	0.965 (75)	1.278 (754)	1.071 (258)
Unpaid family worker	c/	c/	1.327 (10)	0.984 (309)	1.036 (38)
Employer or own account	c/	1.411 (23)	0.872 (16)	0.899 (34)	1.110 (49)
Employee	0.446 (52)	0.854 (33)	0.921 (49)	1.531 (411)	1.067 (171)
			Thailand		
Not in the labour force	0.415 (31)	0.075 (13)	c/	1.029 (1352)	0.704 (225)
In the labour force	0.668 (100)	0.580 (95)	1.136 (64)	1.125 (1352)	0.947 (225)
Unpaid family worker	0.914 (28)	0.619 (16)	1.267 (17)	1.100 (1191)	0.914 (68)
Employer or own account	0.732 (25)	0.586 (70)	1.070 (22)	1.195 (54)	0.761 (84)
Employee	0.487 (47)	c/	1.105 (25)	1.368 (107)	1.192 (73)

Table VII.8 (continued)

Mother's activity and employment status[b/]	Father's occupation				
	Professional managerial, clerical	Sales workers	Service workers	Agricultural workers	Production workers
			LATIN AMERICA		
			Chile		
Not in the labour force	0.687 (415)	1.059 (207)	0.941 (156)	1.171 (804)	1.041 (1526)
In the labour force	0.426 (103)	1.066 (34)	1.168 (40)	0.624 (28)	1.057 (121)
Unpaid family worker	..	..	..	..	..
Employer or own account	0.156 (13)	1.189 (18)	c/	c/	1.391 (34)
Employee	0.465 (90)	0.928 (16)	1.134 (31)	0.713 (21)	0.926 (87)
			Jamaica		
Not in the labour force	c/	c/	0.634 (11)	1.053 (63)	0.876 (62)
In the labour force	0.691 (38)	0.628 (45)	0.825 (41)	1.521 (151)	1.026 (256)
Unpaid family worker	c/	c/	c/	1.257 (41)	2.079 (12)
Employer or own account	c/	0.886 (11)	c/	1.432 (31)	1.189 (38)
Employee	0.776 (34)	0.554 (31)	0.850 (31)	1.693 (79)	0.935 (206)

Table VII.8 (continued)

Mother's activity and employment status b/	Father's occupation				
	Professional managerial, clerical	Sales workers	Service workers	Agricultural workers	Production workers
			LATIN AMERICA (continued)		
			Peru		
Not in the labour force	0.309 (209)	0.708 (109)	0.721 (78)	1.285 (690)	0.889 (467)
In the labour force	0.471 (283)	0.873 (296)	0.737 (132)	1.312 (1508)	0.942 (776)
Unpaid family worker	0.935 (25)	1.259 (61)	1.274 (16)	1.352 (1010)	1.424 (116)
Employer or own account	0.536 (114)	0.835 (189)	0.692 (77)	1.169 (350)	0.913 (441)
Employee	0.339 (144)	0.515 (46)	0.605 (39)	1.382 (148)	0.745 (219)

a/ Not employed, others and not applicable (husbands not matched to wives or single mothers) are not shown in this table.

b/ Ratios and numbers for the "In the labour force" category have been calculated as weighed averages from the employment status categories and consequently do not include classes of women in the labour force of unknown employment status.

c/ Fewer than 10 expected deaths.

Table VII.9 The effect of mother's activity and occupational status on child mortality: regression coefficients and univariate differences

Mother's activity and occupational status	Univariate differences	Stage II	Stage IIIR	Stage IIIU
	AFRICA			
	Ghana			
Employee	0	0	0	0
Employer or self-employed	0.286	-0.130	-0.057	-0.174
Unpaid family worker	0.414	-0.166	-0.102	-0.057
Not in the labour force	0.493	-0.092	-0.018	-0.139
	Kenya			
Employee	0	0	0	0
Unpaid family worker	0.750	0.061	0.065	-0.053
Not in the labour force	0.158	-0.014	-0.021	0.024
	Lesotho			
Employee	0	0	0	0
Employer or self-employed	0.231	0.255**	0.327**	0.389
Unpaid family worker	-0.002	0.036	0.035	0.170
Not in the labour force	-0.054	-0.017	-0.001	-0.165
	Liberia			
Employee	0	0	0	0
Employer or self-employed	0.491	0.138**	0.124**	0.142**
Unpaid family worker	0.528	0.171**	0.150**	0.143**
Not in the labour force	0.278	0.003	-0.022	0.018
	Nigeria			
Employee	0	0	0	0
Employer or self-employed	0.376	-0.161	-0.494**	0.109
Unpaid family worker	0.243	-0.308*	-0.712**	0.162
Not in the labour force	0.138	-0.294*	-0.662**	-0.081

Table VII.9 (continued)

Mother's activity and occupational status	Univariate differences	Stage II	Stage IIIR	Stage IIIU
		AFRICA (continued)		
		Sudan		
Employee	0	0	a/	a/
Employer or self-employed	0.216	-0.024	a/	a/
Unpaid family worker	0.026	..	a/	a/
Not in the labour force	-0.241	-0.111	a/	a/
		ASIA		
		Indonesia		
Employee	0	0	0	0
Employer or self-employed	-0.016	0.078	0.098	-0.066
Unpaid family worker	-0.077	-0.053	-0.039	-0.053
Not in the labour force	-0.137	-0.022	-0.003	-0.086*
		Nepal		
Employee	0	0	a/	a/
Employer or self-employed	0.049	-0.161	a/	a/
Unpaid family worker	-0.191	-0.040	a/	a/
Not in the labour force	-0.232	-0.091	a/	a/
		Republic of Korea		
Employee	0	0	0	0
Employer or self-employed	-0.052	0.012	0.082	-0.106
Unpaid family worker	-0.185	-0.060	0.058	-0.165
Not in the labour force	-0.144	0.058	0.172	-0.109
		Sri Lanka		
Employee	0	0	0	0
Employer or self-employed	-0.240	0.069	0.141	-0.059
Unpaid family worker	-0.284	-0.008	-0.034	0.950**
Not in the labour force	-0.436	-0.128*	-0.137*	-0.151

Table VII.9 (continued)

Mother's activity and occupational status	Univariate differences	Stage II	Stage IIIR	Stage IIIU
	ASIA (continued)			
	Thailand			
Employee	0	0	0	0
Employer or self-employed	-0.269	-0.256**	-0.235*	-0.322*
Unpaid family worker	-0.016	..	..	..
Not in the labour force	-0.476	-0.262**	-0.230*	-0.392
	LATIN AMERICA			
	Chile			
Employee	0	0	0	0
Employer or self-employed	0.355	0.174	0.511	0.151
Not in the labour force	0.291	0.033	0.358	0.001
	Jamaica			
Employee	0	0	0	0
Employer or self-employed	0.111	0.048	0.041	0.091
Unpaid family worker	0.269	-0.001	0.093	-0.617
Not in the labour force	-0.135	-0.236*	-0.225	-0.340
	Peru			
Employee	0	0	0	0
Employer or self-employed	0.146	-0.048	-0.078	-0.002
Unpaid family worker	0.570	0.109**	0.120	0.129**
Not in the labour force	0.190	0.084*	0.161*	0.064

* Significant at the .05 level.
** Significant at the .01 level.

a/ Sample totally or predominantly rural.

Chapter VIII

INCOME AND WEALTH

The potential role of income-related factors in child survival is complex, mainly due to the multi-faceted nature of income itself. Many different concepts of income are in current use:

(a) Household money income: the total value of financial instruments (mainly cash) received by members of a household during a specified period of time;

(b) Household real income: the total value of financial instruments received by members of a household during a specified period of time, plus the value of goods and service received directly ("in-kind" income);

(c) Household full income: the total potential value of household income during a time period if all of its resources - especially the time endowment of its members - were devoted to income-generating activities. Measurement of full income requires information on wage rates for each household member.

Identical concepts pertain at the individual level, although the assignment to individuals of income that is joint to the household (e.g., that which is generated by jointly owned assets, such as land) introduces an additional element of ambiguity. It is also possible to define an equivalent set of measures of income per capita for households, although adult equivalency scales are desirable if one is to use such a measure as an indicator of household welfare.

Since the goal of this analysis is to examine factors impinging on the survival of children, it is clear that income should serve as an indicator of children's consumption of goods and services that affect their health, including, among others calories and nutrients, clothing and shelter, sanitary facilities, use of medical systems and adult supervision. None of the data sets used here, and regrettably few data sets anywhere, contain direct information on these matters. Moreover, income may not be a valid indicator of children's consumption of goods and services that affect their health, when relative prices of those items are very different from the relative importance of the items for increasing a child's chances of survival.

In addition to ambiguities of measurement, the interpretation of income's relation with mortality is not straightforward. It is obviously reasonable to expect that, *ceteris paribus*, a higher income household should experience lower child-mortality risks. This expectation presumes that children in higher income households will consume more health-enhancing goods and services per capita than will children in lower income households. The question then arises whether higher income is purchased at the expense of extra hours of work that have reduced time spent in child care. If so, the effect of income on mortality could be adverse. O'Hara (1980) stresses that because the mother is most directly responsible for child care in most cultures, a rise in her income may have a very different effect on child survival than an equivalent rise in her husband's income, since child care may be more seriously impaired by her market activities. Fortunately, the Nigerian data set permits the testing of this propositon, with striking results reported below. In addition, it should be considered that the effect of mother's income may depend upon the level of household income. In relatively high-income households, extra income could mean more or better care of children; for example, it could be used to hire a full-time baby-sitter or nurse.

Children themselves can produce income, of course, so that the number of children of at least certain minimum age in a household will be positively correlated, ceteris paribus, with child survival probabilities in that household. This tendency will increase (very slightly) the statistical association between household total income and child survival probabilities but not the association between child survival and household income per capita.

Power structure of family and roles and status of its members are important components of child survival, because children do not allocate resources to themselves. Because children must depend upon resource allocation by adults, it must be assumed that the health and survival of all family members are high in the rank order of the parents' personal priorities. This assumption appears plausible in the vast majority of circumstances. However, the allocation of resources to children may depend in part upon the perceived value of those children to the parents or other members of the family. If so, discriminatory behaviour, most often in the form of differential treatment of male and female infants, may be a consequence of anticipated future productivity of the child and expected returns from the investment in human capital. One can assume that the degree to which discriminatory child care by sex is practised depends upon perceptions of employment opportunities for women, the status of women and societal norms, which in turn can be seen as determined by socio-economic development (Rosenzweig and Schultz, 1982). Hence, economic development and increasing personal wealth and equalitarian social norms among the sexes may lead to a reduction of sex discrimination and consequently to lower female child mortality, other things being equal.

It is important to recognize that income can only affect child mortality "through" other variables. To the extent that these other variables are represented in the estimation equations used, the measured impact of income will be reduced. Were it possible to account for all of these paths, the direct effect of income would be nil. Unfortunately, relatively few of the data sets used here contain income information and even fewer have data on intervening variables.

Lastly, several of the data sets contain information on a household's level of wealth, mainly in the form of a stock of assets of a particular type. Wealth is closely related to income, of course; past income has been diverted to produce wealth, and wealth may in turn be used to produce current income. Since wealth is created out of income - in particular, by reducing the level of consumption below the level of income - it is clear that wealth is, in general, a less satisfactory indicator of consumption than is income. Indeed, if it were possible to "control" income histories at a household level, one would expect a negative partial correlation between a household's wealth and its past volume of consumption. Absent such income controls, there is doubtless a strong positive cross-household association between wealth and consumption in all of the countries under study.

Although the present study is based on data on individuals and households, it is useful to review briefly the relationships in studies of data aggregated for countries and regions within a country. In an attempt to generalize the various results from the latter type of studies, Cochrane (1980) points out two major findings: (a) income is negatively related to mortality; and (b) there is an upper limit in income above which further increases in income have no effect on mortality.

A major shortcoming of most of the studies analysing the macro-level relationship between income and mortality is that, because of non-linearities in the income-mortality relation at a household level, the variance in incomes among households within a country has consequences for the average level of mortality in that country. It can be expected that higher income inequality leads to higher average mortality, because the range of possible values for an individual's income is much greater than that for life expectancy. Therefore, it seems conceptually problematical to compare only the two average measures. Some authors (e.g., Rodgers, 1979; and Preston, 1980) have tried to overcome this problem by introducing a variable representing income distribution, which proves to have the expected sign. Although only a micro-level analysis could fully account for income inequalities, the use of an income distribution is probably a preferred procedure in a macro-level analysis.

Most of the studies have focused on income per capita and life expectancy at birth. For infant mortality, Carvalho and Wood (1978) found on regional Brazilian data that infant deaths were particularly sensitive to changes in the level of income. Shin (1975), in a multivariate analysis of infant mortality, using cross-sectional and longitudinal data for 63 countries, obtained a substantially lower squared multiple correlation coefficient (R^2) than when applying the same model to life expectancy at birth. This finding tends to confirm earlier available evidence that infant mortality generally is not as well explained by socio-economic variables as is life expectancy at birth. In Shin's analysis, economic development shows, after newspaper circulation, the second largest effect (in terms of standardized beta coefficient) out of four variables on infant mortality. In Cochrane's (1980) summary table for cross-national data, lastly, income shows after literacy the second largest bivariate correlation coefficient (out of a variety of other indicators) in respect to infant mortality. In all the cases reviewed, the coefficients for income were in the expected direction. However, Auster and others (1969) found a positive effect of income on death rates across states in the United States, possibly reflecting the disadvantages of extreme affluence for adult degenerative processes.

The relatively few studies focusing on the relation between infant mortality and income at a household level in developing countries found a consistently negative association. These studies vary only in terms of the explanatory power attributed to income in relation to other independent variables.

Carvajal and Burgess (1978) used data from the Urban Fertility Study at Bogotá, Caracas and Rio de Janeiro. The five independent variables in their ordinary least-squares models were household income, mother's education, mother's labour force participation, migration and incidence of consensual unions. Taking the number of child deaths reported by each mother in a certain age group as dependent variables, regression coefficients were estimated separately for different age groups. The income coefficients turned out to be negative and significant at the 10 per cent probability level for all age groups at Bogotá and even more significant at Caracas and Rio de Janeiro. Age patterns of statistical significance did not appear in any of the three cities. The income elasticities of child mortality were found to increase with age of mother at Bogotá and to vary inversely with age of mother at Caracas and Rio de Janeiro. However, because of the way they defined their dependent variable, the effects reported confound the effects of income on both fertility and mortality.

Schultz (1979) developed an economic model which takes the ratio of number of children dead to the number of children born alive as a function of market wage offers to the mother and her husband, assets in the physical wealth of the mother's household, market and time prices facing the household, public health input in the region of residence per potential recipient, the region's physical health environment; and, lastly, paternal and maternal educational attainment. An empirical illustration is given with data from the 1973 Colombian census. Schultz cross-classifies income elasticities by age of mother and rural or urban residence. His table shows that income elasticities in respect of infant mortality are significantly higher for educated women than for uneducated, which supports the expectation that education tends to increase the efficiency of income allocated for health. The other significant pattern appearing is that of higher income elasticities in urban areas than in rural areas after controlling for education and age. It is not clear, however, whether this pattern is a real effect or results from the more accurate measurement of income in urban areas.

Another study (Rosenzweig and Schultz, 1982) examines how intra-family resource allocations respond to changes in economic conditions and to genetic differences in children by estimating the determinants of variations in the sex-specific survival differentials among rural Indian children, based on standard census and household survey data. Although this study does not directly focus on the question how household income affects child mortality, its findings appear to be relevant for the understanding of that process. As expected from considerations noted above, the study finds that increases in wealth, in terms of land ownership or other productive capital and asset income, are associated with greater female (in relation to male) improvements in survival prospects, which in consequence will lead to lower child mortality levels.

Anker and Knowles (1980) studied mortality determinants using household level data from the 1969 Kenyan census. Only women aged 20-29 years were selected. In a multiple regression analysis their dependent variable was dichotomous: whether a child survived to age three. The independent variables ranged from the form of water-supply and lavatory facilities, sex, income (the measure was household income per equivalent adult per annum), education and year of birth, to whether the area of residence was malarial. The multiple correlation coeffiecient for income has the expected positive sign and is significant at the 10 per cent level (for the rural sample, 5 per cent). However, this significance is not surprising because, other than a crude educational measure, income was the only socio-economic variable in that equation.

Measurement

Only three of the World Fertility Survey countries studied here -- Jamaica, Sri Lanka and Thailand -- included income as a variable in their questionnaires. Of those countries, only Thailand has relatively complete records for income. Information on income in Thailand was based on interviews with husbands. Because income is only available for husbands who are matched to wives, approximately 500 women out of over 3,500 are missing from these data (World Fertility Survey, 1977). Sri Lanka has the variable only for about half of the cases; persons not asked include: (a) those who had not worked in the preceding 12 months; (b) the self-employed without paid employees, and (c) domestic servants. The majority of the second group were agricultural workers. In Jamaica, income is given for only 18 per cent of the cases; thus, it has been excluded from the analysis here. Because the availability of income figures for Sri Lanka appears to be clearly selective with respect to occupation and other characteristics, the results must be interpreted with extreme caution. However, based on the available information on those households, the assumption can be made that households with income figures mainly belong to the non-agricultural sector of the society. Bearing this in mind, it is possible to treat those households as a sample of a selected subgroup of the population.

Although the three World Fertility Survey countries have husband's or partner's income only, Nigeria, the only other country with income figures, has the husband's and wife's money income, both self-reported, for almost the complete sample.

In order to make the income figures comparable across countries, they were converted into constant 1975 or 1972 United States dollars by deflating or inflating them in local currencies to the year 1975 or 1972 and then converting them into dollars by using the exchange rate for that year.1/ These dollar figures were used for most parts of the analysis. In the case of Nigeria, where household size is available, income figures were also divided by the number of persons in a household to obtain the probably best indicator of material resources per individual in a household.

For two countries, the Republic of Korea and Sierra Leone, the surveys included an indicator of household wealth specifying the number of consumer durables possessed by a household (such as radio or bicycle) out of a fixed list of items. This index largely avoids the problem of income measurement in rural areas and seems to be a reasonable indicator of relative economic status.

For Ghana, a variable specifies whether the occupier of a house owned his accommodation, rented it or obtained it free without being the owner. In Chile, the number of domestic servants in a household can function as a wealth-related indicator. However, this variable suffers from a possible reverse causation: the number of children surviving in a household may affect the presence of servants, a part of whose conventional duties is caring for children. Therefore, results involving this variable should not be interpreted in a straightforward way.

The following analysis attempts to uncover patterns in the income-child mortality relationship and to take maximum advantage of the relatively little information that is given for this variable by treating the income variable in both categorical and continuous forms.

Univariate results

Since income is available for few countries, no attempt is made to generalize about regional features of the child mortality-income relationship; rather each country is discussed individually. Tables VIII.1-4 give the one-way breakdowns of mortality by income in dollars, for income in relation to the national level of gross national product per capita, for the number of consumer goods owned, as well as for some other wealth-related indicators, such as ownership of accommodation and number of domestic servants. The major tendency that appears at first sight is that of a decline in child mortality with increasing material resources of the family. However, this decline is not always monotonic and is quite different in its structure from country to country. The irregularities may be due to the fact that, for Nigeria, Sri Lanka and Thailand, only father's or parents' income, but not the income of the entire family or household, is measured. It is also possible that income might not be reported very accurately.

In Thailand (table VIII.1), the mortality ratios show a rapid decline over the first three groups of father's income until the ratio increases for the $300-$599 group and subsequently continues to decline to the lowest mortality of very few high-income families. Sri Lanka and Nigeria show a very similar pattern of influence of the husband's income on child mortality. As in Thailand, the monotonic decline is only interrupted once in Sri Lanka, but here the increase occurs between the lowest and the second lowest income groups. The overall decline is much steeper in Sri Lanka than in Nigeria. From the category $70-$139 to the level of $1,000+, Sri Lanka shows a decline in the ratios by more than 1.00, with most of the decline occurring in categories below $600. In contrast, in Nigeria an increase in husband's income leads to a slower decline in the lower income groups but has a relatively stronger effect above $600. For the wife's income in Nigeria, there is a slight decrease in the ratio from the lowest to the second lowest category, followed by a slight increase to the third category and after that by a steep and monotonic decline.

For Nigeria, the use of the indicator "income per household member as a fraction of the national GNP per capita" (table VIII.2) leads to a picture that is similar in its main features to that produced by father's income in dollars.

Among the countries where wealth is measured by the ownership of consumer durables out of a specified number of goods (table VIII.3), the Republic of Korea shows a clear decline, which is strongest for the transition from the group of households with no goods at all to that with one and from the group with from two to three goods to that with four or five. For Sierra Leone, again, there is a very substantial decline in the ratio from the group of households without goods to that with one. After that, however, there is almost no further mortality decline with additional consumer durables; in fact, most categories show an increase in the ratio.

Ownership of land, as analysed for the Sudan (table VIII.4), does not appear to have much impact on child mortality. In Ghana, a pattern appears with significantly higher child mortality for people owning their house than for those renting it. An explanation for this pattern may be found in urban/rural differences in ownership and mortality, which are discussed below in the section on bivariate results. For Chile, child mortality obviously declines as the number of servants in the household increases. However, as noted earlier, this pattern is not very informative, because fewer than 6 per cent of the households have servants and the indicator itself is not unambiguous on logical grounds.

Bivariate results

In this section, interactions of the father's income with the mother's education and rural versus urban area of residence in affecting child mortality are investigated. First, education can be expected to be very important in influencing the way household income is allocated. It can be assumed that more highly educated women, other things being equal, are more aware of the importance of investment and tend to spend a higher share of their income on health-related activities. Furthermore, it seems reasonable to expect that education increases the efficiency of money spent on health due to better knowledge about effective health care measures. For both reasons, the income elasticity of mortality could be expected to be greater among the better-educated.

Table VIII.5 presents a diversity of patterns. Those for Nigeria are most straightforward: the father's income has very little effect on child mortality within categories of maternal education, while increases in maternal education tend to reduce mortality within each category of the father's income. Nigeria thus shows a dominance of education effects over income effects. In Thailand and Sri Lanka, the picture is more muddled. Education effects are fairly strong in Thailand; income effects also appear to be operative. In Sri Lanka, there are many reversals of expected relationships, but a general decline in ratios occurs as one moves from the upper left in the table (low income, low education) to the bottom right (high income, high education). Because of the frequent reversals, it is difficult to surmise which variable is dominant and whether interactions exist.

Table VIII.6 presents a cross-tabulation of child mortality ratios by mother's education and certain wealth-related variables. In both Ghana and the Republic of Korea, increases in the mother's education tend to reduce child mortality within wealth classes. As mentioned above, ownership of accommodations in Ghana and of consumer durables in the Republic of Korea have relatively little influence on child mortality within educational categories. The results of both the income and wealth tabulations with maternal education provide strong support for the importance of such education, weaker support for the importance of income and wealth, and practically no support for the suggestion of an interaction between the two.

Next to be considered is the interaction between the father's income and area of residence. Although the issue is dealt with in more detail later, it is useful to gain a preliminary sense of how the relation of income or wealth with child mortality varies in rural and urban areas. In Sri Lanka (see table VIII.7), rural areas have mortality ratios that decline monotonically with income. But income effects are stongly evident in all residential categories. In Ghana, owners of houses show lower mortality only in the capital city and there their advantage is quite weak; in other urban and rural areas, owners are still worse off than those who rent an apartment.

Multivariate results

Table VIII.8 presents the multiple regression coefficients for the income variables for the three countries, Nigeria, Sri Lanka and Thailand, where information on money income was available. The reference category is the highest income group for each country.

At first sight it may be surprising that many of the coefficients are negative, thus implying lower child mortality than in the reference category. This result, however, appears to be due to some peculiar characteristic of the highest income category. In all of the four data sets analysed here, the coefficient of the reference category is higher than that of the preceding category, producing an inverted J-shaped pattern. This tendency seems to be responsible for the relatively large number of negative coefficients.

The expected inverse relationship between income and child mortality is clearly seen only for the mother's income in Nigeria. For the father's income in Nigeria and Sri Lanka, results seem to suggest that there are some thresholds. Sharp drops in mortality ratio are seen between "$0-$69" and "$70-$139" in Nigeria and "$70-$139" and "$140-$299" in Sri Lanka. After these steep falls, no substantial decline in child mortality with income is observed. Thailand shows a rather puzzling U-shaped pattern. the lowest and highest income categories exhibit higher mortality and the two intermediate income categories are associated with lower mortality. Except for the sharp rise for the highest income category in Thailand, the overall observed patterns agree with the expected inverse relationships, if small irregularities are ignored and differences between categories below and above thresholds are considered.

In Nigeria, the slopes of the coefficients seem to be slightly steeper in rural areas than in urban localities. (Results given later in table VIII.12 support this observation.) The high rural slopes are somewhat unexpected because a higher fraction of a household's real income is generally monetized in urban areas, which would lead one to expect less "measurement error" and hence higher coefficients. On the other hand, if stated money income were to be associated with a higher change in real income in rural areas, this tendency could account for the slightly higher measured effect of money income changes on child mortality in rural Nigeria.

Because complete information is lacking on income for all but two countries, the regression equations were rerun for Nigeria and Thailand with the income variable omitted. The purpose of this analysis is to determine whether results for countries without income data were biased because of the missing information. Perhaps too much emphasis had been placed on the importance of the mother's education in this study simply because a key variable, income, was not represented and education was picking up its effect. Given the relatively small size of the income coefficients seen in table VIII.8, it appears likely that improper model specification was not a critical problem here.

In fact, table VIII.9, which compares regression coefficients with and without income, indicates that the failure to control for income does not strongly alter the results. In Thailand, the exclusion of income generally increases the remaining coefficients, although not substantially. Nigeria shows a less consistent pattern. For example, while all but one of the coefficients for the mother's education at Stage II increase in size when income is not included, 8 of the 11 positive coefficients for the father's occupation decrease. It is not known whether these apparently random results arise because income is poorly measured or because income is not as important in determining child mortality as other variables.

Table VIII.10 shows fairly strong mortality effects of the number of goods owned in the Republic of Korea and Sierra Leone. This expected inverse relationship also holds in the Republic of Korea for urban and rural areas separately. In rural areas, again, the possession of eight or more consumer goods seems to imply higher mortality than in any other categories except that without any goods. In Sierra Leone, as in the univariate case, it makes a fairly large, although not quite significant, difference to own one good instead of none, subsequently, however, owning an increasing number of durables does not appear to have much additional effect on mortality.

For Ghana (table VIII.11), the partial regression coefficients show the expected negative coefficients for ownership of house, rent being the reference category, although the relationship was positive at the univariate level. The reason for this inversion of the association with child mortality is perhaps that the regression equation includes such variables as type of roof and walls, lavatory facilites and water-supply, which may be present more frequently in rented housing. Once these characteristics are accounted for, ownership of a dwelling reduces mortality.

Income as a continuous variable -- income elasticities

Regression analyses were rerun with income treated as a continuous variable. This procedure averts some of the peculiarities resulting from anomalous values in the highest "reference" category. The coefficients given in table VIII.12 are not strictly elasticities as they are usually defined. They were calculated as the regression coefficients of an equation where the dependent variable was the ratio of children dead to expected children dead and the independent variable was the natural logarithm of income. (All of the other specified variables are present in the multivariate case.) As this coefficient represents a relative change in the proportion of children dead as a consequence of a proportionate change in income, it may be justified to speak of it as a special indicator of elasticity. In table VIII.12, these coefficients are given for the univariate and for the multivariate cases. For Thailand, the elasticities are very high and significant, and their pattern remains stable when controlling for all the other variables. The elasticities for urban areas are substantially higher than for rural settings. This picture of a strong relationship between income and the child mortality ratio corresponds to our previous observations of the univariate pattern and of the partial regression coefficients for the different income categories.

The relationship is not nearly as strong in Nigeria. Although the univariate elasticities for father's income are nearly as large as those in Thailand, the elasticities from the multivariate analysis are much smaller. It has to be taken into account, however, that the equation for Nigeria controls for many more variables, including the wife's income. The mother's income turns out to be more important in Nigeria. The elasticities for her income are considerably larger than those for the father's income, especially after controlling for other variables. Nigeria also presents larger coefficients for both the mother's and the father's income in rural areas than in urban areas. These results do not support the argument that there is a greater opportunity in urban areas to purchase goods and services that affect health.

In Sri Lanka, the income elasticity of child mortality appears to be strongest in rural areas. The urban coefficient is even positive in the bivariate relationship but becomes negative once one is controlling for the other socio-economic variables. The elasticity of mortality with regard to income in Sri Lanka is relatively similar to that in Nigeria.

Summary and conclusions

Findings from this analysis of the income/wealth-child mortality relationship can be summarized in the following points:

(a) In the univariate analysis, the child mortality ratios generally show a pattern of declining ratios with increasing income and wealth, but the decline is not always monotonic;

(b) Cross-tabulations of the child mortality ratios by the father's income or wealth and the mother's education reveal strong support for the importance of maternal education within income categories; support for the importance of income/wealth variables in most countries, but practically no support for the suggestion of an interaction between the two;

(c) In multivariate relations, except for the anomalously high mortality among those with highest income, the relationship between income and wealth and child mortality is regular. In accordance with expectations, the partial regression coefficients for all countries tend to decrease as income increases;

(d) Introducing income as a continuous variable and calculating income elasticities essentially confirms the patterns described above. Thailand shows the highest and most significant elasticities in the bivariate regression, as well as in the multivariate case (see table VIII.12);

(e) In Nigeria and Sri Lanka, income elasticities are higher in rural areas, but in Thailand they are higher in urban areas;

(f) In Nigeria, where this issue is investigated for what is apparently the first time, the elasticity of child mortality with regard to the mother's income is higher than that with regard to father's income, especially in rural areas.

(g) Removal of income from the regression equations for Nigeria and Thailand does not substantially alter the remaining coefficients.

Drawing generalizations from these results must be done cautiously, bearing in mind the variety of income and wealth indicators that have been used and the small number of countries in the data set that have information on this variable. The most general conclusion that can be made is that the negative association between income or wealth and child mortality seems to prevail for all countries, although the associations are much weaker in the multivariate analysis than in the univariate analysis. For future research in that field, it is important to examine many more countries and to find a more satisfactory solution to the problem of measuring material resources. The wealth indicators specifying the number of consumer durables owned out of a fixed list of such goods apparently gave useful results here and could easily be asked in many surveys, although they will be difficult to standardize in order to make them comparable across different cultures and different stages of economic development.

Note

1/ Exchange rates, inflators and figures for gross national product per capita were taken from the World Tables published for the World Bank, 1980, second edition.

Table VIII.6 Ratio of observed to expected deaths by wealth indicators and mother's education (expected deaths in parentheses)

AFRICA

Ghana

Ownership of house	Mother's education				
	None	Primary	Middle	Secondary	Higher
Owner	1.167 (38453)	0.754 (1654)	0.566 (1357)	0.459 (47)	0.261 (80)
Rent free	0.965 (17140)	0.785 (1424)	0.596 (1314)	0.413 (31)	0.518 (50)
Rent	0.830 (8116)	0.672 (985)	0.475 (1975)	0.389 (77)	0.339 (212)

ASIA

Republic of Korea

Number of goods owned by household	Mother's education			
	None	1-6 years	7-9 years	10 years or more
None	1.378 (213)	1.149 (71)	a/	a/
1 item	1.106 (318)	1.199 (110)	a/	a/
2-3 items	1.118 (549)	1.049 (361)	0.939 (33)	0.474 (15)
4-5 items	0.922 (328)	0.813 (391)	0.642 (68)	0.668 (34)
6-7 items	0.918 (86)	0.843 (199)	0.789 (60)	0.810 (45)
8 items or more	1.688 (13)	0.428 (34)	0.828 (44)	0.578 (120)

a/ Fewer than 10 expected deaths.

Table VIII.2 Ratio of observed to expected deaths by income of household member as proportion of per capita GNP (expected deaths in parentheses)

<u>Nigeria</u>

Household income per member as proportion of national GNP per capita	Ratio
0-0.22	1.091 (1087)
0.23-0.44	1.176 (315)
0.45-0.66	0.926 (179)
0.67-1.33	0.802 (278)
1.34-2.00	0.582 (118)
2.01-4.00	0.417 (55)
4.01+	a/
Missing	1.060 (432)

a/ Fewer than 10 expected deaths.

Table VIII.3 Ratio of observed to expected deaths by a household's ownership of consumer goods (expected deaths in parentheses)

Number of goods owned by household[a]	Sierra Leone	Republic of Korea
None	1.455 (22)	1.320 (286)
1	0.895 (238)	1.132 (433)
2-3	1.034 (581)	1.076 (959)
4-5	0.963 (549)	0.836 (822)
6+	0.914 (70)	0.819 (504)

a/ Out of a list of specified goods.

Table VIII.4 Ratio of observed to expected deaths by certain indicators of wealth (expected deaths in parentheses)

Indicator of wealth	Ratio
Ghana	
Ownership of house	
Owner	1.128 (41590)
Not owner but rent free	0.936 (19960)
Rent	0.743 (11367)
Sudan	
Ownership of land	
Have land	0.962 (34)
Have no land	0.968 (634)
Chile	
Number of servants	
None	1.022 (4060)
One	0.549 (225)
Two and more	0.271 (27)

Table VIII.5 Ratio of observed to expected deaths by father's income and mother's education (expected deaths in parentheses)

Father's income in U.S. dollars	Mother's education: None	1-3 years	4-6 years	7-9 years	10+ years
AFRICA					
Nigeria					
0 - 69	1.198 (488)	0.845 (31)	1.044 (66)	0.897 (28)	0.575 (31)
70 - 139	1.308 (122)	a/	1.016 (11)	a/	a/
140 - 299	1.157 (364)	0.643 (11)	0.541 (28)	1.194 (17)	a/
300 - 499	1.112 (278)	1.376 (18)	0.591 (28)	0.634 (21)	1.154 (16)
600	1.015 (270)	0.973 (20)	0.600 (108)	0.674 (115)	0.518 (131)
ASIA					
Sri Lanka b/					
0 - 69	1.059 (17)	1.250 (24)	a/		a/
70 - 139	1.885 (50)	1.403 (67)	1.191 (13)		a/
140 - 299	1.515 (128)	1.556 (134)	0.529 (70)		0.520 (9)
300 - 499	0.588 (30)	0.618 (94)	0.716 (120)		0.521 (59)
600	a/	0.685 (18)	0.415 (38)		0.390 (40)

Table VIII.5 (continued)

Father's income in U.S. dollars	Mother's education				
	None	1-3 years	4-6 years	7-9 years	10+ years
			ASIA (continued)		
			Thailand[c/]		
0 - 69	1.401 (233)	1.103 (614)	———	a/	———
70 - 139	0.998 (112)	0.776 (336)	———	a/	———
140 - 299	0.776 (31)	0.721 (181)	———	0.360 (11)	———
300 - 499	1.300 (15)	0.893 (37)	———	a/	———
600	a/	0.882 (13)	———	a/	———

a/ Fewer than 10 expected deaths.
b/ Educational categories for Sri Lanka differ as follow: None, 1-5 years, 6-9 years and 10 years or more.
c/ Educational categories for Thailand differ as follow: None, 1-4 years and 5 years or more.

Table VIII.6 Ratio of observed to expected deaths by wealth indicators and mother's education (expected deaths in parentheses)

AFRICA

Ghana

Ownership of house	Mother's education				
	None	Primary	Middle	Secondary	Higher
Owner	1.167 (38453)	0.754 (1654)	0.566 (1357)	0.459 (47)	0.261 (80)
Rent free	0.965 (17140)	0.785 (1424)	0.596 (1314)	0.413 (31)	0.518 (50)
Rent	0.830 (8116)	0.672 (985)	0.475 (1975)	0.389 (77)	0.339 (212)

ASIA

Republic of Korea

Number of goods owned by household	Mother's education			
	None	1-6 years	7-9 years	10 years or more
None	1.378 (213)	1.149 (71)	a/	a/
1 item	1.106 (318)	1.199 (110)	a/	a/
2-3 items	1.118 (549)	1.049 (361)	0.939 (33)	0.474 (15)
4-5 items	0.922 (328)	0.813 (391)	0.642 (68)	0.668 (34)
6-7 items	0.918 (86)	0.843 (199)	0.789 (60)	0,810 (45)
8 items or more	1.688 (13)	0.428 (34)	0.828 (44)	0.578 (120)

a/ Fewer than 10 expected deaths.

Table VIII.7 Ratio of observed to expected deaths by father's income or wealth and rural-urban residence (expected deaths in parentheses)

Father's income	Area of residence			
	Largest city	Other urban	Rural	
AFRICA				
Ghana				
Owner	0.532 (1072)	1.049 (4940)	1.157 (35578)	
Rent free	0.625 (676)	0.791 (3273)	0.966 (16010)	
Rent	0.607 (2811)	0.730 (5245)	0.877 (3309)	
ASIA				
Sri Lanka[a]				
$0 - 69	b/	b/	1.227 (35)	b/
$70 - 139	b/	0.554 (10)	1.194 (74)	2.306 (48)
$140 - 299	0.941 (25)	1.145 (36)	0.783 (174)	1.698 (113)
$300 - 599	0.652 (36)	0.658 (62)	0.633 (200)	b/
$600	0.641 (12)	0.672 (20)	0.501 (34)	b/
$1000	0.348 (10)	0.495 (9)	0.639 (11)	b/

a/ Categories for Sri Lanka are divided as follow: Largest city, other urban, rural and estate.

b/ Fewer than 10 expected deaths.

Table VIII.8 The effect of income on child mortality: regression coefficients and univariate differences

Income (in U.S. dollars)	Univariate differences	Stage II	Stage IIIR	Stage IIIU
	Nigeria (father) a/			
0-69	0.448	0.138	0.283*	0.036
70-139	0.557	-0.066	-0.197	0.521*
140-299	0.407	-0.011	0.059	-0.039
300-599	0.360	-0.054	0.024	-0.135
600-999	0.192	-0.063	-0.028	-0.082
1000+	0	0	0	0
	Nigeria (mother) a/			
0-69	0.681	0.324**	0.574**	0.282
70-139	0.556	0.317**	0.494**	0.336*
140-299	0.658	0.240*	0.498*	0.215
300-599	0.302	0.060	0.412	-0.073
600-999	0.389	-0.066	0.097	-0.023
1000+	0	0	0	0
	Sri Lanka b/			
0-69	0.696	0.133	0.003	0.914
70-139	0.997	0.201	0.281	-0.308
140-299	0.589	0.003	-0.018	-0.026
300-599	0.091	-0.034	0.021	-0.195
600+	0	0	0	0
Not stated	0.026	-0.069	-0.062	-0.108
	Thailand b/			
0-69	0.283	0.044	-0.084	0.369
70-139	0.023	-0.153	-0.294	0.104
140-299	-0.204	-0.199	-0.366*	0.163
300+	0	0	0	0
Not stated	-0.257	-0.349	-0.172	0.267

* Significant at the .05 level.
** Significant at the .01 level.

a/ Categories based on 1972 U.S. dollars.
b/ Categories based on 1975 U.S. dollars.

Table VIII.9 Regression coefficients with income included and excluded from the model

Independent variable	Stage II		Stage IIIR		Stage IIIU	
	Income included	Income excluded	Income included	Income excluded	Income included	Income excluded
			Nigeria			
Mother's education						
None	0	0	0	0	0	0
1-3 years	-0.216	-0.195	-0.097	-0.122	-0.489**	-0.425**
4-6 years	-0.168*	-0.176*	-0.268*	-0.287*	-0.141	-0.138
7-9 years	-0.005	-0.020	-0.058	-0.057	0.036	0.019
10-11 years	-0.138	-0.207	-0.399	-0.534*	0.045	0.045
12 years or more	-0.092	-0.179	-0.414	-0.677*	0.066	0.014
Father's education						
None 0	0	0	0	0	0	
1-3 years	0.028	0.016	0.030	0.021	0.036	0.062
4-6 years	0.122	0.094	-0.021	-0.035	0.111	0.100
7-9 years	-0.083	-0.118	-0.062	-0.100	-0.173	-0.178
10-11 years	0.209*	0.148	0.437	0.333*	0.023	-0.010
12 years or more	-0.136	-0.180*	-0.028	-0.110	-0.272	-0.276*
Mother's ethnicity						
Yoruba	0	0	0	0	0	0
Northern	0.157	0.177	0.107	0.132	0.194	0.174
Eastern	-0.218	-0.197	-0.392	-0.440	0.009	-0.002
Edo	-0.265**	-0.267**	-0.228*	-0.243*	-0.106	-0.078
Urhobo	-0.481**	-0.442**	-0.558**	-0.534**	0.218	0.236
Other	0.113	0.124	0.114	0.098	0.084	0.090
Mother's religion						
Catholic	0	0	0	0	0	0
Protestant	0.112	0.117	0.157	0.145	0.088	0.066
Muslim	0.191	0.189	0.270	0.241	0.160	0.127
Traditional	0.072	0.073	0.067	0.077	-0.123	-0.266

Table VIII.9 (continued)

Independent variable	Stage II		Stage IIIR		Stage IIIU	
	Income included	Income excluded	Income included	Income excluded	Income included	Income excluded
			Nigeria (continued)			
Maternal grandfather's occupation						
White collar	0	0	0	0	0	0
Agriculture	-0.011	0.011	0.003	0.022	0.051	0.040
Trade and sales	0.024	0.042	0.193	0.199	-0.066	-0.073
Production	-0.138	-0.129	-0.027	-0.054	-0.159	-0.157
Service	0.672**	0.688**	0.234	0.219	0.708**	0.706**
Not employed	0.231	0.254	0.725	0.723	-0.718	-0.635
Paternal grandfather's occupation						
White collar	0	0	0	0	0	0
Agriculture	0.057	-0.046	0.177	-0.037	0.052	0.035
Trade and sales	-0.013	-0.098	0.012	-0.129	0.080	0.055
Production	0.235*	0.138	0.075	-0.114	0.370*	0.365*
Service	0.246	0.193	0.823*	0.684	-0.007	0.014
Not employed	0.348	0.260	-0.594	-0.731	0.570	0.526
Father's occupation						
White collar:						
employee	0	0	0	0	0	0
employer/own account	0.207	0.207	0.369	0.373	0.038	0.052
family	0.315	0.432	-0.405	-0.010	0.205	0.435
Sales:						
employee	0.280	0.226	-0.105	-0.208	0.410	0.383
employer/own account	0.188*	0.179	0.406**	0.399**	-0.064	-0.075
family	0.100	0.085	0.408	0.389	-0.282	-0.174
Agriculture:						
employee	-0.097	-0.094	-0.586	-0.614	0.030	0.013
employer/own account	0.204*	0.224**	0.237	0.285	0.0071	0.107
family	0.233	0.230	0.349	0.379	-0.435	-0.467
Service:						
employee	0.119	0.102	0.284	0.285	0.052	0.031
employer/own account	0.200	0.195	0.176	0.206	0.076	0.079
Production:						
employee	0.149	0.146	0.316	0.320	-0.093	-0.116
employer/own account	0.159	0.147	0.163	0.176	0.066	0.059
Unemployed	-0.236	-0.208	-0.483	-0.343	-0.078	-0.068

Table VIII.9 (continued)

Independent variable	Stage II		Stage IIIR		Stage IIIU	
	Income included	Income excluded	Income included	Income excluded	Income included	Income excluded
			Nigeria (continued)			
Mother's work status						
Employee	0	0	0	0	0	0
Employer/Own account	-0.161	-0.090	-0.494**	-0.427**	0.109	0.193
Unpaid family	-0.308*	-0.210	-0.712**	-0.639**	0.162	0.282
Not employed	-0.294*	-0.119	-0.662**	-0.520**	-0.081	0.143
Rural-urban residence						
Urban	0	0	..	..	..	..
Rural	0.011	0.005	..	..	..	..
Marital status						
Monogamous						
married once	0	0	0	0	0	0
married 2+	0.509**	0.529**	0.676**	0.681**	0.242	0.270
Polygamous						
two wives	0.018	0.015	-0.016	-0.019	0.029	0.030
three wives	0.313**	0.322**	0.232*	0.231*	0.516**	0.510**
Lavatory facility						
Yes	0	0	0	0	0	0
No	-0.011	-0.007	-0.129	-0.131	0.137	0.139
Running water						
Yes	0	0	0	0	0	0
No	0.168*	0.177*	0.185	0.230	0.109	0.121
Electricity						
Yes	0	0	0	0	0	0
No	0.138	0.161*	0.135	0.171	0.090	0.122

Table VIII.9 (continued)

Independent variable	Stage II		Stage IIIR		Stage IIIU	
	Income included	Income excluded	Income included	Income excluded	Income included	Income excluded
			Thailand			
Mother's education						
None	0	0	0	0	0	0
1-4 years	-0.129*	-0.135*	-0.137*	-0.146*	-0.027	-0.002
5-10 years	-0.503**	-0.523**	-0.463*	-0.510*	-0.463*	-0.432
11 years or more	-0.382	-0.411	-0.405	-0.423	-0.397	-0.420
Father's education						
None	0	0	0	0	0	0
1-4 years	-0.042	-0.053	-0.045	-0.056	0.088	0.085
5-10 years	0.019	-0.015	0.061	0.024	-0.002	-0.015
11 years or more	-0.212	-0.228	-0.032	-0.054	-0.301	-0.301
Mother's ethnicity						
Thai	0	0	0	0	0	0
Thai Chinese	-0.317	-0.334	-0.749*	-0.741*	-0.073	-0.103
Chinese	-0.156	-0.148	-0.480	-0.462	0.066	0.034
Mother's religion						
Buddhist	0	0	0	0	0	0
Muslim	0.022	0.024	0.014	0.032	-0.161	-0.138
Other	0.425	0.434	0.202	0.216	0.537*	0.559*
Mother's place of birth						
Urban	0	0	0	0	0	0
Rural	0.121	0.099	0.095	0.069	0.076	0.076

Table VIII.9 (continued)

Independent variable	Stage II		Stage IIIR		Stage IIIU	
	Income included	Income excluded	Income included	Income excluded	Income included	Income excluded
	Thailand (continued)					
Father's occupation						
White collar	0	0	0	0	0	0
Sales:						
employee	-0.092	-0.042	-0.086	-0.035	-0.155	-0.104
employer/own account	-0.016	0.006	0.162	0.195	-0.302	-0.283
Agriculture:						
employee	0.137	0.187	0.161	0.218	0.168	0.229
employer/own account	0.225	0.268*	0.256	0.312*	0.261	0.284
Service:						
employee	0.253	0.266	0.289	0.300	0.147	0.190
employer/own account	0.313	0.371	0.393	0.479	-0.094	-0.186
Production:						
employee	0.075	0.100	0.059	0.096	0.106	0.107
employer/own account	0.347*	0.381*	0.447*	0.486*	0.098	0.167
Not employed	0.255	0.279	0.298	0.331*	-0.037	-0.048
Mother's work status						
Employee	0	0	0	0	0	0
Employer/Own account	-0.254**	-0.278**	-0.234*	-0.265*	-0.307*	-0.300
Not employed	-0.260**	-0.273**	-0.231*	-0.253*	-0.364	-0.340
Rural-urban residence						
Capital	0	0	..	..	..	..
Other urban	0.058	0.050	..	..	..	..
Rural	0.126	0.127	..	..	..	..
Marital status						
Married	0	0	0	0	0	0
Widowed	0.024	0.029	0.043	0.042	-0.225	-0.153
Separated	0.202	0.212	0.325	0.324	-0.411	-0.358

Table VIII.9 (continued)

Independent variable	Stage II		Stage IIIR		Stage IIIU	
	Income included	Income excluded	Income included	Income excluded	Income included	Income excluded
			Thailand (continued)			
Region of residence						
Central Bangkok	0	0	0	0	0	0
Northern	0.214**	0.239**	0.221**	0.245**	0.265	0.272
Northeastern	0.198**	0.252**	0.208**	0.265**	0.152	0.180
Southern	-0.089	-0.073	-0.079	-0.063	-0.127	-0.121
Knowledge of contraception						
Knows efficient method	0	0	0	0	0	0
Knows inefficient method	-0.360	-0.386	-0.376	-0.406		
Knows no method	-0.135	-0.107	-0.148	-0.121	0.097	0.091

* Significant at the .05 level.
** Significant at the .01 level.

Table VIII.10 The effect of household wealth (ownership of goods) on child mortality: regression coefficients and univariate differences

Number of goods owned by household	Univariate differences	Stage II	Stage IIIR	Stage IIIU
	Sierra Leone			
None	0.541	0.439	a/	a/
1	-0.019	-0.017	a/	a/
2-3	0.120	0.012	a/	a/
4-5	0.049	-0.141	a/	a/
6	0	0	a/	a/
	Republic of Korea			
None	0.599	0.332*	0.061	0.445
1	0.411	0.227	-0.077	0.481*
2-3	0.355	0.190	-0.053	0.237
4-5	0.115	-0.017	-0.247	0.038
6-7	0.127	0.043	-0.179	0.074
8+	0	0	0	0

* Significant at the .05 level.

Table VIII.11 The effect of home ownership on child mortality: regression coefficients: Ghana[a/]

Ownership of house	Univariate differences	Stage II	Stage IIIR	Stage IIIU
Owner	0.385	-0.055	-0.138*	-0.041
Not owner, but rent free	0.193	-0.001	-0.096	0.057
Rent	0	0	0	0

* Significant at the .05 level.

a/ Additional regression equations were estimated for Ghana in order to produce coefficients for this and other non-standard variables. These equations included all the usual variables appropriate to each stage in addition to the non-standard variables.

Table VIII.12 Income elasticities of child mortality ratio[a/]
Standard errors in parentheses

Area of residence	Nigeria		Sri Lanka	Thailand
	Father	Mother	Father	Father
Without controlling for other variables				
Total	-0.1590** (0.0223)	-0.1802 (0.0235)	-0.1001 (0.0109)	-0.1988** (0.0267)
Urban	-0.0908** (0.0323)	-0.0900* (0.0386)	0.0270 (0.0208)	-0.2883** (0.0595)
Rural	-0.2169** (0.0337)	-0.2671** (0.0325)	-0.0289* (0.0299)	-0.1644** (0.0129)
After controlling for other variables				
Total	-0.0141 (0.0372)	-0.0725 (0.0376)	-0.0305 (0.0310)	-0.1318** (0.0139)
Urban	0.0143 (0.0516)	-0.0467 (0.0552)	-0.0110 (0.0253)	-0.1987** (0.0645)
Rural	-0.0486 (0.0554)	-0.1621** (0.0549)	-0.0330* (0.0167)	-0.1237** (0.0341)

* Significant at the .05 level.
** Significant at the .01 level.

a/ More precisely, unit changes in the ratio of children dead over children expected dead as a consequence of a unit change in the logarithm of income in constant U.S. dollars.

Chapter IX

MARITAL STATUS AND HOUSEHOLD STRUCTURE

In most societies, the division of labour is arranged in such a way that mothers have almost the entire responsibility for child care, including both infants and young children. They usually put in long hours of attentive care, particularly with regard to the child's feeding. Most commonly, other adults and older children living in the same household or one in the vicinity provide additional support, especially when the mothers are engaged in economic activities within or outside their homes.

This chapter examines the relation of marital status of the mother and household structure to the mortality of her children. Because of the paramount importance of the husband as a main or additional provider of support, it focuses on a woman's marital status as a determinant of child mortality. It examines not only whether she is currently married but also aspects of her marital history, the type of union in which she resides and whether the husband has more than one wife.

Child mortality is investigated in this chapter in relation to the following five aspects of marital status and household structure: whether the mother is currently single, married, widowed or divorced; legal status of union; polygamous versus monogamous union; marital frequency; and presence of other adults and other children in the household. First, births to mothers who have never been married are considered illegitimate. It is a very common finding that illegitimate births (i.e., those conceived by and born to unmarried women) have a higher risk of mortality than do legitimate births. In its comparative study of social and biological effects on perinatal mortality, which focused mainly on developed countries, the World Health Organization (1978) found that, in all the societies studied, illegitimate births had higher rates of perinatal mortality. Much of this higher mortality could be ascribed to the fact that the birth-weight distribution of illegitimate babies was lower. Some additional disadvantage of illegitimate births resulted from their being born disproportionately to teen-age mothers and to women without previous births. An earlier study in Denmark also demonstrated a higher mortality rate and lower birth-weight distribution for illegitimate children (United States National Center for Health Statistics, 1967). A review of Caribbean populations by Roberts (1975) disclosed an infant mortality rate consistently higher for illegitimate than for legitimate births. The differential was much larger in the post-neonatal than in the neonatal period, which suggests that it may be produced principally by environmental factors, including aspects of child care, rather than by endogenous factors present at a child's birth.

Behm (1983) reports that in a study in Bangladesh, the mortality of children of widowed or divorced mothers was found to be higher than that of the currently married. A large United Nations review (1973) also concludes that children of currently married persons very commonly had lower child mortality than children of women in any other marital category. A major explanation offered was the higher socio-economic status of currently married women as reflected, in particular, in their higher educational attainment. It is also possible that widowhood and divorce are associated with substantial stress, which in turn may affect child health. By depriving the mother of a principal means of support for her child-rearing activities, widowhood and divorce may also have a calamitous effect on her financial situation (cf. Taubman and Rosen, 1981). These effects are doubtless culturally mediated. Morley and his associates (1968) reported that, among the Inmesi in Nigeria, a newly widowed or separated woman returned with her children to her parents' family circle and typically remained there until she remarried. Nevertheless, they report that the children received less attention than children in an intact marriage.

The second marital status factor to be considered here is legal status of union. It is typically found that children of consensual unions - those lacking official legal sanction - have higher mortality than children of legal unions. This difference is usually attributed to a lower social status among consensual unions. Carvajal and Burgess (1978) found that infant mortality was higher among the consensually united in Bogotá, Caracas and Rio de Janeiro. The differential appeared to increase with age of mother. The authors argued that because consensual unions did not last as long as legal marriages, on average, children born in these marriages may be prone to higher mortality because of lack of appropriate care. They also suggested that the degree of mortality differential varied directly with the degree of negative sanction against consensual unions that prevails in a country. This relation may also explain, they argue, why differentials are greater among older women, since these women would have generally experienced greater sanctions against consensual unions than would younger women.

Ebanks (1983) has also documented higher infant mortality among consensual unions than legal marriages in Trinidad and Tobago. He suggests that parity may be an important intervening mechanism, since the consensual unions have higher fertility.

We now turn to another aspect of marriage, polygamous versus monogamous unions. There are several reasons to expect that polygamous unions in some societies might have lower child mortality. First, polygamy may increase the length of the interbirth interval for a woman by delaying the resumption of intercourse after childbirth or by reducing frequency of intercourse (Okang, 1979). Secondly, the men who take several wives in a polygamous society are generally wealthier (Harrington, 1971; Masden, 1964; Welbourn, cited in Morley and others, 1968), so that polygamy may be associated with increased resources for child-rearing. On the other hand, those resources must be shared among more wives and more children, so that the predicted net effect is ambiguous. Perhaps more important is the association between polygamy and traditionalism. All societies have been exposed to some extent to value systems of developed countries, in which polygamy is held in low esteem. Ideas from developed countries are transforming traditional family systems in Africa, where polygamy is most prevalent (Caldwell, 1979). Those who maintain polygamy are to some extent adhering to traditional as opposed to modern practices. In turn, this traditionalism is likely to be associated with traditional health practices. Indeed, a number of studies have shown polygamous marriages to be more traditional in child care and health practices (Tawiah, 1979; Mott, 1979; Harrington, 1971). The study of factors influencing the growth and nutritional status of children in a Nigerian village showed that children of monogamous unions received more attention and better care (Morley and others, 1968). Children of the first wife in a polygamous union generally fared most poorly. This result is surprising because older wives are expected to have more access to household resources and to participate more in decision making. Morley and his associates suggest that the reason for their greater disadvantages in child health may be the higher average parity of first wives. The link between polygamy and traditionalism is made somewhat less precise by the spread of Muslim culture, which sometimes permits the practice of polygamy.

Most studies that have examined differences in child mortality between polygamous and monogamous unions have found that the detrimental effects of polygamy dominate. In Nigeria, the death rate of children in polygamous unions was a third higher than that of children in monogamous unions (Caldwell, 1979). Harrington (1971) revealed that in Burkina Faso,1/ the Niger and in two regions of Ghana, infant mortality in rural areas was higher among polygamous unions. Okang (1979) found that urban infant mortality was 30 per cent higher in Ghana among those who were polygamously married than among monogamous unions. Tawiah (1979) reports, again for Ghana, that the disadvantages of children of polygamous unions are greater in urban than rural areas.

Polygamy has not always been found to increase mortality. A study of nine villages in Sierra Leone showed that infant survival was independent of whether the woman was in a monogamous or polygamous relationship (Isaac and Feinberg, 1982). Furthermore, a child's probability of dying appeared to be unrelated to the mother's rank within the polygamous household. Children of the first of "big wives " were no more disadvantaged than the children of "junior co-wives", a finding that contrasts with the report of Morley and his associates (1968).

The fourth determinant of child mortality in this chapter is continuity and frequency of marriage. Discontinuity in marriage is expected to reduce the resources available for raising children, particularly children from earlier marriages. Separation of the original spouses means that at least one of them is not physically living with the child to provide the resources normally expected. Very little empirical work has been done to verify this hypothesis. Ebanks (1983) uses World Fertility Survey data for Trinidad and Tobago to show that child mortality is higher for mothers who have been in more unions. Women in continuous unions experience the lowest child mortality. These findings do not control other variables with which frequency of union may be associated.

Lastly, the presence of other adults and children, including both relatives and non-relatives is considered to be related to child mortality. The availability of other adults in the household, in addition to the mother and her husband, is expected to reduce mortality, because these added adults are able to participate in child care when the parents are absent or indisposed. In addition to this direct effect, it is also possible that additional adults represent an augmentation or a drain on a family's resources, depending upon their economic role. Perhaps most important, the presence of added kin may represent an aspect of traditionalism in family relations, a traditionalism that may carry over into child care practices with, typically, deleterious effects on child health.

The traditionalism explanation was invoked to explain why couples who lived in an extended family setting during the two years immediately following marriage at Khartoum appeared to have higher mortality by from 5 to 6 per cent after controlling other socio-economic factors (Farah and Preston, 1982). On the other hand, Butz and his colleagues (1982) found that an increase in the "number of grandparents and other relatives in the household" substantially reduced infant mortality. They contend that a family may seek aid from other relatives in order to combat detrimental conditions that may arise from the mother's inability to care for her infant.

Measurement

Although all data sets studied here include some information on marital status, different sample definitions pose some limits to the analysis of marital status differentials in some countries. The sample of only three countries, i.e., Chile, Kenya and Liberia, contain women of all major marital status categories, including single women. The samples are limited to ever-married women in Ghana, Indonesia, Jamaica, Lesotho, Nepal, Peru, the Republic of Korea, Sierra Leone, Sri Lanka, the Sudan and Thailand, and to currently married women in Nigeria.

Data on special aspects of marital life are available for some countries. Monogamous marriage and polygamous marriage are distinguished in data sets from five African countries, Ghana, Kenya, Lesotho, Nigeria and Sierra Leone. In Kenya and Lesotho, the rank of women in polygamous marriage was asked. Legal marriage and consensual union are distinguished in the three Latin American countries, Chile, Jamaica and Peru. The number of previous marriages was asked in Jamaica, Kenya, Lesotho, Nigeria, Peru and Sri Lanka. In addition, information on the relation of the respondent to the head of household in Chile, Ghana and the Republic of Korea could supplement the analysis by marital status in these countries. All of these data were obtained by asking respondents relatively straightforward questions such as "Are you now married, widowed, divorced or separated?"

It should be reiterated that, except for certain aspects of a woman's marital history, the variables considered relate to a woman's current status at the time of survey, whereas the mortality of children pertains to earlier periods. The timing of the measurement of variables will generally bias downward the effect of marital status on mortality, because it introduces a form of "measurement error" into the independent variables. However, in one respect, it may also exaggerate the impact of a variable on mortality if child mortality has affected a woman's status. For example, a child's death could destabilize a union and lead to separation or divorce. In this case, mortality would have helped to shape one's current status, rather than status shaping mortality. There is no hope of disentangling such reverse causation in the type of data examined here; one can only attempt to be cautious in the conclusions drawn.

Univariate results

Table IX.1 presents the basic tabulation of child mortality by the mother's current marital status for the countries reviewed. As expected, it shows that currently married women, in general, have lower child mortality levels than widowed, divorced or separated women, with three exceptions - Jamaica, Peru and Sierra Leone. The major surprise in the table relates to single women, whose children have mortality levels substantially below average in Chile, Kenya and Liberia, the only three countries where the category was examined. It is very unlikely that illegitimate births in these countries reverse the mortality pattern commonly observed. Most likely, single women are less inclined to mention a child who has died than women who have been, or currently are, married.

The role of polygamous as compared with monogamous unions can be investigated in table IX.2 for five countries, all of them in Africa. In all five countries, women in polygamous marriages have higher child mortality than monogamously married women. In Kenya and Lesotho, it was possible to examine child mortality according to the rank of the mother as a wife in polygamy. Table IX.3 shows that first wives (i.e., women whose duration in current union is the highest) have slightly higher child mortality than higher order wives in Kenya and slightly lower child mortality than second order wives in Lesotho. Thus, no systematic variation by this factor is found.

Women who have married more than once appear to have very high child mortality in the four countries of Africa and Asia (Kenya, Lesotho, Nigeria and Sri Lanka) where they can be examined (table IX.4). Mortality ratios are elevated by 61 per cent in Kenya, 52 per cent in Lesotho, 73 per cent in Nigeria and 42 per cent in Sri Lanka. It seems very surprising that such women who are able to remarry should have higher child mortality than women who have remained divorced or widowed. (Compare results for Kenya, Lesotho and Sri Lanka in tables IX.1 and IX.4.) One possible explanation is that the death of a child may, for some women, actually facilitate remarriage. In any event, it is again clear that the mere presence of a husband does not always confer a special advantage, particularly if the husband is not the father of all of a woman's children. In Jamaica and Peru, on the other hand, women married more than once experience similar high child mortality levels to those of women married once, perhaps because less stigma is attached to such women under the somewhat more fluid marriage systems that prevail there.

It is the three countries in Latin America that provide information on the relative child mortality in consensual or non-sanctioned unions. Once again, these women do not appear to be particularly disadvantaged in child-rearing either in Jamaica or Peru (table IX.5). It should be noted that consensual unions are very popular in the Caribbean region, so that there is no strong reason to expect substantial sanction against women in consensual unions in Jamaica. Only in Chile, where a high fraction of the population is of European descent, is living in a consensual union associated with a high level of child mortality.

A breakdown of child mortality in Ghana and the Republic of Korea according to the marital status of a woman and whether she lives in a nuclear or extended family setting is given in table IX.6. Married women living in extended families present very similar child mortality to that of married women living in nuclear families. But the patterns for not married women are not consistent.

Table IX.7 shows mortality ratios by the mother's relationship to the head of household in Chile. Differences are evident for consensual cohabitors, who have unusually high mortality as shown in table IX.5, and for the children, grandchildren and the non-relatives of the head, which are the lowest mortality categories.

Multivariate results

Next to be investigated is the degree to which the marital status/household differentials just described are maintained when other social and economic variables are introduced. As shown in the literature review, an important explanation of several differentials is the association of a category with social and economic characteristics. Given that information on the set of husband's characteristics is not available in women who are not currently married, the present multivariate investigation of marital status differences in non-World Fertility Survey countries introduces only women's characteristics.2/

The group of women who are once and currently married in monogamous unions was selected as the reference category, and child mortality in all other marital categories is compared to that in the reference category. The relation between marital status and child mortality remains quite strong in multiple regression, particularly in Africa and Asia. Table IX.8 shows a predominance of positive coefficients, meaning that the majority of marital categories in nearly all countries have higher mortality than that occurring among once and currently married women in monogamous unions.

Marital frequency differentials in child mortality generally remain quite large in Africa and Asia after controlling other variables. In the four African and Asian countries where the effects can be studied (Kenya, Lesotho, Nigeria and Sri Lanka), the relative disadvantage of those married more than once ranges from 38 per cent higher mortality in Sri Lanka to 51 per cent in Nigeria. All five pairs of coefficients, including two pairs in Nigeria, one for the monogamously married and the other for the polygamously married, are significant, and in all four countries the category "married more than once" is the most seriously disadvantaged in child mortality levels. This is a surprising finding, because there are reasons to suppose that a woman who has married a second time should have more resources at her disposal than women who are currently divorced, separated or widowed. On the other hand, it might be hypothesized that remarried women are more likely to be traditional: a traditional culture may facilitate their remarrying brothers-in-law, cousins etc. It may be that children from earlier unions suffer relative neglect when a woman remarries or that, as argued above, the death of children in earlier unions facilitates remarriage. Investigation into the timing of events of death and remarriage would shed light on this issue. On the contrary, in the two Latin American countries where this category is studied, children of women married more than once exhibit lower mortality (in Jamaica) or only slightly higher mortality (in Peru) than those of women married only once.

At the multivariate level, the categories of widowed/divorced/separated continue to be associated with excess mortality, with few exceptions. Ten of the 11 coefficients that are significant at the 5 per cent level among the widowed/divorced/separated are all positive, the only exception being the widowed in Indonesia. The effect of being in these categories is particularly strong in Nepal and Kenya, with a range of from 23 to 35 per cent excess mortality. But none of the significant coefficients for these variables in any country is as high as the lowest of the coefficients for the monogamously married more than once in the four countries of Africa and Asia where this variable could be measured. It appears that the effect on child mortality of marital status is not as large as that of marital frequency.

In the four African countries where the mortality effects of polygamy can be investigated, polygamous unions are clearly disadvantageous. Five of the nine coefficients are significant at the 5 per cent level, and eight are positive. The excess mortality range from 4 per cent in Sierra Leone to 34 per cent in Nigeria.[3/] It is important to recognize that polygamous unions are not simply acting as a proxy for religion, ethnicity or certain socio-economic variables, since these are controlled in table IX.8. Polygamy itself is associated with excess mortality, probably operating through a dilution of household resources. However, there continues to be no clear association between the number of wives in a polygamous union and child mortality.

The effect of consensual union can be examined for the three Latin American countries. The multivariate results imply that the consensual union has the effect of raising child mortality by 20 per cent in Chile and 9 per cent in Jamaica after controlling the other variables, although the effect is slightly negative in Peru. Its effect in Chile is significant, which helps to reject the speculation that the consensually united are disadvantaged mainly because of their lower socio-economic status.

Rural/urban differences in multivariate results are not particularly marked or systematic when compared interregionally. One regional pattern that can be clearly seen is that there are more significantly positive coefficients in rural than urban areas in Africa. One possible interpretation of these rural/urban differences in the African countries is that women who are not in the normative category - monogamously married once, husband present - are better able to find alternative means of support or to experience reduced social sanctions in urban areas than in rural areas.

The relationship between household structure (nuclear versus extended) and child mortality is given in table IX.9. Living in an extended family raises child mortality significantly in Ghana but reduces child mortality slightly in Chile and the Republic of Korea.

Summary and conclusion

Both univariate and multivariate results show that mortality of children is raised if the woman is not currently married, if she has married more than once or if she is in a polygamous union. However, the evidence is not conclusive about the effect of consensual versus legal unions. Overall, it appears that there is a strong, direct association between stable family relationships and low levels of child mortality, although the direction of causation cannot be inferred from the data.

Notes

1/ Formerly called Upper Volta.

2/ Women in World Fertility Survey countries who were not married at the time of the survey were questioned about previous mates. Women in Kenya, however, who had children, but had never been married, were not asked about the father(s) of their children.

3/ This is the difference between the averages of monogamous coefficients and polygamous coefficients.

Table IX.1. Ratio of observed to expected deaths, by marital status (expected deaths in parentheses)

<table>
<tr><th rowspan="2">Marital status</th><th colspan="6">AFRICA</th><th colspan="5">ASIA</th><th colspan="3">LATIN AMERICA</th></tr>
<tr><th>Ghana</th><th>Kenya</th><th>Lesotho</th><th>Liberia</th><th>Sierra Leone</th><th>Sudan</th><th>Indonesia</th><th>Nepal</th><th>Republic of Korea</th><th>Sri Lanka</th><th>Thailand</th><th>Chile</th><th>Jamaica</th><th>Peru</th></tr>
<tr><td>Married[a/]</td><td>0.993
(63199)</td><td>0.964
(4560)</td><td>0.975
(1649)</td><td>1.000
(21974)</td><td>0.999
(1319)</td><td>0.935
(592)</td><td>0.965
(79808)</td><td>0.985
(4563)</td><td>0.952
(2755)</td><td>0.962
(2471)</td><td>1.011
(1831)</td><td>1.018
(3808)</td><td>1.067
(594)</td><td>1.022
(4171)</td></tr>
<tr><td>Widowed</td><td>1.324
(3364)</td><td>1.173
(251)</td><td>1.013
(225)</td><td>1.214
(399)</td><td>0.901
(17)</td><td>1.063
(57)</td><td>1.132
(9190)</td><td>1.203
(378)</td><td rowspan="2">1.503
(254)</td><td>1.164
(184)</td><td>1.150
(82)</td><td>1.026
(31)</td><td rowspan="2">0.886
(112)</td><td>1.424
(163)</td></tr>
<tr><td>Divorced or separated</td><td>1.045
(6377)</td><td>1.083
(192)</td><td>1.136
(265)</td><td>1.171
(1003)</td><td>0.963
(43)</td><td>1.656
(20)</td><td>1.123
(6222)</td><td>1.286
(47)</td><td>1.348
(80)</td><td>1.111
(63)</td><td>1.116
(96)</td><td>0.934
(256)</td></tr>
<tr><td>Single</td><td>..</td><td>0.775
(85)</td><td>..</td><td>0.716
(1260)</td><td>..</td><td>..</td><td>..</td><td>..</td><td>..</td><td>..</td><td>..</td><td>0.688
(347)</td><td>..</td><td>..</td></tr>
</table>

a/ Includes consensual union.

Table IX.2 Ratio of observed to expected deaths by type of marriage,[a] African countries (expected death in parenthesis)

Type of marriage	Ghana	Kenya	Lesotho	Nigeria	Sierra Leone
Monogamously married	0.925 (35811)	0.880 (3149)	0.962 (1501)	0.923 (1528)	0.938 (431)
Polygamously married	1.082 (27387)	1.152 (1411)	1.106 (148)	1.159 (878)	1.029 (888)

a/ For currently married women only.

Table IX.3 Ratio of observed to expected deaths by rank of mother in polygamous unions (expected deaths in parentheses)

Rank of mother	Kenya	Lesotho
First wife	1.192 (593)	1.093 (19)
Second wife	1.117 (636)	1.164 (126)
Greater than two	1.143 (181)	0.609 (15)

Table IX.4 Ratio of observed to expected deaths by marital frequency[a/]
(expected death in parenthesis)

Marital frequency	AFRICA			ASIA	LATIN AMERICA	
	Kenya	Lesotho	Nigeria	Sri Lanka	Jamaica	Peru
Once	0.843 (2958)	0.954 (1479)	0.878 (1434)	0.941 (2349)	1.074 (251)	1.015 (3617)
More than once	1.452 (191)	1.472 (22)	1.604 (94)	1.357 (123)	1.062 (343)	1.064 (554)

a/ For women who are currently in monogamous marriage.

Table IX.5 Ratio of observed to expected deaths by legal status of current marriage (expected deaths in parenthesis)

Legal status of marriage	Chile	Jamaica	Peru
Legally married	0.998 (3600)	1.037 (297)	1.025 (3313)
Consensual union	1.365 (208)	1.098 (296)	1.010 (858)

Table IX.6 Ratio of observed to expected deaths by type of family and marital status (expected deaths in parenthesis)

Type of family	Ghana		Republic of Korea	
	Married	Not married	Married	Not married
Nuclear family	0.952 (33141)	1.091 (3268)	0.956 (2066)	1.547 (187)
Extended family	0.941 (12897)	1.667 (6473)	0.940 (689)	1.379 (66)

Table IX.7 Ratio of observed to expected deaths by mother's relationship to head of household, Chile (expected deaths in parentheses)

Mother's relationship to head of household	Ratio
Head	1.094 (279)
Spouse	1.009 (2898)
Consensual cohabitator	1.259 (170)
Child	0.793 (466)
Parent or parent in law	a/
Grandchild	0.857 (15)
Other relatives	0.957 (292)
Non-relatives	0.872 (184)
Unknown	2.285 (13)

a/ Fewer than 10 expected deaths.

Table IX.8 The effect of marital status on child mortality: regression coefficients

Marital status	Univariate differences	Stage II	Stage IIIR	Stage IIIU
	AFRICA			
	Ghana[a/]			
Married; monogamous	0	0		
Married; polygamous	0.157	0.057**		
Widowed	0.399	0.071		
Divorced	0.132	0.172*		
Separated	0.055	0.142*		
	Kenya[b/]			
Married; monogamous once	0	0	0	0
Married; monogamous more than once	0.609	0.433**	0.466**	0.158
Married; polygamous; husband has 2 wives	0.295	0.147**	0.171**	-0.016
Married; polygamous; husband has 3+ wives	0.343	0.117*	0.119*	0.043
Widowed	0.330	0.234**	0.275**	-0.072
Divorced	0.217	0.265**	0.318**	0.080
Separated	0.263	0.245*	0.119	0.577**
	Lesotho			
Married; monogamous once	0	0	0	0
Married; monogamous more than once	0.518	0.469*	0.551*	-0.420
Married; polygamous; husband has 2 wives	0.195	0.188*	0.226*	-0.201
Married; polygamous; husband has 3+ wives	-0.204	-0.139	-0.110	0.323
Widowed	0.059	-0.010	0.009	-0.101
Divorced	0.334	0.290**	0.311**	0.078
Separated	0.075	0.066	0.072	0.278
	Liberia[a/]			
Married; monogamous once	0	0	0	0
Widowed	0.214	0.075	0.110*	-0.039
Divorced or separated	0.171	0.120**	0.071	0.192**
Single	-0.284	-0.178**	-0.233**	-0.097*
	Nigeria			
Married; monogamous once	0	0	0	0
Married; monogamous more than once	0.726	0.509**	0.676**	0.242
Married; polygamous once	0.231	0.018	-0.016	0.029
Married; polygamous more than once	0.485	0.313**	0.232*	0.516**

Table IX.8 (continued)

Marital status	Univariate differences	Stage II	Stage IIIR	Stage IIIU
AFRICA (continued)				
Sierra Leone[a]				
Married; monogamous once	0	0	c/	c/
Married; polygamous; husband has 2 wives	0.065	0.035	c/	c/
Married; polygamous; husband has 3+ wives	0.106	0.099	c/	c/
Widowed	-0.037	-0.135	c/	c/
Divorced or separated	-0.025	-0.071	c/	c/
Single	0.069	0.325	c/	c/
Sudan[a]				
Married; monogamous	0	0	c/	c/
Widowed	0.128	0.027	c/	c/
Divorced	0.721	0.539	c/	c/
ASIA				
Indonesia[a]				
Married	0	0		
Widowed	0.169	-0.087**		
Divorced	0.262	0.100*		
Separated	0.068	-0.032		
Nepal				
Married; monogamous once	0	0	c/	c/
Widowed	0.218	0.237**	c/	c/
Divorced or separated	0.309	0.354**	c/	c/
Republic of Korea[a]				
Married	0	0		
Widowed, divorced or separated	0.551	0.806		
Sri Lanka				
Married; monogamous once	0	0	0	0
Married; monogamous more than once	0.416	0.381**	0.311**	0.678*
Widowed	0.222	0.138	0.133	0.138
Divorced	-0.228	-0.312	-0.199	-0.406
Separated	0.477	0.221	0.364*	-0.229

Table IX.8 (continued)

Marital status	Univariate differences	Stage II	Stage IIIR	Stage IIIU
	ASIA (continued)			
	Thailand			
Married	0	0	0	0
Widowed	0.139	0.020	0.044	-0.243
Divorced or separated	0.100	0.202	0.327	-0.417
	LATIN AMERICA			
	Chile[a/]			
Married	0	0		
Widowed	0.028	0.062		
Divorced or separated	0.118	0.159		
Single	-0.310	-0.417**		
Consensual	0.367	0.200**		
	Jamaica			
Married; once	0	0	0	0
Married; more than once	0.278	-0.043	0.110	-0.155
Widowed, divorced or separated	0.099	-0.155	-0.219	-0.020
Consensual once	0.327	0.142	0.392	-0.131
Consensual more than once	0.264	0.092	0.079	0.202
	Peru			
Married; once	0	0	0	0
Married; more than once	0.054	0.037	-0.096	0.175*
Widowed	0.403	0.141	0.112	0.122
Divorced	0.158	0.239	-0.895	0.394
Separated	-0.098	-0.012	-0.092	0.037
Consensual once	-0.037	-0.075	-0.092	-0.045
Consensual more than once	0.034	-0.053	0.007	-0.079

* Significant at the .05 level.
** Significant at the .01 level.

Table IX.8 (continued)

a/ In principle, women who are not matched with their husbands are excluded in Stage II in order to introduce characteristics of husbands into multivariage analysis. The availability of information on husbands, however, is related to the current marital status of women. The association is strong particularly for Ghana, Indonesia, the Republic of Korea, Sierra Leone and the Sudan, thereby making regression coefficients extremely unreliable or even unestimable. Therefore, a second version of Stage II regression analysis has been conducted, including women who are not matched with their husbands and thus deleting characteristics of husbands from the multivariate model. Stage II coefficients presented for the five countries are results of the second version of regression analysis. Because of this problem and special treatment, it was decided for multivariate analysis not to proceed to Stages IIIR and IIIU.

b/ Although information on child mortality is available for single women in the Kenyan data set, the "single" category is not included in the multivariate analysis. All women with missing information on husbands occupation are single, which makes it impossible to include both the "missing" category for father's occupation and the "single" category for mother's marital status, in the multivariate analysis.

c/ Stages IIIR and IIIU are omitted from Sierra Leone, the Sudan and Nepal because the sample was totally or predominantly rural.

Table IX.9. The effect of type of family on child mortality: regression coefficients

Type of family	Univariate differences	Stage II	Stage IIIR	Stage IIIU
	Ghana			
Nuclear	0	0	0	0
Extended	0.220	0.061**	0.062*	0.030
	Republic of Korea			
Nuclear	0	0	0	0
Extended	-0.027	-0.026	-0.069	0.045
	Chile			
Nuclear	0	0	0	0
Extended	-0.088	-0.014	-0.002	-0.016

* Significant at the .05 level.
** Significant at the .01 level.

Chapter X

CHARACTERISTICS OF HOUSING, INCLUDING LAVATORY AND WATER SUPPLY FACILITIES

The characteristics of the dwelling-place have long been recognized as an important influence on infant and child mortality. In part because of their perceived health effects, the United Nations General Assembly, in its resolution 35/18, proclaimed 1981-1990 as the International Drinking Water Supply and Sanitation Decade. During the decade, Member States will assume a commitment to improve substantially the standards and levels of potable water-supply and sanitation services by the year 1990. In this chapter, previous reports on the effect of these and other housing-related variables on child mortality are briefly reviewed, and these relationships in the countries being studied are then examined.

The majority of relevant studies of the impact of housing conditions on mortality have focused on the presence and type of water-supply, the type of lavatory facilities, the power source and the type of building materials used to construct the house. Harrington's (1974) study of West African societies views a child's chance of survival as the outcome of a series of factors governing exposure to disease and those encompassing the course and outcome of disease. These factors can be conveniently summarized as exposure and resource variables, the former group including environmental and socio-economic elements and the latter containing such components as nutritional status and access to medical care. The type of dwelling affects mortality mainly through the elements of exposure. In addition to Harrington's study of Western Africa, similar approaches are employed in many studies of infant and child mortality in developing countries (Rosenzweig and Wolpin, 1982; Gordon and others, 1967; Roberts, 1973; Frenzen and Hogan, 1982; World Health Organization, 1974 and 1978).

Benjamin (1965) contends that the most important effects of housing conditions on health work through their impact on the incidence of infectious diseases; in particular, he singles out diarrhoeal diseases, which he found to increase in prevalence in England and Wales with the incidence of crowding. Particularly problematical were instances where rooms are used for both day-to-day living and sleeping and where more than one family shared the same sanitary facilities. He calls attention to the difficulty of separating the effects of housing characteristics from other determinants of child mortality with which they are highly correlated: social class, social status, income, unemployment, and urban/rural residence.

The role of infectious disease in mediating the effect of the family dwelling on child mortality has been noted by others. Feachem (1981) points out that, of the infectious diseases related to water-supply and lavatory facilities, diarrhoeal diseases are of the greatest importance and that the reduction of these diseases would be the major benefit of programmes launched to improve dwelling units and the facilities therein.

Rowland (1979) argues that the transmission of infectious diseases in Africa through a polluted water-supply or unsanitary lavatory facilities contributes to the contamination of traditional weaning foods. This argument is supported by the findings of Butz and his colleagues (1982), in Malaysia, that breast-feeding has a larger protective effect on infant mortality in areas where sanitary facilities are poorer.

Variables related to type of dwelling have not always been found to be closely related to child mortality. Using regional data from Bangladesh,[1/] Costa Rica, Mexico and Puerto Rico, Sloan (1971) found that sanitation variables and other measures of the quality of housing explained very little variation in mortality rates, and thus concluded that there is little proof of a causal relationship. He rejects the possibility that measurement errors obscured a strong underlying relationship. The variables found to have the most important effect on mortality among young children were mother's literacy and nutrition (Sloan, 1971).

In his study of neonatal mortality in Sri Lanka, Meegama (1980) examines deaths per 1,000 live births by type of lavatory facility in the dwelling; the lowest mortality, as expected, is associated with the presence of a flush lavatory system or a water seal system and the highest with the absence of any system. Expanding his analysis to include two- and three-way cross-classifications of sanitary facilities with husband's education and mother's literacy, he finds lavatory facilities to have the most important impact on neonatal mortality.

In an ecological study of Sri Lanka, only type-of-dwelling variables were used in an attempt to explain regional variation in the infant mortality rate (Patel, 1981). This study regressed the percentage of households in each district of Sri Lanka having certain basic utilities against the infant mortality rate. A stepwise regression procedure showed that a supply of well-water, the presence of latrines and the presence of asbestos or tiled roofs explained 76 per cent of the regional variation in the dependent variable. One incongruity of the study is the positive sign on the coefficient for latrines. Patel mentions the possibility that some of these variables are acting as proxies for income, and hence that coefficients may overstate the direct effects. Among the variables examined in this chapter, this warning applies in particular to electricity availability but also to a lesser extent to housing structure, water-supply and lavatory facilities.

A study of the determinants of child mortality in the Sudan included variables reflecting the type of household structure. The results show that living in a house made from mud raises child mortality by a statistically significant 6 per cent in the capital city and by 7 per cent in all of the Sudan (Farah and Preston, 1981). One merit of this study is the avoidance of using rural or urban location as a substitute for type of dwelling - a recurring problem in the literature. The general presumption is that rural or urban residence distinguishes sufficiently and clearly between poor and good conditions of sanitation, drinking water and housing structure (Boulier and Paqueo, 1981; Mott, 1979; Caldwell, 1979). In Caldwell's study using Nigerian data, the distinction is between newer and older Ibadan, which makes the generalization less sweeping. The role of dwelling type in rural/urban differentials in child mortality merits much closer attention; accordingly, the present analysis includes a bivariate cross-tabulation of type of dwelling variables with rural or urban residence.

Measurement

The discussion examines the relationships of child mortality and four pertinent aspects of the dwelling-place: housing materials; lavatory facilities; water-supply; and electricity (power source). Data on at least one of these four variables are available in six of the study countries - Ghana, Jamaica, Nigeria, Sierra Leone, Sri Lanka and the Sudan. However, only the data sets for Ghana and Sri Lanka include all of those variables. The Nigerian data set lacks information on housing materials, the data from Sierra Leone and the Sudan do not include the electricity variable and information is missing about housing materials and lavatory facilities in Jamaica.

In most cases, information was obtained by asking respondents straightforward questions about those relevant aspects of their dwelling. In Sri Lanka, however, data on housing materials are based on the observation of interviewers.

Although categories of housing materials, water-supply and electricity appear quite clear, a few remarks about categories of lavatory facilities are needed. Between the most advanced flush lavatory system and the least developed conditions in which bushes and fields are used, there are three major types of intermediate-level facilities: pit latrine, pan/bucket latrine and water seal. A brief outline of these three types is given below on the basis of a more detailed description by Iwugo (1981).

First, the conventional pit latrine consists of a squatting-slab, a pit (which is usually deep) and a superstructure, if provided, around the pit and slab in order to provide some privacy. Excreta are directly dropped into the pit. Since the pits are not vented, strong odour and fly nuisances are found in most of them.

Next, the traditional pan/bucket latrine consists of a squatting-plate and a pan or metal bucket that is located in a small compartment immediately below the squatting-plate. Excreta are deposited into the pan or bucket, which is periodically emptied into a larger collection bucket, which, when full, is then carried to a night-soil collection deposit.

Lastly, the water-seal system is essentially a septic tank located immediately below the squatting-plate. Water is poured into the tank, usually every day, in order to maintain a water seal, which reduces odour and fly and mosquito nuisances very considerably. The three systems can be ordered as pit latrine, pan/bucket latrine and water seal in an increasing order of cost.

Another important distinction is whether the family has the facility in the house or outside. The combination of two dimensions - type of facility and its location - forms the categories of the lavatory facility variable presented in table X.1.

Univariate and bivariate results

Table X.1 shows the levels of child mortality according to different housing characteristics. The first variable is the type of building materials used in the house. In the four countries studied, it is clear that the greatest advantage derives from living in a house constructed from modern materials (concrete, brick or tiles), although the mortality levels of children living in houses constructed with intermediate materials in Ghana and traditional materials in the Sudan are almost as low as those of their modern material counterparts. This result confirms a priori expectations, but examination of the other types of housing structure reveals a more deviant trend. Of the countries for which the information is available, only Ghana displays a deteriorating trend in mortality moving from modern through intermediate to traditional housing. The "other" category in Ghana, which is essentially another "intermediate" category,[3/] is also associated with a mortality level between those of the "modern" and "traditional" categories. Sierra Leone, Sri Lanka and the Sudan, all show the highest mortality ratio for those living in a house constructed with "intermediate" materials - materials that are a combination of both modern and traditional (examples are concrete walls and a thatch roof or a tile roof and mud walls). One tentative explanation of this anomaly is that an intermediate housing structure could indicate hastily constructed temporary housing using whatever materials were at hand, whereas modern and traditional housing may have received greater care in construction. Public health engineers have made the point that because many of these intermediate type houses are built without a general master plan and planning consent, they degenerate into modern slums (Iwugo, 1981). Problems in the quality of data might also be responsible for the anomaly.

To identify whether the disadvantages of intermediate-type dwellings are maintained within urban and rural areas, table X.2 presents a cross-tabulation of child mortality by housing materials and rural or urban area of residence in Ghana and Sri Lanka. Small cell sizes prevent this examination in the other two countries. It is clear from table X.2 that, within urban or rural areas, intermediate housing materials are almost always associated with intermediate mortality conditions. The only exception occurs in the estate areas of Sri Lanka, where intermediate-type dwellings exhibit exceptionally high mortality, which would suggest that the disadvantage of such dwellings is largely a consequence of their disproportionate location in high-mortality areas.

As with housing materials, the greatest mortality advantage with regard to lavatory facilities occurs for those houses with the most modern amenity, a flush lavatory (table X.1). All three countries, Ghana, Nigeria and Sri Lanka, where this amenity is available for a significant number of cases show markedly lower child mortality for this category, with the largest advantage occurring in Ghana. Likewise, the highest mortality category in four of the five countries investigated is "other, field, or none", which is the category in which lavatory facilities are minimal or absent altogether. The private pan/bucket is a relatively advantaged category in Ghana. The other noticeable trend in this variable is the low mortality ratio associated with "outside pan or bucket" in Ghana and Sri Lanka and with "outside pit or cesspool" in Sri Lanka and the Sudan. Again the explanation probably lies in the sanitary engineers' finding that pit latrines are generally very efficiently managed and operated when a clearly defined social system assures the regularity and efficiency of maintenance (Iwugo, 1981). A reversal of the expected pattern is seen in Sierra Leone, where the mortality ratio associated with pit latrines is slightly higher than that of the "other, field, or none" category.

The tendency for the most modern facility to exhibit the lowest mortality ratio is maintained with regard to water-supply and power-source variables. In most countries for which data are available, mortality is lowest where running water is available inside the house and also where electricity is available. Deviations from the expected patterns are found in Sierra Leone, where the child mortality in houses with taps in the household yard is higher than that associated with the water-supply from public taps, and the Sudan, where the mortality level related to pipes in the compounds is slightly higher than that in the households obtaining water from village pipes. A further point to note is the marginally better performance of a river or stream as a source of water-supply, as compared with a well, pump or rainwater in Ghana and Sierra Leone, and the poor performance of pipe outside the house in Sri Lanka. It should be noted that piped water in some areas is more subject to the risk of contamination than water from wells or streams, particularly where the water-supply system is not well maintained.

Multivariate results

Table X.3 shows the net effects of being located in the various dwelling categories, controlling other socio-economic variables. In all cases, the most modern of the dwelling characteristics is chosen as the reference category (modern construction materials, flush lavatory, running water and availability of electricity).

The mortality disadvantages of traditional and intermediate housing materials in relation to modern materials are reduced between the univariate and multivariate stages in Ghana, Sri Lanka and the Sudan, except for the "other" category in Ghana. The disadvantages remain substantial only in Sierra Leone. Similarly, in most countries where pertinent data are available, after other socio-economic variables are controlled, excess mortality levels associated with underdeveloped lavatory and water-supply facilities and the lack of electricity over those related to modern amenities and power sources are reduced, often considerably, and were reversed in some cases.

The results for these few countries suggest, therefore, the relative unimportance of the four dwelling variables in accounting for child mortality differentials. Only two of the 25 non-reference categories at Stage II have mortality levels that are significantly different from the reference category at the 5 per cent level. Seven of the 25 coefficients are negative, indicating that mortality levels in the category are lower than in the modern, reference category when other variables are controlled. Of the 18 positive coefficients, 9 are smaller than +0.10, suggesting that mortality levels are within 10 per cent of those of the reference category. Furthermore, there is very little consistency in the relative position of the lavatory and water-supply variables across the different countries, with positive and negative coefficients for the same variables appearing nearly at random. These results clearly indicate the need of deeper studies controlling, for example, for the quality of water supply rather than a simple classification of facilities. The most consistent results are found for power sources, perhaps because the variable has only two categories. The availability of electricity reduces child mortality by 7-14 per cent in the three countries that are investigated.

The role of dwelling characteristics might be expected to differ between rural and urban areas. One might expect lavatory facilities to be more important in urban areas because naturally-occurring disposal opportunities are surely fewer and the disposed human excreta tend to be more contaminated than in rural areas. On the other hand, the availability of a water-supply at home might be more important in rural areas because distances to alternative sources tend to be greater there. These postulates receive scant support in table X.3. Regression coefficients calculated separately in rural and urban areas do not show any clear and consistent patterns of rural/urban differentials in the impact of the housing variables.

Summary and conclusion

The major findings in this chapter may be summarized as follows: (a) large differentials in child mortality are observed with respect to housing materials, lavatory facilities, water-supply and electricity such that the lowest mortality levels are usually associated with the most modern amenities; (b) when other characteristics of the household are introduced, the large differentials that are evident at the univariate level are, for the most part, obliterated and more anomalies in the relationships between child mortality and dwelling characteristics are observed; (c) no systematic rural/urban differences in the effects on mortality of dwelling characteristics are found.

The results appear somewhat puzzling. Housing characteristics are expected to exert a relatively direct impact on mortality because these conditions are closely related to the risk of exposure to infectious agents (germs, vectors etc.) and the extent to which residents are protected from cold, heat, wind, rain and so on. One would expect that, if these variables are important for child mortality, much of their impact would be retained when other socio-economic variables are introduced. This does not prove to be the case.

The sharp reduction of differentials by dwelling characteristics in multivariate results suggests at least two possibilities. First, attitudes and behaviour related to health practices and personal hygiene, which are considered to be greatly affected by education, may be more important than physical facilities. For example, establishing the habit of washing hands after using lavatory facilities and before meals may have more health impact than the physical structure of the lavatory facilities. At the multivariate stage, this could explain the greater differentials by socio-economic factors, particularly the mother's education, which are considered to be closely related to attitude and behaviour than those by dwelling characteristics. Also, as noted, the fact that a particular type of facility exists does not mean that it is used in anything resembling an optimal fashion.

The second possibility is that each of the four dwelling factors are related to only some particular aspects of disease prevention, whereas socio-economic factors affect overall health promotion in the family. If this is the case, the impact of socio-economic factors operate through many "direct" variables other than dwelling characteristics that are not measured in this study, so that marked mortality differentials by dwelling characteristics observed at the univariate stage are, to a very large extent, a product of the considerable mortality impact of socio-economic factors and the strong association between type of dwelling and socio-economic characteristics.

Notes

1/ It was called East Pakistan at the time of the study.

2/ The sample from the Sudan includes relatively few women living in traditional houses, in spite of the fact that the sample is predominantly rural. The reason for this apparent contradiction is that the sample is restricted to residents of villages in the large Gezira agricultural scheme, which is a special rural development plan and thus include few traditional houses.

3/ The "other" category for Ghana indicates the combination of traditional walls (mud or its variations) and modern roof (corrugated metal or asbestos, concrete, wood or other tiles). The "other" category differs from the "intermediate" category in that the latter has (a) modern walls (brick) and a traditional roof or (b) intermediate walls (corrugated metal or asbestos, packing-cases, bamboo, wooden boards) and a modern or traditional roof.

Table X.1. Ratio of observed to expected deaths, by type of dwelling (expected deaths in parentheses)

Dwelling characteristics	AFRICA				ASIA
	Ghana	Nigeria	Sierra Leone	Sudan	Sri Lanka
Housing materials					
Modern	0.729 (14056)	..	0.644 (79)	0.721 (276)	0.756 (927)
Intermediate	0.795a/ (910)	..	1.038 (719)	1.168 (367)	1.153 (796)
Traditional	1.276 (25198)	..	1.002 (589)	0.733 (26)	1.066 (1014)
Other	0.939 (32748)	..	..	..	..
Lavatory facilities					
Flush toilet	0.502 (1510)	0.825 (855)	b/	..	0.678 (115)
Water seal	..	..	..	..	1.057 (88)
Private pan/ bucket	0.674 (7635)	..	..	..	..
Outside pan/ bucket	0.881 (11577)	..	..	..	0.714 (406)
Private pit	0.862 (5516)	..	..	..	..
Outside pit/ cesspool	0.994 (29808)	..	1.008 (1261)	0.658 (286)	0.891 (1180)
Other/field/none	1.382 (16900)	1.102 (1534)	0.975 (114)	1.198c/ (382)	1.254 (948)

Table X.1. (continued)

Dwelling characteristics	AFRICA				ASIA	LATIN AMERICA
	Ghana	Nigeria	Sierra Leone	Sudan	Sri Lanka	Jamaica
Water supply						
Running water inside	0.569 (3940)	0.639 (578)	0.926 d/ (38)	0.946 (506)	0.598 (103)	0.845 (135)
Private well/ pump	..	..	..	..	0.858 (1021)	..
Pipe outside	0.883 (15274)	..	0.872 e/ (312)	0.925 (105)	1.392 (375)	1.080 (476)
Public well/ public pump/rain	1.110 (12573)	..	..	1.121 (443)	0.955 (1018)	..
River/stream	1.057 (36170)	..	0.981 (597)	1.255 f/ (57)	..	1.118 (34)
Lake/pond/ dam/other	1.195 (4985)	1.103 (1534)	..	..	1.169 (244)	b/
Not stated	..	..	..	..	..	0.697 (17)
Electricity						
Yes	0.582 (6898)	0.714 (711)	..	..	0.619 (251)	0.912 (295)
No	1.058 (66043)	1.134 (1736)	..	..	1.024 (2486)	1.148 (393)
Not stated	..	0.992 (25)	..	..	b/	0.697 (17)

a/ Combines modern walls, traditional roof and intermediate housing materials.
b/ Fewer than 10 expected deaths.
c/ Combines categories "neighbour" and "other".
d/ Tap in household yard.
e/ Public tap.
f/ Includes category "canal".

Table X.2 Ratio of observed to expected deaths by housing type and rural/urban residence (expected deaths in parentheses)

AFRICA

Ghana

Housing type	Area of residence	
	Urban	Rural
Modern	0.629 (8841)	0.898 (5215)
Intermediate	0.693 (658)	1.061 (252)
Traditional	1.465 (1806)	1.261 (23389)
Other	0.843 (6687)	0.964 (26061)

ASIA

Sri Lanka

Housing type	Area of residence			
	Metro Colombo	Other urban	Rural	Estate
Modern	0.657 (96)	0.789 (155)	0.754 (655)	1.036 (21)
Intermediate	0.952 (38)	1.043 (70)	0.885 (479)	1.843 (208)
Traditional	1.173 (19)	1.091 (79)	1.062 (913)	a/

a/ Fewer than 10 expected deaths.

Table X.3 The effect of dwelling characteristics on child mortality: regression coefficients[a] and univariate differences

Dwelling characteristics	Univariate differences[b]	Stage II	Stage IIIR	Stage IIIU
Housing materials				
	Ghana			
Modern	0	0	0	0
Intermediate	0.066	0.012	-0.061	-0.051
Traditional	0.547	0.091	-0.005	0.010
Other	0.210	0.483*	0.423*	0.440*
	Sierra Leone			
Modern	0	0	c/	c/
Intermediate	0.394	0.365**	c/	c/
Traditional	0.358	0.443**	c/	c/
	Sudan			
Modern	0	0	c/	c/
Intermediate	0.447	0.070	c/	c/
Traditional	0.089	-0.610	c/	c/
	Sri Lanka			
Modern	0	0	0	0
Intermediate	0.397	-0.002	-0.011	0.035
Traditional	0.310	0.084	0.114	-0.063
Lavatory facilities				
	Ghana			
Flush	0	0	0	0
Private pan	0.172	-0.039	0.024	-0.029
Outside pan/bucket	0.379	-0.010	0.014	0.033
Private pit	0.360	0.003	0.053	0.072
Outside pit/cesspit	0.492	0.024	0.060	0.012
Other/none	0.880	0.073	0.146	0.142
	Nigeria			
Flush	0	0	0	0
Other/none	0.277	-0.011	-0.129	0.137
	Sierra Leone			
Flush	0	0	c/	c/
Pit latrine	0.420	0.281	c/	c/
Bush/stream/other	0.387	0.179	c/	c/

Table X.3 (continued)

Dwelling characteristics	Univariate differences[b/]	Stage II	Stage IIIR	Stage IIIU
Lavatory facilities (continued)				
	Sudan			
Cesspool	0	0	c/	c/
Neighbour/field	0.540	0.288	c/	c/
	Sri Lanka			
Flush	0	0	0	0
Water seal	0.379	0.119	0.234	0.138
Outside pit	0.213	0.027	-0.039	0.048
Outside pan/bucket	0.036	-0.025	-0.065	-0.097
Other/none	0.576	0.167	0.086	0.215
Water supply				
	Ghana			
Running water inside	0	0	0	0
Pipe outside	0.314	0.062	-0.013	0.075
Well/pump/rain	0.541	0.137	0.110	0.017
River/stream	0.488	0.040	0.010	0.080
Other/lake/pond/dam/none	0.626	0.003	-0.002	-0.145
	Nigeria			
Running water inside	0	0	0	0
Other/lake/pond/dam/none	0.464	0.168*	0.185	0.109
	Sierra Leone			
Tap in household yard	0	0	c/	c/
Public tap	-0.054	-0.162	c/	c/
Well	0.195	-0.090	c/	c/
River/stream/other	0.055	-0.173	c/	c/
	Sudan			
Private pipe	0	0	c/	c/
Public pipe	-0.021	-0.310*	c/	c/
Canal/other/none	-0.287	-0.213	c/	c/

Table X.3 (continued)

Dwelling characteristics	Univariate differences b/	Stage II	Stage IIIR	Stage IIIU
Water supply (continued)				
	Sri Lanka			
Running water inside	0	0	0	0
Pipe outside	0.794	0.112	0.377	-0.088
Well/pump/rain	0.308	0.022	0.218	-0.060
Other	0.571	0.013	0.192	0.431
	Jamaica			
Running water inside	0	0	0	0
Pipe outside	0.235	0.006	-0.100	0.064
River/stream	0.273	-0.077	-0.160	..
Other	0.410	0.055	-0.025	-0.240
Electricity				
	Ghana			
Yes	0	0	0	0
No	0.476	0.071	0.097	0.003
	Nigeria			
Yes	0	0	0	0
No	0.420	0.138	0.177	0.090
	Sri Lanka			
Yes	0	0	0	0
No	0.405	0.073	0.098	0.043

* Significant at the .05 level.

a/ Multivariate analysis for Jamaica does not include the electricity variable because extreme results arise as a statistical artifact of multicollinearity when it is included.

b/ Statistical significance was not calculated for univariate differences.

c/ Sample totally or predominantly rural.

Chapter XI

RURAL-URBAN RESIDENCE

A fundamental distinction in developing societies is whether one lives in the countryside or in an urban area. Place of residence in these societies usually determines people's life-styles, their perceptions of the world and of others; their economic, social, cultural and political activities; and, most importantly for the discussion here, how long they live. It has even been suggested that urban/rural differences transcend in importance many other social and economic characteristics; and that residents of Bangkok, Lima or Nairobi may have more in common with each other than with their own rural countrymen. On the other hand, it may also be true that as a consequence of the development of communication systems, cities, towns and villages are now more closely linked. Knowledge of city life is carried back to the countryside by travellers, and by radio and television. The lot of those in the rural areas is noted by visiting friends and relatives from the city and described by rural migrants.

Because of the life-defining importance of residence - and the frequent availability of statistics distinguishing between rural and urban residence - the rural/urban dichotomy has provided a common point of reference for researchers examining a variety of social and economic characteristics. At first glance, it may seem self-evident that city-dwellers fare better than peasants. However, with respect to mortality, this has not always been true. Before major advances were made in transportation, health and sanitation, and medicine, higher mortality was associated with urban life. Prior to the industrial revolution, the cities in Western European countries were such deadly places that the urban populace could not replace itself and needed a constant stream of migrants from rural areas to facilitate growth (Davis, 1973). This grim fact was apparent to commentators of the time; one of the first students of population, John Graunt, held as a principle that urban mortality was higher than rural mortality (Federici, 1976). Contagious disease, environmental contamination, starvation, and warfare were common threats to urban residents. Sheer crowding facilitated the transmission of infectious disease (Preston and others, 1981). Even as late as the end of the nineteenth century, Weber (1963) found a positive correlation in Europe between size of place and death rates.

The city environment in the new industrial era was compromised in a multitude of ways. Housing units were dark and damp, and intermingled with shops and factories. Because refuse was not collected, streets were dirty. Moreover, sewerage systems did not exist, water-supplies were rarely potable and food supplies often were contaminated (United Nations, 1973; Benjamin, 1965). A cause-of-death analysis confirms the picture of a populace at war with its surroundings; smallpox, typhus, typhoid fever, cholera, childhood diarrhoea, scarlet fever, tuberculosis and bronchitis, all extremely sensitive to the environment, were major killers in cities during the nineteenth century (United Nations, 1973). Life in rural communities was probably not much better, but farmers were at least spared some of the environmental and epidemiological assaults resulting from the transmission of disease vectors in a densely populated area.

It has only been within the past hundred years, with advances in knowledge of the causes of disease transmission, in health and sanitation practices and in medical technology, that cities began to claim an advantage. Today, in developed societies, differentials in infant mortality by area of residence have considerably narrowed; and they no longer show a consistent pattern (Federici, 1976; United Nations, 1982).

Research on mortality in developing countries has frequently shown that mortality is lower in the cities (Behm and Vallin, 1982). Access to health care and the availability of recent medical advances have been suggested as reasons for the urban advantage (Davis, 1973). This view implies that the majority of people in developing countries are subject to higher risks of mortality because they live mainly in rural areas (Behm, 1980).

Yet, there is conflicting evidence. For example, in the United Republic of Tanzania, mortality at Dar-es-Salaam was estimated to be higher than in other urban areas, although this finding was attributed to a more complete register of deaths in the capital (Hogan and Jiwani, 1973). A similar finding was reported for the city of Sao Paulo in the 1960s (Vallin, 1976). Preston and Trussell (1982) found that rural mortality was slightly lower than urban mortality in the Republic of Korea and Sri Lanka.

Identification of rural/urban mortality differentials has been the task of many; explaining why they exist has been the burden of only a few. One of the frequently mentioned possible causes of the disparity is the availability of health resources (Puffer and Serrano, 1973). Throughout the world, there is a well-documented concentration of medical facilities in urban areas, but the maldistribution in less developed societies, where mortality levels are much higher, causes more hardship. Some studies point out that even when facilities are available in rural areas, they are often ill-suited to deliver the primary health services needed by the rural population (United Nations, 1982; Epstein, 1981). The importance of health resources for the urban advantage is mentioned in case studies of Ghana (Tawiah, 1979), Nepal (Thapa and Retherford, 1982), the Philippines (United Nations, 1978) and Sri Lanka (Trussell and Hammerslough, 1983). Although availability of health resources frequently has been cited in the literature, few attempts have been made to define, in a rigorous manner, its real influence on morbidity and mortality. In an analysis of determinants of fertility and child mortality in urban and rural areas of Colombia, some indicators of health input items were examined, such as availability of public and private hospital beds, and access to medical centres, clinics, dispensaries and mobile care units (Rosenzweig and Schultz, 1982). Availability of medical services was found to be associated with lower child mortality in urban areas, particularly among less educated mothers. No effects were found in rural areas.

Below the surface of what might appear to be a straightforward relationship between mortality and place of residence are a set of complex relationships that caution against a simple interpretation (Behm, 1980). It has been suggested that observed disparities in mortality merely reflect the very different socio-economic standards that exist between the countryside and the city in less developed countries (Behm and Vallin, 1982; Gilbert and Gugler, 1982). These socio-economic factors require examination because they may be acting independently on mortality, thus causing a spurious relationship between mortality and type of residence. To illustrate, it has been pointed out that urban populations usually benefit from more and better health resources, but they also have a higher average income and are better educated than rural-dwellers (United Nations, 1982). When income or education are controlled, as has been shown here and by others (Carvalho and Wood, 1978), the gap between urban and rural mortality is considerably reduced.

The effect of a variety of individual and community-level variables on child mortality in urban and rural settings has recently been considered for Colombia (Rosenzweig and Schultz, 1982). Interaction between locale and other factors, which has rarely been examined, is considered by them in some detail. The authors conclude that in the two settings, different sets of factors emerge as important determinants of child mortality.

Measurement

A major problem in analysis of rural/urban differentials has revolved around the definitions of localities and their rural or urban classification; and various criteria have been in use for this purpose. Some countries define localities in terms of administrative boundaries, others conceptualize localities in terms of agglomerations, that is, taking into account the physical structure; and still a third group uses metropolitan areas that are based on administrative units and/or socio-economic characteristics. Other criteria are used to classify a locality as urban: population size; population density; percentage of labour force in non-agricultural activities; function of the city (for example, administrative centre); certain unspecified "urban" characteristics; or a combination of several of these criteria.

The cases included in this study constitute a good example of the variety of criteria used by national statistical offices to classify a locality as urban. Of the 13 countries with national samples, seven use population size as criteria, one uses the function of the city, another uses the characteristics of the localities and four use different combinations of criteria. Even for those which use population size as the criterion, the minimum size required for a locality to be classified as urban varies from 450 to 50,000 inhabitants. (For the definitions of urban population used in this study, see annex IV). While a particular number may be logical for one society, the wide range of definitions weakens any international comparisons of rural/urban mortality differentials (Federici, 1976). Moreover, a simple rural/urban dichotomy cannot begin to portray adequately the variety of situations that exist between the extremes of a capital-metropolis and an isolated hamlet (Behm, 1980). Fortunately, for most of the countries covered in this study, the urban sector itself can be split into two or three segments: the largest urban agglomeration, other large cities and the rest of the urban population.

Univariate results

According to much of the literature reviewed, the relatively more favourable conditions in cities result in a lower level of infant and child mortality than is found in rural areas. Findings from this study show significant differences in mortality favouring urban areas in all countries except Lesotho (table XI.1). In Lesotho, where the population is overwhelmingly rural, the largest city has fewer than 50,000 inhabitants and the rest of the urban population is composed of very small towns, child mortality is slightly lower in rural settings.

Elsewhere, the advantage that urban children hold over rural children ranges from very large in Nepal, Peru and Thailand, to modest in the Republic of Korea and Sri Lanka. There is no evidence of patterning by region or mortality level. Variation in the rural/urban differential within regions is pronounced, although it appears to be somewhat less in Africa than in Latin America or Asia. Some of the variation may result from differences in the definition of an urban area. But even if a uniform demographic definition of an urban area would have been used, a single definition cannot capture the large variety of urban and rural situations. To mention but a few characteristics of the urbanization process in these countries, the size of their urban population varies from fewer than 50,000 in Lesotho to more than 20 million in Indonesia, their proportions urban vary from a few percentage points in Lesotho and Nepal to three quarters in Chile. They also vary greatly in urban structure and in the population size of the main city. Those countries whose urban population is very much concentrated in a large city, and thus more likely to have better health care facilities, may be expected to display greater differentials. But this is not always the case. The large differentials in infant and child mortality in Thailand, with 69 per cent of its urban population concentrated at Bangkok, contrasts with the relatively small variation in Jamaica, with 67 per cent of its urban population concentrated at Kingston-St. Andrew.

It might also be expected that in countries with very high levels of infant and child mortality, the contrast between the experience of women in the large cities - those places which have been characterized as extensions of the developed world or "islands of modernization" - and those in the countryside would be pronounced. However, no such relation is observed. In fact, the three largest differentials are observed in one of the very high mortality countries (Nepal) and two countries of moderate mortality (Peru and Thailand). At the other extreme, relatively small differentials were found in some countries with very high mortality, such as Liberia and Nigeria.

When the comparison is expanded to differentiate between the largest cities and the rest of the urban population, a clear pattern emerges. The largest cities, usually capitals, which would be expected to have the most modern and best-equipped health facilities, present the lowest child mortality in all but a few cases. Life in capital cities is conducive to child survival, either from services the city renders or because residents of large cities experience better socio-economic conditions. Ghana and Kenya in Africa, Nepal and Sri Lanka in Asia, and Chile and Peru in Latin America exhibit their lowest standardized mortality ratios in capital cities. (No information is available for Jamaica, Liberia and Nigeria.) The extent of the advantage that these large cities have over other cities is most pronounced in Ghana (which incorporates the three urban areas of Accra, Kumasi and Sekondi/Takoradi), Nepal and Peru. Women from Nairobi and Mombasa in Kenya and from Santiago in Chile do not have a markedly lower child mortality level than women in other urban areas. Chile and Peru provide somewhat different perspectives on the question of differentials in Latin America (Baum and Arriaga, 1981; Behm, 1980). Child mortality at Santiago is approximately 9 per cent lower than that in other urban areas and 26 per cent lower than that in rural areas. The disparity in Peru is much more pronounced. The level of child mortality at Lima is 31 per cent lower than that for children in other large cities, 54 per cent lower than that for children in small cities and 62 per cent lower than that for rural children. There are some notable exceptions. In the Republic of Korea, child mortality conditions for mothers at Seoul are virtually the same as those experienced by mothers in other urban areas. In Lesotho, the higher mortality observed for children of urban women presents no differential between Maseru and smaller towns. In Indonesia, children residing at Jakarta have a higher mortality level than children in other cities.

Multivariate analysis

Table XI.2 presents regression coefficients for the rural-urban variable. For all countries except Jamaica, Liberia and Nigeria, the reference category is the capital city; in these three countries, only a simple rural/urban dichotomy is possible and the urban area is the reference category. Nepal has been excluded from this analysis because of the very small sample size in urban areas, where expected deaths represent only 2 per cent of total deaths.

Rural or urban residence is a current status characteristic; and, as such, it enters into the model at Stage II, along with a variety of other factors. The picture previously presented of wide variation along rural/urban lines is dramatically changed when other factors are controlled. In most countries, only minor, statistically insignificant differences are found between the capital city, other urban areas and rural areas after controlling other variables. It is clear that the basic reason why urban areas and capital cities generally have lower mortality than other areas in developing counries is the higher social and economic status of urban residents, which is reflected in such indicators as education and occupation, rather than such a feature as better health services, which operates on the ecological level.

Of added interest, moreover, is that for a few countries, the advantage that the capital city holds over other areas at the univariate analysis is turned into a disadvantage when other characteristics are considered. In Ghana, for example, the exceptionally large advantage that children at Accra, Kumasi and Sekondi/Takoradi have over those in other cities or in rural areas becomes a minor disadvantage when other variables are considered at Stage II. One possible explanation for this reversal is that once socio-economic differences across urban or rural groups are controlled, underlying ecological or environmental factors, which work in favour of rural or smaller urban areas, manifest themselves. In these countries, it appears that the advantage enjoyed by capital cities in health services, which may be captured in the rural/urban variable, is outweighed by negative features of the city environment. It must be noted, however, that the reversal does not prove to be significant in any country.

In Asia also, all the countries show a deterioration in the relative standing of children living in the capital city. The advantage that children at Jakarta held over rural children without controls becomes a disadvantage at Stage II. In the Republic of Korea and Sri Lanka, sizeable, but again statistically insignificant, declines were found in the relative standing of mothers in the capital city. In going from univariate results to those of Stage II, the countries of Latin America showed no reversals in the direction of sign; but in Peru, the advantage of mothers at Lima drops off sharply. The disparity between mortality conditions at Lima and those in rural Peruvian areas before any other variables are introduced is the largest disparity of this type found in any country. Nevertheless, virtually nothing remains of that disparity after other variables are introduced.

Summary and conclusion

This chapter considers only the differences between mortality in rural and urban areas, assuming that the structure of relations between mortality and other variables is the same for both places. Not addressed here is the issue of the relative importance to child survival of socio-economic factors in rural and urban settings. The issue of interactions between the ecological setting and the variety of socio-economic factors considered in this study is taken up in separate variable sections.

Results reported in this chapter support the general notion that an urban advantage exists in child mortality. Sometimes, as in Peru, this advantage is extremely large. It has been possible to show, however, that this advantage is not produced by some unmeasured feature of urban life, such as an urban bias in the distribution of health and other public services. The findings from the multivariate analysis suggest that it is the socio-economic characteristics of the urban population, rather than life in the city itself, which explain the superior child survival experience of urban women. When these socio-economic factors are controlled, the urban advantage generally evaporates; and an underlying urban hazard sometimes appears. An "urban bias" in health services doubtless exists in most of the countries considered, but it is beyond the scope of this study to assess the distribution and accessibility of health services among different socio-economic groups in the cities. In view of the persistently weak findings about the importance of urban-based curative services for general mortality conditions, it is perhaps not surprising that they do not seem to account for an urban superiority in child mortality conditions. The findings of this study clearly show that the urban mortality advantage is attributable more to characteristics associated with the higher socio-economic status of its population than to the specificities of the health sector.

Table XI.1. Ratio of observed to expected deaths, by area of residence (expected deaths in parentheses)

Area of residence	AFRICA					ASIA					LATIN AMERICA		
	Ghana	Kenya	Lesotho	Liberia	Nigeria	Indonesia	Republic of Korea	Nepal	Sri Lanka	Thailand	Chile	Jamaica	Peru
Rural	1.085 (54917)	1.002 (4382)	0.996 (1984)	1.080 (16841)	1.095 (1459)	1.020 (79773)	1.041 (2043)	1.014 (4822)	1.008 (2280)	1.076 (1734)	1.191 (1011)	1.117 (429)	1.340 (1925)
Non-state	..	..	..	..	..	..	..	..	0.922 (2047)	..	..	..	..
State	..	..	..	..	..	..	..	..	1.758 (233)	..	..	..	..
Urban	0.794 (18024)	0.811 (706)	1.051 (150)	0.838 (8312)	0.893 (1013)	0.848 (15447)	0.909 (965)	0.526 (108)	0.882 (457)	0.624 (242)	0.931 (3303)	0.915 (276)	0.809 (2665)
Largest city	0.609[a] (7502)	0.796[b] (416)	1.050 (62)	..	..	0.923 (3405)	0.911 (386)	0.327 (46)	0.794 (152)	..	0.884 (1484)	..	0.503 (942)
Other large cities		..	..	..	..	..	..	..	..	..	..	..	0.732 (529)
Other urban	0.926 (10522)	0.832 (290)	1.052 (88)	..	..	0.827 (12041)	0.908 (579)	0.675[c] (62)	0.926 (305)	..	0.970 (1819)	..	1.084 (1194)

a/ Includes Accra, Kumasi and Sekondi and Takoradi.
b/ Includes Nairobi and Mombasa.
c/ Towns.

Table XI.2. The effect of area of residence on child mortality: regression coefficients and univariate differences

Region and country	Residence	Univariate differences	Stage II
		AFRICA	
Ghana	Capital[a/]	0	0
	Other urban	0.317	-0.170
	Rural	0.476	-0.121
Kenya	Capital[b/]	0	0
	Other urban	0.036	-0.038
	Rural	0.206	0.103
Lesotho	Capital	0	0
	Other urban	0.002	-0.019
	Rural	-0.054	-0.068
Liberia	Urban	0	0
	Rural	0.242	0.041*
Nigeria	Urban	0	0
	Rural	0.202	0.005
		ASIA	
Indonesia	Capital	0	0
	Other urban	-0.096	-0.067
	Rural	0.097	-0.036
Republic of Korea	Capital	0	0
	Other urban	-0.003	-0.090
	Rural	0.130	0.107
Sri Lanka	Capital	0	0
	Other urban	0.132	0.030
	Rural Non-Estate	0.128	-0.032
	Rural Estate	0.964	0.254

Table XI.2. (continued)

Region and country	Residence	Univariate differences	Stage II
		ASIA (continued)	
Thailand			
	Capital		0
	Other urban	0	0.061
	Rural	0.452	0.130
		LATIN AMERICA	
Chile			
	Capital	0	0
	Other urban	0.086	0.077*
	Rural	0.307	0.121*
Jamaica			
	Urban	0	0
	Rural	0.202	0.202
Peru			
	Capital	0	0
	Other urban	0.473	0.107*
	Rural	0.837	0.054

* Significant at the .05 level.

a/ Includes Accra, Kumasi and Sekondi Takoradi.
b/ Includes Nairobi and Mombasa.

Chapter XII

REGION OF RESIDENCE

There is no generally accepted theory that links infant and child mortality with region of residence, although a number of recent studies attempt to document and explain areal variations in developing countries. For Africa, regional estimates of mortality in Kenya, the Sudan and the United Republic of Tanzania, show the existence of regionally differentiated risk. In Kenya, estimates of regional levels of life expectancy at birth vary from 39 years in Nyanza Province to 60 years in Central Province (Anker and Knowles, 1977). According to this study, both community-level and individual-level analyses support the finding that variation in disease prevalence in Kenya is an important factor in explaining regional variation. Hogan and Juwani (1973) find that in the United Republic of Tanzania, the malarial coastal and lacustrine regions have higher infant and child mortality than other regions.

Farah and Preston (1982) find that the southern regions of the Sudan have much higher levels of infant and child mortality than the northern regions, even after controlling for a variety of other factors. In relation to mothers in the capital area of Khartoum, mothers in the south experience levels of infant and child mortality that are 48-71 per cent higher. Disease environment is put forth as a possible explanation, the authors arguing that, "although we cannot rule out the importance of social community factors, we lean toward an explanation emphasizing the disease environment". Gaisie (1976) finds regional variation in Ghana, with the very low infant death rate in Accra contrasting with high rates for up-country regions.

As reported by Behm (1980), studies of life expectancy or infant mortality in Brazil, Chile and Mexico have revealed substantial regional diversity. Behm and Vallin (1982) suggest that an inquiry into causes leads to consideration of differentials in socio-economic standards, such as the mother's education. Regional estimates of life expectancy in Brazil in 1970 ranged from 35 to 51 years (Carvalho, 1974). Carvalho and Wood (1978) argue that variation in life expectancy across regions in Brazil are mirrored in socio-economic differentials.

It has been proposed that regional variation in climate may help to explain variation in disease environment and, thus, variation in morbidity and mortality. In a detailed study of the effects of a number of individual-level and community-level factors on child survival in Colombia, Rosenzweig and Schultz (1982) include the average temperature of over 900 municipalities as an independent variable. Results show that for rural women over age 25 and urban women over age 30 there is an optimum temperature range for child survival. This finding might well offer added insight to results already reported; however, the authors caution against hasty conclusions. They note that factors other than disease vectors vary roughly according to temperature, and that this variable may be capturing these unspecified effects.

Geographical variation also has been examined in Sri Lanka. Several important studies have attempted to explain the linkages between geography, climate and malaria endemicity prior to the malaria campaign (Newman, 1969; Gray, 1974; Meegama, 1967). Fernando (1981) showed that hill country districts in which the tea and rubber plantations were concentrated had the highest infant mortality rates. Indian Tamils made up a considerable portion of the population in these districts raising the possibility of interaction between climate, occupation and ethnicity. Elsewhere in Asia, indirect estimates of mortality in Thailand from the 1970 census show that the Northern and North-eastern regions had higher infant death than the Central or Southern regions (Knodel and Chamratrithirong, 1978).

It has been suggested that region of residence is not a determinant of mortality in the same sense as other demographic or socio-economic factors (Farah and Preston, 1982). More properly, region should be viewed as accounting for the current environmental setting, and, as such, it acts as a mediator for associated characteristics which may be either undefined or ill-defined.

The brief review of the literature included here shows that region of residence may be an important factor because it captures a sizeable amount of variation. The question then arises as to the major cause of regional variation in infant and child mortality. Some analysts, such as Behm and Vallin, argue that behind the areal inequalities are inequalities in such critical socio-economic factors as education, income and health care services. In some countries where the capital city and other large cities are districts or regions in themselves, the inequality may be compounded as a consequence of extreme urban privilege. This proposal is one that can be tested here, since it is possible to control the family's socio-economic circumstances and see whether regional variation persists.

Other commentators have emphasized the ecological dimension. They point to an association between ecological variation, climate and disease environment, and suggest that where climate and ecology are not supportive of good health, that is, for example, where major disease vectors flourish, infant and child mortality will be higher. In studies where socio-economic factors and health services are controlled and regional variations persist, the argument for at least considering the ecological explanation seems convincing.

Measurement

The region of the respondent's residence can be reported either by the respondent herself or by the field-work staff. Questions about the place of residence were asked directly of respondents in the WFS countries of Jamaica, Kenya, Lesotho, Nepal, Peru, Sri Lanka and Thailand. Countries where the place of residence was recorded by interviewers or field work administrators include Chile, Ghana, Indonesia, Liberia, Nigeria, the Republic of Korea and Sierra Leone.

Different countries are divided into different numbers of regions, ranging from nine regions in Ghana to two in Jamaica. Regional classification in the countries studied are often for sampling purposes and thus may not correspond very well to regional differences in geography, ecology and culture.

Univariate results

African countries with sharp variations in ecology, climate and disease environment may be expected to have sizeable regional child mortality differentials.1/ Results for two of the surveyed countries, Kenya and Ghana, give evidence of substantial variation (table XII.1). Ghana ratios exhibit a range of 1.02 points, resulting from an exceptionally high mortality level in remote Upper Region and an exceptionally low level in the capital area of Accra. Mothers in Northern Region adjacent to Upper Region and those living in Central Region also have above-average mortality. In Kenya, the range between the regions with the highest and lowest standard mortality ratios, Nyanza and Central province respectively, is approximately .7 points. Coastal and Western provinces have relatively high infant and child mortality levels, whereas Rift Valley, a province where the majority of the populace lives in a mild climatic zone and the area around the capital, Nairobi, which has a concentration of health care facilities, have below average levels. In support of the climate-disease vector argument, it should be pointed out that malaria is endemic in all or parts of the high mortality provinces.

Lesotho and Liberia have less pronounced regional variation than Kenya and Ghana, in part, perhaps, because they are smaller and have less ecological variation. Malaria is omnipresent in Liberia, but it is endemic in Coastal and Northern Highland provinces where the level of child mortality is quite high. The range between Montserrado Province, where the capital, Monrovia, is located, and Northern Highlands is .50 points. Regional variation in Lesotho, a small country of little more than 30,000 square kilometres, is almost non-existent; a difference of only .06 points separates mothers from the mountains and the foothills.

Regional variation in the Asian countries surveyed is not as pronounced as in Ghana or Kenya, with the possible exception of Indonesia. The Irian Jaya Province of Indonesia, which was part of New Guinea until 1971, exhibits very low child mortality. The abnormally low level of mortality raises some doubt about the representativeness of the sample in Irian Jaya, because the province is mostly covered with jungles and sparsely populated, which makes the data collection extremely difficult. It is suspected that the sample mostly or entirely represents an urban and European segment and thus is very biased. Excluding the value for this province, the range in Indonesia is moderate. A similar situation exists for the Republic of Korea, where there is little variability in regional child mortality levels apart from Kangwon Province. Kangwon has a high concentration of mining communities, and it is possible that excessive mortality in these areas - a phenomenon that has been obeserved in other countries - is responsible for the abnormally high level.

Child mortality differentials among the three major regions of Nepal are relatively small, ranging from the lowest level in the hill region, which is the valley basin including Kathmandu, through the intermediate level in the Terai, the vast east-west stretch of low-level fertile and alluvial plains extending along the boundary with India, to the highest mortality in the mountains of the Himalayas and sub-Himalayas.

Sri Lanka and Thailand are characterized by roughly similar ranges of infant and child mortality, and in both countries the capital city region, metropolitan Colombo in Sri Lanka and Central Province in Thailand, have low levels. The south-western lowlands in Sri Lanka, a densely populated region adjacent to metropolitan Colombo, also exhibit low child mortality.

Of the countries studied, Peru has one of the greatest geographical diversity, and the ecological classification provided should enhance the mortality differentials. The standard mortality ratio ranges from a low of .5 in Metropolitan Lima to a high 1.3 in the Andean regions. Even the alternative administrative classification produces a similarly expansive range. In Jamaica, Kingston and St. Andrew incorporate the main urban areas of the country; consequently, their combined ratio is lower than that for all other parishes.

Indices of dissimilarity provide a simple measure of areal inequality. The results given in table XII.2 show that Kenya, Ghana and Peru have the greatest regional diversity. As noted elsewhere, caution must be exercised in interpreting the value of the index because it is in part a function of the complexity of the classification scheme, which varies from country to country. For example, when one uses ecological regions in Peru, the index of dissimilarity is 0.1450, whereas it is only 0.0984 (still comparatively high) when administrative regions are used. It is interesting to note that, of the eight countries where both regional and ethnic indices of dissimilarity can be computed, the ethnic index is higher than the regional index only in Sri Lanka.

Consideration of the relationship between child mortality and region of residence at this univariate-analysis stage suggests the following conclusions: (a) the presence of marked variation by region, particularly in those countries characterized by diversity of ecology and climate; (b) low mortality in regions in which capital cities are located, and high mortality in regions that are isolated, are known to have unhealthy climates or are plagued by endemic diseases, such as malaria.

Multivariate results

Table XII.3 shows results from multivariate analyses which control for a variety of socio-economic factors and ethnicity. In this study, region of residence is regarded as a current-state variable and enters the analysis at the second stage, after background factors at the first stage.

Ghana and Kenya, two countries that exhibited substantial regional differences at the preliminary stage, offer contrasting multivariate results. The advantage of mothers in Accra over those in other regions persists even after controlling for other factors. In some regions, the effects are reduced, but in all cases, the differences with the reference category are statistically significant.

Whereas stability and statistical significance characterize the results for Ghana, there are major changes in size and direction in Kenya when controls are added. Changes from the univariate to the Stage-II multivariate analysis appear quite large. However, this is mainly due to a large change of the relative position of the reference category, Nairobi. In looking more closely at the results, it can be seen that the relative mortality level changed drastically in only two regions. Nairobi, where the mortality level is close to the lowest level of the Central and Rift Valley regions at the univariate stage, falls into the highest mortality group, which includes the Coastal and Western regions, after other variables are introduced. The direction of this change is not surprising because declines in the relative advantage held by women from the capital are to be expected as socio-economic factors are controlled; the size of the change, however, is substantial. Nyanza, the highest mortality region at the univariate stage, exhibits only the average level effect at Stage II.[2/] Results for Lesotho show no significant differentials. In Liberia, introduction of other variables drastically reduced differences among the three regions, Coastal, Inland and Montserado, although the high mortality level of Northern Highlands in relation to the others remains at the multivariate stage.

In Asia, modest regional variations exist at the multivariate stage. Regions characterized by exceptionally high infant and child mortality at the univariate level - Kangwon province in the Republic of Korea, East Coast in Sri Lanka, and North and North-eastern regions in Thailand - show large, albeit reduced, net effects at this stage.

Regional variation is greatly reduced in Peru when controls are introduced, but mother's in mountain and jungle areas continue to show substantially higher levels relative to those in metropolitan Lima and Coast.

If, as it has been hypothesized elsewhere in this study, cities in developing countries may be viewed as extensions of the industrialized world, then it might be expected that one consequence would be a levelling across urban areas which would reduce regional effects. Results from Stages IIIR and IIIU offer some support for this hypothesis.

In Ghana, the difference between the level of infant and child mortality for mothers in the capital region and mothers in other regions is relatively smaller in the urban than in the rural areas in four of eight regions. The greatest contrast is for Western Province, where the level is 27 per cent higher in relation to Accra in the rural areas but only 11 per cent higher in the urban areas, and in Upper Province, where the disparity drops from 73 to 33 per cent. A possible explanation may be that the rural areas of the capital region of Accra are more unique in terms of the available health services and the characteristics of the inhabitants than urban Accra. But there are exceptions; in Northern Province, urban mothers are at a greater relative disadvantage than rural mothers. All values are statistically significant in the rural analysis, but at the urban stage only Central and Northern provinces have significant values. This is in large measure attributable to the relatively small urban sample size.

In Kenya, where because of the urban nature of the capital region the reference category was enlarged to include Nairobi and adjacent Central Province, most regional disparities are lower in the urban than in the rural areas; women in urban areas in three provinces have lower infant and child mortality than urban women at Nairobi and in Central Province. Multivariate results for Liberia reveal that the mortality disadvantage of Northern Highland region is pronounced in rural areas and virtually non-existent in urban areas.

In two Asian countries, the Republic of Korea and Sri Lanka, mothers in rural areas in regions characterized by high infant and child mortality are at a greater relative disadvantage than mothers in urban areas in these regions. Rural mothers in Kangwon Province in the Republic of Korea have significantly higher child mortality than rural mothers in the other provinces. However, urban mothers in all provinces have relatively low mortality level when all other factors are taken into account. At the multivariate stage (IIIR), mothers in rural areas in the East Coast region in Sri Lanka have substantially higher mortality level than those in rural areas in the other four regions. Their pronounced disadvantages, however, disappear in urban areas.

Lower child survival levels are characteristic of mothers in mountain and jungle areas in Peru in relation to metropolitan Lima, irrespective of whether they live in the city or the countryside. Similar findings are evident when the analysis is repeated with metropolitan Lima and Coast provinces as the reference group, and all coefficients except that for rural mothers in jungle areas are statistically significant.

Summary and conclusion

Findings from this chapter indicate that regional variations in child mortality range from modest in Indonesia, Lesotho, Nepal and the Republic of Korea to substantial in Ghana, Kenya and Peru. The literature suggests that regional inequalities may be attributable to variations in disease environment, health care services or socio-economic factors. Controlling for a number of socio-economic factors and ethnicity results in the reduction of differentials present at the univariate stage, but in several countries some net effects remain large and statistically significant. In these societies it appears that inequalities in socio-economic standards are not the only cause of inequalities in child mortality. The disease environment or the social environment, neither of which is specifically taken into account in this study, probably contribute to differentials by region. The ecological argument gains some support from the observation that several countries with the greatest regional inequalities are characterized by diversity in climate and disease environment. Regional variation in infant and child mortality appears to be somewhat less important in cities, where the effects of an inhospitable climate may be moderated by other factors and access to health care may offset socio-economic inequality.

A cautionary remark may be needed about the multivariate results presented here. Regional mortality differentials, even after controlling socio-economic variables and ethnicity, may still reflect the mortality effect of socio-economic factors to some extent, because it is difficult to control the effect fully. In many of the study countries, education is measured as completed years of schooling and occupations are classified into very broad categories. However, schools in some regions may be of higher quality than schools of the same level in other regions, and farmers in some regions, for example, may be substantially more affluent than those in others. Those socio-economic differences by region remain uncontrolled even after the education and occupation variables are included in the multivariate model. Results in this chapter, therefore, should be viewed with this caution in mind.

Notes

1/ Although data on region of residence are available for Sierra Leone, the results from the geographically restricted survey are not shown here because they are not comparable with other findings. The surveyed area was dichotomized by the original survey staff into regions of high and low infant mortality. As a consequence, results do little more than confirm the classification scheme.

2/ The change of the relative position of the coefficient for Nyanza from the univariate stage to stage II is unexpectedly large. However, it may not be appropriate to interpret the result as suggesting a relatively moderate effect of the ecology of Nyanza Province on child mortality. An important factor to be considered here is the very strong association between region of residence and ethnicity in Kenya: among the respondents of the Kenyan Fertility Survey, 67 per cent of residents in Nyanza Province are Nilotics, and 84 per cent of Nilotics in Kenya live in the Province. The association suggests two possibilities. First, the large change of the relative position of Nyanza may be merely a statistical artifact produced by the so-called multicollinearity problem because it is difficult to separate effects on child mortality of Nyanza and those of Nilotics. Second, the other principal ethnic group is the Kisii, who live in a higher, hilly country district with well-drained soils, whereas the Nilotics live in low-lying, flat and swampy areas. It is possible, therefore, that the high coefficient for Nilotics (in table IV.4) includes ecological effects on child mortality of Nilotic districts, and the regression coefficient for Nyanza reflects mainly the mortality effects of the ecology and geography of the Kisii district.

Table XII.1 Ratio of observed to expected deaths by region of residence (expected deaths in parentheses)

Region of residence	Ratio
AFRICA	
Ghana	
Accra	0.596 (5479)
Central	1.088 (7157)
Western	0.972 (6790)
Eastern	0.845 (9912)
Volta	0.886 (7921)
Ashanti	0.852 (12837)
Brong Ahafo	0.975 (7346)
Northern	1.302 (7399)
Upper	1.616 (8098)

Table XII.1 (continued)

Region of residence	Ratio
AFRICA (continued)	
Kenya	
Nairobi	0.757 (298)
Central	0.694 (835)
Coast	1.183 (357)
Nyanza	1.358 (1107)
Rift Valley	0.689 (931)
Western	1.194 (673)
Eastern/Northeastern	0.891 (880)
Lesotho	
Lowlands	1.005 (907)
Foothills	0.980 (506)
Orange River	0.988 (281)
Mountains	1.043 (364)
Not stated	0.865 (81)

Table XII.1 (continued)

Region of residence	Ratio
AFRICA (continued)	
Liberia	
Coastal	1.061 (7817)
Inland	0.937 (9146)
N. Highland	1.316 (3244)
Montserrado	0.812 (4945)
ASIA	
Indonesia	
Java	0.980 (61441)
Sumatra	1.038 (17210)
Kalimantan	0.872 (3890)
Sulawesi	0.984 (6793)
Nusatenggara	1.088 (4904)
Maluku	1.047 (878)
Irian Jaya	0.265 (104)

Table XII.1 (continued)

Region of residence	Ratio
ASIA (continued)	
Nepal	
Hill	0.941 (2452)
Terai	1.052 (2068)
Mountain	1.142 (445)
Other	0.828 (18)
Republic of Korea	
Kyonggi	0.957 (671)
Chonbuk	0.954 (309)
Chonnam	0.957 (398)
Chungbuk	0.989 (143)
Chungnam	0.905 (266)
Kangwon	1.459 (196)
Kyongbuk	0.950 (51)
Kyongnam	0.995 (472)
Not ascertained	1.498 (42)

Table XII.1 (continued)

Region of residence	Ratio
ASIA (continued)	
Sri Lanka	
Metropolitan Colombo	0.807 (153)
South West Lowlands	0.802 (691)
East Coast	1.238 (170)
North Dry Zone	1.044 (189)
Other Dry Zone	0.915 (427)
Central Hill	1.106 (1106)
Thailand	
Central	0.758 (541)
South	0.915 (215)
North East	1.152 (768)
North	1.161 (451)

Table XII.1 (continued)

Region of residence	Ratio
LATIN AMERICA	
Jamaica	
Kingston and St. Andrew	0.793 (184)
Other parishes	1.125 (521)
Peru[a]	
Metropolitan Lima	0.505 (951)
Coast	0.816 (864)
Mountain	1.335 (2196)
Jungle	1.063 (579)

a/ Ecological regions; administrative regions have the following levels: Metro Lima, 0.505; North, 1.093; Central, 1.203; South, 1.311; and East, 0.974.

Table XII.2. Index of dissimilarity of child mortality by region

Region and country	Index of dissimilarity
AFRICA	
Ghana	0.134
Kenya	0.130
Lesotho	0.011
Liberia	0.060
Sierra Leone[a/]	0.060
ASIA	
Indonesia	0.017
Nepal	0.032
Republic of Korea	0.038
Sri Lanka	0.069
Thailand	0.082
LATIN AMERICA	
Jamaica	0.062
Peru[b/]	0.145 (0.098)

a/ Limited to a high and a low mortality region.
b/ Ecological regions; the number in parentheses is index of dissimilarity for administrative regions.

Table XII.3. The effect of region of residence on child mortality: regression coefficients and univariate differences

Region of residence	Univariate differences[a/]	Stage II	Stage IIIR	Stage IIIU
	AFRICA			
	Ghana			
Accra	0	0	0	0
Central	0.492	0.367**	0.360**	0.368*
Western	0.376	0.245**	0.275*	0.106
Eastern	0.249	0.247*	0.244*	0.289
Volta	0.290	0.277**	0.261*	0.268
Ashanti	0.256	0.202*	0.247	0.123
Brong Ahafo	0.379	0.267**	0.281*	0.238
Northern	0.706	0.399**	0.315*	0.461*
Upper	1.020	0.737**	0.726**	0.327
	Kenya			
Nairobi	0	0	0	0
Central	-0.063	-0.365**	0	0
Coast	0.426	0.022	0.295*	0.155
Nyanza	0.601	-0.187	0.214	-0.016
Rift Valley	-0.068	-0.378**	-0.013	-0.093
Western	0.437	0.004	0.442**	0.229
Eastern/Northeastern	0.134	-0.237	0.137*	-0.129
	Lesotho			
Lowlands	0	0	0	0
Foothills	-0.025	-0.055	-0.041	-0.114
Orange River	-0.017	-0.040	-0.027	0.369
Mountains	0.038	0.018	0.032	..
	Liberia			
Coastal	0	0	0	0
Inland	-0.124	-0.026	0.084*	0.109**
N. Highland	0.255	0.317**	0.394**	0.056
Montserrado	-0.249	-0.056*	-0.032	-0.046

Table XII.3. (continued)

Region of residence	Univariate differences[a/]	Stage II	Stage IIIR	Stage IIIU
		ASIA		
		Indonesia		
Java	0	0	0	0
Sumatra	0.058	0.085	0.079	0.011
Kalimantan	-0.108	-0.118	-0.910	0.025
Sulawesi	0.004	-0.202	-0.113	-0.300**
Nusatenggara	0.108	0.115	0.151	0.164
Maluku	0.067	0.033	b/	-0.138
Irian Jaya	-0.715	-1.512**	b/	-0.547
		Republic of Korea		
Kyonggi	0	0	0	0
Chonbuk	-0.003	-0.093	-0.131	-0.057
Chonnam	0.000	-0.042	-0.056	-0.308
Chunbuk	0.032	0.002	0.028	..
Chungnam	-0.052	-0.071	-0.054	-0.190
Kangwon	0.502	0.364**	0.515**	-0.199
Kyongbuk	-0.007	-0.011	-0.007	-0.147
Kyongnam	0.038	0.008	0.001	-0.082
		Nepal		
Hill	0	0	c/	c/
Terai	0.111	0.091*	c/	c/
Mountain	0.201	0.168**	c/	c/
		Sri Lanka		
Metropolitan Colombo and S.W. Lowlands	0	0	0	0
East Coast	0.435	0.182	0.281*	0.086
Northern Dry Zone	0.241	0.060	0.014	0.284
Other Dry Zone	0.112	-0.012	0.010	0.220
Central Hill	0.303	0.054	0.085	0.176

Table XII.3. (continued)

Region of residence	Univariate differences[a]	Stage II	Stage IIIR	Stage IIIU
	ASIA (continued)			
	Thailand			
Central and Bangkok	0	0	0	0
South	0.157	-0.089	-0.079	-0.127
North East	0.394	0.198**	0.208**	0.152
North	0.403	0.214**	0.221**	0.265
	LATIN AMERICA			
	Jamaica			
Kingston and St. Andrew	0	0	0	0
Other parishes	0.332	0.268*	-0.543	0.317*
	Peru			
Metropolitan Lima and Coast	0	0	0	0
Mountain	0.682	0.251**	0.289**	0.259**
Jungle	0.410	0.141**	0.143	0.217**

* Significant at the .05 level.
** Significant at the .01 level.

a/ Statistical significance was not calculated for univariate analysis.
b/ Predominantly urban (see text for further explanation).
c/ Sample predominantly rural.

Chapter XIII

HEALTH CARE

It is not unreasonable to expect child survival to be linked to the availability of health care services. Access to modern medical facilities throughout a mother's pregnancy, at delivery and during infancy and childhood is thought to be particularly important in reducing mortality. Governments in developing countries often assume that the optimal route to lower child mortality is through expansion of the formal health sector and are further encouraged along these lines by the benefits that accrue to builders and occupants of modern highly visible health facilities (Mosley, 1983).

Recently, however, this assumption has been challenged by those who argue that too much emphasis is still being placed on short-term vertically organized public health interventions and modern medical institutions at the expense of social and economic development. The apparent reduction in the rate of mortality decline after a period of rapid progress has helped to convince some that the current approach to health care in developing societies is not appropriate to the disease environment (see, for example, Gwatkin, 1980; and Palloni, 1981). The importation of medical technology in the form of vaccines and insecticides reduced, or in some areas even eliminated, such diseases as smallpox and malaria. Now, it is argued, a much greater proportion of deaths is due to diseases borne by water, food and feces, the prevention of which appears to be responsive to improved personal hygiene. Even when specific cures, such as oral rehydration, are available, they are not necessarily effective in the long run. As Mosley (1983) argues, it is not a single episode of diarrhoea that kills, but the fact that children, weakened by malnutrition, continually battle disease. Thus, in his model of child morbidity and mortality, Mosley does not label diseases or "disease states", such as malnutrition, as "causal factors", but instead calls them "indicator" variables.

The incidence of water-borne and feces-borne diseases is disproportionately concentrated among infants and children. Currently, at least for developing countries in Latin America, where data are generally more detailed than those in the other less developed regions, there is a higher proportion of infant and child deaths compared with developed countries when they had achieved an equivalent life expectancy, as is shown by Palloni (1981). He argues that this pattern of excess infant and child mortality is a result of reliance upon exogenously developed medical innovations. The mortality transition that the currently developed countries experienced in the past was characterized by socio-economic progress that was contemporaneous with or even preceded the transformation in medical care. The decline in mortality would not have been sustained, however, without the improvements in medical technology that have occurred in this century.

Few would claim that development of health care systems should be abandoned in favour of improvements in levels of living. Yet, advocates of the primacy of education contend that "... it is wasteful to put large inputs into health services without putting equivalent inputs into education, especially that of girls" (Caldwell and McDonald, 1981). Which is cost beneficial? Those who come down on the side of education are not arguing against hospitals and clinics, but rather in favour of development programmes, be they health or education, which reach the majority of the population.

In developing strategies to combat child mortality, a number of research issues arise. Whether access to and utilization of current health facilities guarantee significant reductions in child mortality is perhaps the most important question. Recently there has been emphasis on the development of primary health care systems that are village-based, use paramedics and traditional health care workers, and employ relatively simple and inexpensive technologies (Mosley, 1983). There is evidence, albeit limited, to suggest that health care of this type can have a significant effect on child mortality (Gwatkin and Brandel, 1981). Even one of the leading advocates of increased maternal education for the reduction of child mortality has documented the important role that rural health services played in one Nigerian village (Orubuloye and Caldwell, 1975). But this finding has not invariably been repeated. In Colombia, public health care programmes were found to be weakly related to survival in rural areas (Rosenzweig and Schultz, 1982). Furthermore, the authors of the study reporting the success of pilot projects in primary care acknowledge that extension of comparable health systems from local to national populations is a "formidable" task (Gwatkin and Brandel, 1981).

The effect of health care access on child mortality is often said to vary with education such that the highly educated, who presumably have the means and the knowledge to deal with modern bureaucracies, are more likely to take advantage of modern medical services (Ware, 1983). If those who utilize medical services are indeed selected for higher social status, then the effect of health care on child survival will be greatest where education is most common. In an aggregate level analysis of differential utilization of health care facilities in two Indian states, Kerala and West Bengal, Nag (1981) argues that education promotes awareness and use of public services. Despite higher per capita income and greater urbanization and industrialization, West Bengal has markedly lower levels of literacy, particularly among women. Although direct evidence is not provided, the claim that the traditional emphasis on education in Kerala has contributed to greater health care utilization and lower infant and child mortality is not unreasonable. In fact, this point has been developed in another article devoted to the uniqueness of the Kerala demographic experience. Emphasizing the critical role of development programmes in Kerala, which had as their goal equal division of resources, Ratcliffe (1978) maintains that mass education aided in the expansion of political participation. This development, in turn, gave rise to a more equitable distribution of land, income and services. Although Kerala ranked ninth among 15 Indian states in per capita expenditure on health during the early 1970s, it ranked first in the number of patients treated per 100,000 people (Ratcliffe, 1978).

Results from an experiment in Bangladesh designed to measure the effect of immunization of mothers on neonatal tetanus, a major killer of infants, indicate that this issue of whether health care programmes and maternal education operate as substitutes or complements for each other, is unresolved. Attempting to explain the small difference in child mortality rates among intervention and control populations, Chen and his colleagues (1981) speculate that those 22 per cent who accepted the tetanus vaccine in the intervention population might have been disproportionately selected for higher social status. Projecting from the results of the control population, they argue that the acceptors' children would have been less likely to die from neonatal tetanus even if their mothers had not received the vaccine. Results from a study done by Rosenzweig and Schultz (1982), using data from Colombia, indicate that the impact of private medical facilities in urban areas appears to depend upon the mother's education. However, they discovered that health care availability was most beneficial for the least educated, which suggests that, at least for Colombia, education compensates for inadequate health care facilities.

Micro-level studies have questioned whether the impact of health care on mortality is constant throughout infancy and childhood. In an individual-level analysis of successive segments of the first year of life in Malaysia, it was found (Butz and others, 1982) that the variable indicating whether the child was born in a hospital has a significant influence on mortality in months 2-6, but not in the two months preceding nor the six months succeeding that period. They attribute this finding to the fact that mothers who give birth in hospitals are more likely to provide adequate home care. They assume that behavioural variables, such as maternal ability to provide care, are significant determinants of mortality only after the first few months of life. Neonatal mortality, in contrast, is believed to be due to such endogenous factors as congenital defects. It is not clear why the "hospital birth" variable, if it is merely a proxy for ability to provide care, is not significant during months 7-12, a time when environmental insult often remains high due to weaning. Moreover, the division between exogenous and endogenous mortality may be somewhat arbitrary, given that such diseases as neonatal tetanus, which occur shortly after birth, can be prevented if adequate sterilization measures are taken.

Measurement

Out of 15 countries in this study, only two, Nigeria and Peru, provide information related to the subject. The Nigerian data set includes the access to health care facilities. In the survey, interviewers filled in the distances (in miles) from the households to the nearest hospitals and dispensaries. A combination of two variables, one for hospitals and the other for dispensaries, produces the set of categories shown in table XIII.1.

In the Peruvian survey, women were asked about the place of medical attention during the most recent birth and whether their last children had been vaccinated during the first months of life. The place of medical attention during the last birth is considered to be an indicator of the type of facilities the family usually use for medical care. Since the type of health care facility a woman chooses to use for pregnancy and childbirth may be different from that for cure and prevention of diseases, this indicator is only a proxy for the major health care facility that is used by the family.

Results

Table XIII.1 shows the relationship between child mortality and access to health care facilities in Nigeria. The observed pattern meets the expectation: child mortality is inversely related to the accessibility of health care facilities. The inverse relationship still holds when other variables are controlled in the multivariate analysis, as is seen in the stage II results given in table XIII.2.

Regression results are somewhat different for rural and urban residents. In rural areas, living very far away from the nearest health care facility is a considerable disadvantage. Among those living in rural areas who are eight or more miles away from the nearest hospital or dispensary, child mortality is nearly 30 per cent greater than that of persons with both a hospital and a dispensary in the community. However, for those living 1-7 miles from the nearest hospital or dispensary, variation in access to health care facilities does not make substantial differences in child mortality. It is noteworthy that the effect of only a dispensary is nearly equivalent to that of both a dispensary and a hospital.

In urban areas in Nigeria, only a few families live very far from medical facilities, so that physical distance to the medical facilities does not seem very important. In contrast to rural areas, the primary concern, therefore, is the size of the health care facilities: a 38 per cent difference in child mortality is estimated between urban areas that have hospitals and urban areas that have only dispensaries.

Turning now to the data on use of medical care facilities in Peru, it is found, not surprisingly, that the mortality of children of mothers who use more professional, more institutionalized medical services is lower, as shown in table XIII.3. The highest mortality is observed for children of mothers who did not receive any medical attention during the last birth, the second highest being children of mothers who received medical attention at home or at the medical post. Among mothers who received medical attention outside their houses, mortality of children of those who went to private clinics or offices of physicians is lower than that of those who went to hospitals or medical posts. This mortality differential perhaps reflects some self-selection process because private, more expensive services are provided in the former facilities, whereas services available in the latter facilities tend to be of a more public nature.

One possibility to be considered is that the relationships of use of health care facilities to child mortality may explain the rural/urban mortality differentials, because a wider range of health care facilities is usually available in urban areas. Table XIII.4 shows mortality ratios by place of medical attention during the most recent birth and area of residence. For each type of medical facility, the survival advantage of urban over rural children is observed; for each category of residential area, the expected relationship between mortality and place of medical attention is found. The results in table XIII.4 suggest, therefore, that a substantial portion of rural/urban mortality differentials in Peru cannot be explained by rural/urban differentials in availability of health care facilities. This is consistent with the results given in chapter XI, which suggest that rural/urban mortality differentials are to a large extent attributable to differences in social, economic and cultural characteristics among rural and urban residents.

Another possibility worth investigating is that the relationship between child mortality and use of health care facilities may be spurious and merely a reflection of the effect of socio-economic status on child mortality: wealthy people who have more resources for raising survival chances of their children can also afford expensive medical services; educated parents who exercise effective health care practices at home may prefer institutionalized, highly professional medical services. This hypothesis can be examined in table XIII.5, where child mortality ratios are cross-tabulated by the place of medical attention during the last birth and the mother's completed years of schooling. Expected relationships between child mortality and the place of medical attention that are observed on the univariate level hold, although somewhat attenuated, for each category of maternal education, suggesting that the relationship observed on the univariate level may indicate direct effects on child mortality of the use of health care facilities.

This issue can be further investigated through multivariate analysis, the results of which are given in table XIII.6. Stage II results show that child mortality is related to the place of medical attention during the last birth in the descending order of "did not receive medical attention", "at home", "hospital or medical post" and "private clinic or doctor's office". The pattern of the relationship between child mortality and the place of medical attention found at Stage II is consistent with the univariate results given in table XIII.3 and the results of cross-tabulations with area of residence (table XIII.4) and maternal education (table XIII.5). It should be noted, however, that the size of child mortality differentials is markedly reduced from the univariate to the multivariate (Stage II) results, suggesting that the strong association between child mortality and the place of medical attention at the univariate level is mainly due to the impact on child mortality of social, economic and cultural characteristics of users of different health care facilities. This finding appears to be consistent with the fact that, as chapter IX strongly states, rural/urban differentials virtually disappear in multivariate analysis despite a much discussed "urban bias" in health services.

It should not be overlooked, however, that child mortality of women who received medical attention during last births is lower than that of those who did not by about 10 per cent on the average, even after controlling other variables: the mean of the Stage II regression coefficients of the five places of medical attention in table XIII.6 weighted by the number of expected deaths is -0.096. Unfortunately, it remains uncertain whether the disadvantages of children of women who do not utilize medical facilities are due to their lack of access to the facilities, their inactiveness in utilizing available health services, or their poor personal hygiene and health habits.

Table XIII.6 also shows that the expected relationships hold in regression results for urban areas but not for rural areas. More alternative health care facilities are available in urban areas, so that results for urban areas are more likely to exhibit meaningful patterns than those for rural areas.

Last, table XIII.7 reveals that child mortality is lower for mothers whose last children were immunized during the first month of life. This result is, of course, hardly surprising. However, because the child must survive long enough to qualify for vaccination, this relationship could be partly spurious.

Summary and conclusion

Data from Nigeria and Peru that are analysed in this chapter show that, as expected, both access to medical care facilities and utilization of health care services are positively related to the survival chance of children. Their effects often remain substantial, even after the control of other variables has weakened the univariate-level relationships. The Nigerian results suggested that providing residents, particularly in rural areas, with health care facilities at locations that are accessible, and educating and ecouraging them to utilize available services are important. The Peruvian results, however, are not as clear-cut. Mortality is not significantly related to used health services in rural areas when socio-economic status is taken into account.

Table XIII.1 Ratio of observed to expected deaths by access to health care facility: Nigeria (expected deaths in parenthesis)

Access to health care facility	Ratio
Both hospital and dispensary in the community	0.820 (966)
Only dispensary in the community	1.053 (707)
1-7 miles to the nearest hospital or dispensary	1.190 (197)
8 miles or more to the nearest hospital or dispensary	1.277 (51)

Table XIII.2 The effect of access to health care facility on child mortality: regression coefficients and univariate differences, Nigeria

Access to health care facility	Univariate differences[a/]	Stage II	Stage IIIR	Stage IIIU
Both hospital and dispensary in the community	0	0	0	0
Only dispensary in the community	0.233	0.047	-0.014	0.383**
1-7 miles to the nearest hospital or dispensary	0.370	0.124	0.081	-
8 miles or more to the nearest hospital or dispensary	0.457	0.327**	0.287*	-

* Significant at the .05 level.
** Significant at the .01 level.

a/ Statistical significance was not calculated for univariate analysis.

Table XIII.3. Ratio of observed to expected deaths by place of medical attention during last birth: Peru (expected deaths in parenthesis)

Place of medical attention	Ratio
Private clinic	0.408 (151)
Doctor's office	0.589 (337)
Hospital	0.669 (893)
Medical post	0.827 (317)
At home	0.842 (134)
Did not receive medical attention	1.280 (2704)

Table XIII.4 Ratio of observed to expected deaths by place of medical attention during last birth and area of residence: Peru (expected deaths in parentheses)

Place of medical attention	Area of residence			
	Lima	Other large city	Small city	Rural
Private clinic or doctor's office	0.573 (188)	0.355 (96)	0.676 (138)	0.962 (66)
Hospital or medical post	0.438 (482)	0.637 (196)	0.920 (333)	1.088 (200)
At home	0.609 (48)	0.586 (13)	0.931 (54)	1.381 (18)
Did not receive medical attention	0.744 (212)	1.005 (213)	1.270 (650)	1.390 (1629)

Table XIII.5 Ratio of observed to expected deaths by place of medical attention during last birth and mother's education: Peru (expected deaths in parentheses)

Place of medical attention	Mother's completed years of schooling			
	None	1-3 years	4-6 years	7 + years
Private clinic or doctor's office	1.131 (62)	0.845 (92)	0.456 (149)	0.241 (186)
Hospital or medical post	1.174 (276)	0.890 (304)	0.500 (364)	0.313 (267)
At home	1.498 (31)	0.986 (42)	0.439 (44)	0.367 (18)
Did not receive medical attention	1.471 (1615)	1.106 (721)	0.860 (300)	0.456 (69)

Table XIII.6 The effect of place of medical attention during last birth on child mortality: regression coefficients and univariate differences, Peru

Place of medical attention	Univariate differences[a/]	Stage II	Stage IIIR	Stage IIIU
Private clinic or doctor's office[b/]	-0.747	(-0.134)	(-0.036)	(-0.158)
Private clinic	-0.872	-0.151	0.012	-0.198**
Doctor's office	-0.691	-0.126	-0.047	-0.139*
Hospital or medical post[b/]	-0.570	(-0.085)	(-0.078)	(-0.105)
Hospital	-0.611	-0.053	-0.029	-0.077
Medical post	-0.453	-0.176**	-0.127	-0.207**
At home	-0.438	-0.054	0.084	-0.093
Did not receive medical attention	0	0	0	0

* Significant at the .05 level.
** Significant at the .01 level.

a/ Statistical significance was not calculated for univariate analysis.
b/ Figures in parentheses indicate weighed averages of two regression coefficients.

Table XIII.7 Ratio of observed to expected deaths by whether last child was vaccinated during the first month of life: Peru (expected deaths in parentheses)

Status	Ratio
Yes	0.871 (2791)
No	1.340 (1473)
Not applicable /Not stated	1.013 (326)

Chapter XIV

CONCLUSION

This volume has attempted to document systematically the factors associated with mortality variation in 15 developing countries. Part of this task is accomplished by examining one socio-economic factor at a time, which is the appropriate design for identifying target groups for programmatic intervention or studying the degree of social inequality in mortality. Virtually all of the one-factor analyses show results in the expected direction, if not always of the expected magnitude. Membership in a social group that is more advantaged or more modern is associated with lower child mortality, whether the variable of interest is education, income, urban residence, housing type, father's occupation, or one of the many other variables examined. The amount of inequality is often very large, with sizeable social groups often differing from one another in their levels of child mortality by a factor of two or more.

A second and more important analytic step is to disentangle the effects of the many variables and say which of them is "more important" or "less important". Such statements are not possible without at least a rudimentary model of causality. The model used here is very simple: variables whose values are established in childhood of parents are considered to be "exogenous" to parents of the children whose mortality is studied. That is, these variables do not, for the most part, involve parental choices. These are termed Stage I variables. To these exogenous variables are then added Stage II variables whose values are established in later life, and through which some of the effects of the Stage I variables are operating. The "total" effect of Stage I variables is found in regressions where only these variables appear. The "direct" effects of both Stage I and Stage II variables are found in Stage II equations wherein both sets of variables appear. Variables are presumed to act additively on mortality, with one exception: it was believed that effects of certain variables may differ between rural and urban areas, hence Stage II equations were re-estimated separately for urban and rural subsamples at Stage III.

What constitutes a large or small effect of a variable on mortality depends on the criterion employed. For policy purposes, the most pertinent consideration is the cost-effectiveness of various policies and programmes. Even though a coefficient may be small, indicating little effect of changes in its value on mortality, it may still be the case that large changes in the distribution of that variable can be achieved very cheaply through social programmes. If so, the programmes may have high priority in health planning.

We are not able to introduce cost considerations into this volume. Therefore, our criteria for evaluating the size of effects refers to effectiveness alone. A natural standard that suggests itself is a comparison of effects to those of mother's years of schooling. Mother's education is generally believed to be well-measured; it is available in all countries; it is measured on a cardinal scale; and it has universal (though multi-dimensional) meaning. Furthermore, our results on this variable tend to be quite consistent. When examined by itself, an additional year of mother's schooling reduces child mortality by an average across our 15 countries of 6.8 per cent, with the majority of countries falling in the range of 5.0 to 9.0 per cent (table II.13). After all other variables are entered into the estimation equation, the effect is still a reduction of 3.4 per cent in mortality per year of schooling. This latter is the "direct" effect of schooling and is biased downward as an estimate of the "total" effect by the inclusion of variables whose value is partly determined by mother's schooling itself.

Educational programmes are not aimed at supplying only one year of schooling, of course, and in nearly all of our countries a sizeable group of women has no schooling while another has at least 10 years. Substantially increasing the size of the latter group is within reach of every country. About 10 years of schooling seems desirable in order to learn basic skills of reading, writing and calculating necessary for working successfully in modern sectors of industrialized economies, although 10 years may be too short for highly professional occupations. In addition, those who just completed 10 years of continuous schooling starting at about 6 years of age can be considered old enough to enter marriage or the labour market, although those younger by a few or more years of age may be considered too young by the standard of industrilized societies. The above-mentioned direct effect to reduce mortality by 3.4 per cent per year of schooling implies that 10 years of schooling is associated with a reduction on mortality of at least 34 per cent, on average; the reduction would be larger still if the calculation took account of indirect effects. Thus, it is reasonable to use the 34 per cent figure as a standard against which to compare other effects.

Against this standard, most of the other factors in this analysis show mild or weak effects when other factors are controlled, although sizeable effects often appear in particular countries. Two variables are clear exceptions to this generalization. Ethnic variation in child mortality within countries often remains quite large even after all other variables are controlled. Such variation was examined in eleven countries, and in all but one (Nepal) a pair of sizeable ethnic groups differed from one another by at least 25 per cent in levels of child mortality (table IV.4). In 7 of the 11, the maximum difference exceed 50 per cent. The differences tended to be substantially larger in rural than in urban areas.

The other variable with effects comparable in magnitude to mother's education is father's education, but this sizeable effect is observed only in urban areas. Only in Chile was the effect of father's education larger in rural than in urban areas. The tendency of father's education to have a much weaker impact in rural areas is shown in the following table, derived from tables II.13 and III.6:

Average effect of an additional year of mother's and father's schooling on child mortality (Stage II)

Schooling of	Living in	
	Urban areas	Rural areas
Mother	-0.039	-0.035
Father	-0.036	-0.012

Since the population is predominantly rural in most of the countries examined, the effect of father's education for an entire country tends to be weaker than the effect of mother's education.

At the opposite extreme from these variables is rural-urban residence, often believed to be a powerful influence on child mortality by virtue of the greater availability of medical care in urban areas. Rural-urban residence per se, however, has very little effect on child mortality. With the exceptions of Jamaica and Sri Lanka (estate), the difference in child mortality between rural areas and the capital city is about 13 per cent or less (table XI.2). In fact, three countries (Ghana, Indonesia and Lesotho) actually have lower rural than capital city mortality in Stage II. The results suggest that urban mortality is generally substantially lower than rural mortality in raw figures not because of some advantage in the urban setting, but mainly because of the higher social status of urban residents. Even if there is "urban bias" in public services in these countries, which is likely, the services themselves do not appear to have much impact on child survival. This finding seems consistent with the view that existing urban health care systems, emphasizing large hospitals and expensive curative strategies that have been developed in industrialized countries of low mortality levels, may not be appropriately adapted to conditions in most developing countries.

Measures of economic status are typically related in the expected direction to child mortality, but the effects are usually relatively small. The largest difference in occupational status in developing countries is probably between white collar workers and agricultural employees. When Stage II results are averaged over nine countries in table VI.6, the mean excess in mortality for children of agricultural workers relative to the white collar category chosen as a reference is only 16.3 per cent; without Jamaica, where the differential is exceptionally large, it is only 12.3 per cent. Income also shows small effects in the expected direction. After controlling other variables, a doubling of household (or a particular parent's) income is expected to reduce mortality by between 1 per cent (for fathers in Nigeria) and 9 per cent (for households in Sri Lanka).[1/] Thus, the income coefficients appear to offer very little support for pursuing health advance through an income policy. It is interesting to note in chapter VII that in (a highly monetized region of) Nigeria, where data both on husband's and wife's income is available an increment in the wife's income has roughly five times as large an effect in reducing mortality as an equiproportionate increment in husband's income. This difference has been attributed to the prevailing cultural belief in the region that the wife is responsible not only for child care but also for earning the bulk of funds necessary for child-rearing (Sulaiman, 1984).

Even those wealth-related variables that one would expect to be most closely associated with the biological processes of morbidity and mortality - availability of piped water and flush lavatories in the household - show mild effects on child mortality. Piped water has virtually no systematic effect, presumably because it is a poor indicator of the quality (and perhaps quantity) of water used in the household. The availability of a flush lavatory is somewhat more influential, reducing mortality relative to "no facility/other" by an average of 10.2 per cent in the four countries where data are available.

Taking these economic variables one at a time neglects their combined effect and can lead to an underestimate of their importance in strategies for improving health. But the results suggest that even the sum of "direct" mortality effects of doubling everyone's income, providing every household with a flush lavatory and piped water, and turning every agricultural labourer into a professional/white collar worker would be less than the "direct" effect of providing 10 years of schooling for each woman.

Our results thus tend to emphasize the importance of socio-cultural variables relative to socio-economic ones. The very considerable impact of mother's education and ethnicity points above all to the potential importance of child care practices in determining levels of child mortality. It is reasonable to suppose that these practices are generally improved by school attendance both for the specific hygienic practices learned and for the general changes in outlook and break with resistance to innovations that inevitably results. Similarly, it seems likely that much of the impact of ethnicity represents variation in child care practices, perhaps particularly those practices surrounding the event of birth itself. The resources available to the household are also important, but their role is hardly overwhelming. In this regard, it is interesting to note that the professional classes in 1900 in the United States, a country even at that time far richer than most developing countries today, had virtually the same mortality level as the much poorer agricultural classes in the contemporary countries studied here (Preston, 1985). A reasonable explanation for this state of affairs is that modern theories of disease causation had not become embedded in child care and public health practices even among the elite classes in 1900. The spread of good hygienic practices (based on findings of modern medicine including the germ theory) among even the poorer classes in developing countries has very likely served to offset much of the material disadvantage that these groups suffer.

The fact that these non-economic factors evidently play such a major role in child mortality should be reassuring to policy-makers, since they are probably not subject to the same inertial forces as are the economic factors. The clustering of biomedical factors affecting child mortality into groups distinguished by mother's education and ethnicity does not necessarily suggest direct policy interventions. But it does focus the search for the intervening biomedical variables that affect mortality directly, while at the same time helping to suggest that these factors are not necessarily severely constrained by economic circumstances. The results would appear to support some of the assumptions underlying the primary health care movement, which emphasizes broad outreach into every home with a range of simple preventative measures. This support gains strength when it is recognized that the mother is indeed a vital link in the delivery of primary health care. Her importance is also emphasized by the survival advantage for children of mothers who work in family enterprises or who do not participate in the labour force.

The results presented in this volume, therefore, seem to emphasize the importance of "technique" such as child care practices and personal hygiene relative to the importance of the sheer volume of material and monetary inputs that is reflected in such variables as income, housing facilities and residence in urban areas. This implication is strikingly similar to conclusions reached in studies of the sources of economic growth. The bulk of these studies conclude that improved techniques of production and improved levels of human capital that underpin and embody the technical advances are responsible for most of what growth has occurred. Increases in the sheer volume of capital and labour are of secondary importance (Denison and Chung, 1976). Similarly, an attempt to explain mortality variation over time or among social groups at the same point in time simply in terms of the quantity of available economic resources is clearly inadequate (Preston, 1976). In short, it appears to be the manner in which inputs are combined, rather than the sheer volume of inputs, that is critically important both for mortality and for economic growth.

The view of mortality differentials just presented is more appropriate for rural areas, where the bulk of residents live, than for urban areas. In urban areas, ethnicity loses much of its power to discriminate among mortality levels. At the same time, father's education becomes a much more powerful predictor of child mortality. The suggestion is that the socio-cultural environment is more homogeneous in urban areas, at least in ways that are salient for child mortality. It seems reasonable to attribute this homogeneity to greater contact among groups and to their mutual presence in an environment far more uniform in its modernity. At the same time, the extremes of wealth may be greater in urban areas, which often range from shanty towns on the periphery to the modern apartment of the university-educated elite. Father's education in urban areas hence simply seems to tell us more about socio-economic circumstances than they do in rural areas, and are associated with sharper mortality gradations.

The differentiation in mortality relations between urban and rural areas appears far more important than the differentiation among regions of the world (Africa, Asia and Latin America) or among countries arrayed by level of mortality. For the most part, the variables studied here do not have effects that vary systematically with features of the national setting. This conclusion appears particularly noteworthy for sub-Saharan Africa, where very little has been known about the relation between child mortality and other variables. We have also found evidence that regional inequalities in mortality are greatest in countries with the largest regional differences in ecology and climate, probably reflecting the more hostile disease environment typical of hot, wet, tropical areas (Gourou, 1980).

A final comment is appropriate on a third set of variables, those that pertain to a person's access to or use of a health care system. We have very little information on such variables in our data set. What little evidence is available here shows that better access (in Nigeria) or more use (in Peru) is associated with lower levels of mortality, suggesting that health services are of some use for reducing child mortality in developing countries. The approximately equal importance of access to dispensaries and access to hospitals in rural areas of Nigeria is, however, partial evidence that health care systems could be reconstituted in a more cost-effective manner. But it would be wrong to place exclusive reliance on health services for improving child mortality. The results presented in this volume clearly show that other systems, particularly educational systems, have an important role to play in the modernization of child mortality levels.

Notes

1/ Derived from table VIII.12. A doubling of income raises the natural log of income by .693; this is the number used to multiply coefficients in the table to give results cited in the text.

Annex I

COMPARISON OF ORDINARY LEAST SQUARES REGRESSION RESULTS WITH LOGIT REGRESSION RESULTS FOR PERU

In this project, the ordinary least squares (OLS) regression method is extensively used for estimating simultaneously the effects of a number of factors on child mortality. The OLS procedure is simpler and less costly than the other alternatives such as logit and probit regression methods, and the adoption of the OLS procedure can be justified to the extent that results obtained by applying the OLS technique are similar to outcomes of more elaborate and expensive techniques. In this annex, the validity of the use of the OLS technique in the present research is tested by comparing OLS outcomes and those resulting from logit regression using Peruvian data (see Hamshek and Jackson, 1977).

The Peru Fertility Survey (WFS) contains information on the birthdate of all live-born children, on their current survival status, and on their date of death if they had died. This information permits one to use one of several techniques available for analysing event histories. These techniques have several advantages relative to the ordinary least squares (OLS) techniques used in this report:

(1) They enable the investigation of mortality relations within separate age groups, rather than for all ages combined

(2) They avoid imposing a standard age-pattern of mortality but permit the data to determine the shape of the age pattern

(3) By distinguishing among the mortality experiences of individual births, they permit the circumstances of an individual birth (e.g., mother's age and parity at birth) to be investigated.

Set against these advantages is the considerably greater cost of the procedures and the additional space required to display all results separately by age group or to add results on age-covariate interactions. In this project an additonal disadvantage is that most data sets could not support any method other than OLS and it was desirable to use a uniform method so that the comparative results were not influenced by procedural differences.

In what follows, the value of the information sacrificed by OLS relative to logit regression is examined using Peruvian data. The age groups chosen for separate logit regressions are 0-1 month, 1 month-1 year, and 1 year-5 years. Observations are included in an age segment only if a child was alive at the beginning of the age segment and could have completed it before the survey had he or she survived. The same variables are included in each of the three logit regressions and OLS regressions (Stage II) were rerun with exactly the same set of variables.

Table A.1 presents the coefficients for the four regressions. To facilitate comparison, a weighted average of the logit coefficients is computed, where the weights are the number of deaths falling into a particular age-range within the category in question. It is clear from a comparison of the last two columns in table 1 that the mean logit coefficient for a particular category is, in general, quite similar to the OLS coefficient for that category. The major differences are that Lima appear to be somewhat healthier (by about 20 per cent) in logit than in OLS results. Children of very well educated mothers and professional fathers are also more advantaged in logit than in OLS results. Some of these differences are attributable to the fact that the coefficients are not strictly comparable. The logit coefficient indicates the proportionate effects of being in a category on the ratio of the probability of dying to the probability of surviving, whereas the OLS coeffient indicates the proportionate effect on the probability of dying, so that logit coefficients should be, in general, somewhat larger in absolute value. Other differences may result from the fact that the logit regression pertains to a subset of children included in the OLS regressions, a subset biased towards more distant births. The basic point, however, is that the OLS results do not appear to be seriously distorted relative to the mean of logit results.

A second question is the degree to which the mean logit (or OLS) coefficients obscure important age variation in coefficients. For most variables, there is no evidence of systematic differences in the size or sign of the coefficients across age groups of children. There are differences, to be sure, but typically they do not widen or narrow systematically as the child ages, or they show quite different patterns for very similar categories of mothers or fathers.

There is an important exception to this indeterminancy of pattern. Both paternal and maternal education variables show a systematic tendency to become more influential at older ages of the child. A similar tendency was noted by Hobcraft and others (1982) for a large sample of World Fertility Survey countries. This tendency accords with commonsense notions that environmental influences become more important as children age: but it is also the case that many other variables that might be presumed to influence the child's environment show no such tendency. It appears that special features associated with education (perhaps knowledge of proper health practices), rather than general socio-economic circumstances, become more important as children age. In any event it is clear that OLS results that agglomerate all ages of children may obscure relatively important age patterns. The OLS coefficient does not distort the mean of the logit coefficients; these coefficients, however, may vary with the age of child.

Table A.1. Coefficients of logit and ordinary least squares regression for Peru World Fertility Survey data

Independent variable	Logit regression for ages			Weighted average of logit coefficients	OLS coefficient
	0-1 month	1-12 months	1-5 years		
Mother's education (Reference = None)					
1-3 years	-0.1352	-0.1764	-0.3362	-0.2123	-0.1816
4-6 years	-0.3684	-0.4000	-0.9127	-0.5013	-0.4403
7-9 years	-0.4206	-0.8220	-1.8373	-0.7512	-0.5762
10-11 years	-0.4552	-1.4852	-1.4661	-0.9758	-0.6576
12+ years	-1.0492	-1.5218	-1.0894	-1.2276	-0.7249
Father's education (Reference = None)					
1-3 years	-0.1217	-0.1265	-0.1391	-0.0507	-0.0813
4-6 years	-0.0901	-0.2192	-0.2415	-0.1889	-0.2156
7-9 years	-0.0131	-0.2509	-0.4356	-0.2066	-0.2230
10-11 years	-0.0775	-0.1884	-0.5702	-0.2157	-0.2492
12+ years	-0.0878	-0.3202	-0.2021	-0.2052	-0.2368
Mother's place of birth (Reference = Urban)					
Rural	-0.0453	-0.1665	0.0773	-0.0467	-0.0266
Ethnicity (Reference = Spanish)					
Ancash	0.1802	0.0415	-0.0713	0.0483	0.0497
Ayacucho	0.3857	0.2948	0.0789	0.2589	0.2996
Cuzco	0.3023	0.3780	0.1070	0.2691	0.3140
Aymara	-0.0602	0.1378	-0.3864	-0.0654	-0.0254
Region of residence (Reference = Coast)					
Mountain	0.0273	0.3811	0.3252	0.2608	0.2432
Jungle	-0.0598	0.2248	0.0811	0.0944	0.1129
Rural/Urban (Reference = Lima)					
Other urban	0.4359	0.1918	0.3829	0.3243	0.1444
Rural	0.2832	0.1015	0.3724	0.2470	0.0965

Table A.1. (continued)

Independent variable	Logit regression for ages 0-1 month	1-12 months	1-5 years	Weighted average of logit coefficients	OLS coefficient
Father's occupation					
(Reference = Professional)					
Sales	0.2368	0.2641	0.4153	0.3062	0.1047
Service	0.1612	0.3583	0.1342	0.2514	0.1269
Agriculture	0.5902	0.1653	0.3205	0.3475	0.0769
Production	0.4470	0.2404	0.3587	0.3375	0.1308
Mother's activity status					
(Reference = Never in the labour force)					
Now and before	-0.1649	0.0762	-0.1141	-0.0532	-0.0495
Now not before	-0.0537	-0.0362	-0.0725	-0.0534	-0.0363
Since and before	-0.2640	0.0018	0.1261	-0.0198	-0.0221
Since not before	-0.0828	0.3022	0.0674	0.1286	0.0630
Before only	-0.1405	-0.0984	-0.1019	-0.1131	-0.0708
Contraception					
(Reference = Knows efficient method)					
No method	0.1880	0.1647	0.1411	0.1638	0.2169
Inefficient method	-0.1128	-0.0924	-0.0050	-0.0669	-0.0546
Mother's martial status					
(Reference = Married once, legal)					
Widowed	0.3845	-0.0781	-0.1032	0.0831	0.1485
Divorced	0.7140	0.3548	-0.0013	0.4273	0.2847
Separated	0.0252	-0.1723	0.0240	-0.0472	0.0132
Once consensual	0.0913	-0.1585	-0.1487	-0.0678	-0.0782
1+ legal	0.0006	0.0483	-0.1084	-0.0151	0.0442
1+ consensual	-0.1129	-0.1808	0.0174	-0.0872	-0.0533
Mother's age					
(Reference = 45-49)					
15-19 years	-0.1041	0.0723	2.3557	0.0550	-0.0338
20-24 years	-0.2236	0.1385	-0.1531	-0.0245	-0.0192
25-29 years	-0.1238	-0.0826	-0.1867	-0.1198	-0.0184
30-34 years	-0.1119	-0.1438	-0.2375	-0.1587	-0.0386
35-39 years	-0.1285	-0.1898	-0.1432	-0.1558	-0.0579
40-44 years	-0.1400	-0.1229	0.0109	-0.0767	-0.0091

Annex II

THE EFFECT OF THE INCLUSION OF BREAST-FEEDING ON THE REGRESSION COEFFICIENT ESTIMATES OF OTHER MORTALITY DETERMINANTS KENYA FERTILITY SURVEY: 1977-1978

It is generally accepted that breast-feeding has an important influence on child morbidity and mortality in developing countries: a sufficiently long period of breast-feeding has a positive effect on the health and survival of a child. An overview of the literature on this subject is given in Mhloyi (1982) and an issue of the Population Reports (1982).

Although the focus of the present study is on social, economic, cultural and geographical determinants of mortality, it seems desirable to include breast-feeding in the multivariate analysis at least for controlling its strong effect on child mortality and thereby keeping the estimated coefficients of other variables from being significantly biased. Unfortunately, a breast-feeding variable cannot be included in the present research. Because the mortality experience of the mother is taken as the unit of analysis, the average breast-feeding duration of the mother is needed. This is impossible to obtain in most data sets.

The purpose of this annex is, therefore, to detect whether the failure to include a breast-feeding variable in the analysis may have biased the estimated regression coefficients. If duration of breast-feeding is significantly different for women with other social, economic and cultural characteristics, the failure to control for this difference can lead to a bias in the estimated regression coefficients of these variables.

To test whether the inclusion of breast-feeding indeed leads to different regression coefficients, two sets of OLS-regressions were run on the data from the Kenya Fertility Survey: one to test the full breast-feeding and one to test the partial breast-feeding effect. Partial breast-feeding means a mixture of mother's milk and other foods in the child's diet. Note that the lack of partial breast-feeding implies full weaning, and the lack of full breast-feeding implies partial or full weaning.

The regression model used to perform the test in the full weaning case was set up in the following way. Because reported duration of breast-feeding and age at death in retrospective surveys are very often distorted by heaping at 6, 12, 18 and 24 months, the first 3 years of a child's life were subdivided in 3 unorthodox age-intervals: 1-8, 9-17 and 18-36 months. For each interval only those children who survived up to the beginning of the interval and who were born at least 9, 18 and 36 months before the survey, respectively, were selected. All regressions were, furthermore, restricted to those children born within a period of 10 years before the survey and unweighted data were used. The dependent variable in the regression is a dichotomy and indicates whether the child survives to the end of the age interval (0 if survived; 1 if not).

Children who were breast-fed for a very short period because they died strengthen the negative relation between mortality and breast-feeding duration. The first month of life is excluded from the analysis because those children who are never breast-fed are often too weak or sick to take in any food or have mothers too sick to produce milk. The breast-feeding variable (WEANED) is introduced in the regression as a dummy variable: 0 if the child is not fully weaned at the beginning of the age-interval, 1 if the child is fully weaned. By using this dummy variable rather than breast-feeding duration, we avoid the reverse causation problem. Some other problems remain, however. First, the effect of weaning on mortality will not appear in the present model for a child who is, for example, weaned at the age of 2 months and who dies of some complication due to weaning at, say, 6 months. Given the breast-feeding status at the beginning of the second month (still breast-feeding), it will look as if weaning did not affect the child's death. For this reason we may expect that this model will lead to a conservative estimate of the weaning effect. Second, by subdividing the first three years of life into three intervals, the number of deaths in each interval becomes rather small. This small number can make it more difficult to find regression coefficients significantly different from 0, because it is more likely that random processes distort the data.

For each interval two OLS-regressions are run. In the first model the survival status at the end of the interval is made a function of two socio-economic characteristics of the mother: HIGHED and WORKED. HIGHED is a simple binary variable which indicates whether the mother has had more than 5 years of schooling (0 if less than 5 years; 1 if more than 5 years). WORKED stands for a dummy variable indicating the activity status of the mother (0 if never in the labour force; 1 if ever in the labour force). These two variables were selected because they have proved in previous research on this topic to be highly differential with regard to the duration of breast-feeding. Table A.2 shows that better educated women in Kenya have a tendency to breast-feed for shorter periods, a tendency that exists in many developing countries. The fact that mothers who never worked have higher durations of breast-feeding (table A.3) can probably be explained through their lower level of modernization and because they do not have to leave their babies at home to go to work. In the second model HIGHED and WORKED are included together with the breast-feeding variable. A comparison of the results of the two regression models can determine whether the relationship between HIGHED and WORKED and the probability of dying in the interval is explained through their association with breast-feeding.

To test whether full breast-feeding can also act as an intervening factor in the estimation of social, economic and cultural mortality determinants a similar test was performed. Since practically no child is fully breast-fed for more than 9 months, the age-intervals were chosen as: 1-8, 4-12 and 8-14 months. Again two OLS-regressions were run for each age-interval: the first with HIGHED and WORKED and the second with HIGHED, WORKED and the full breast-feeding status in the beginning of the interval (PWEANED is 1 if partially (or fully) weaned, 0 if still fully breast-fed). In contrast with the partial breast-feeding duration differentials, no marked differences were found among educational groups and working status.

Table A.4 shows the results of the regression with and without the inclusion of the partial breast-feeding variable. The regression coefficients for WEANED show clearly that weaning has indeed an important influence on infant and child mortality. In the age-interval 1-8 months the probability of dying in the interval is 76.7 per thousand higher for those who are already weaned at the beginning of the second month (1 per cent significance). Although not significant at the 10 per cent level, the regression coefficient for WEANED suggests that in the age-interval 9-17 months child mortality is slightly higher for those who are weaned. Between 18 and 36 months, however, the probability of dying for those children who are breast-fed at the beginning of the interval is significantly higher than for those already weaned. This is most probably due to the selection effect, whereby children who are weak or sick are breast-fed well beyond the ages at which healthy children are weaned.

A comparison of the regression results in each age-interval, with and without the breast-feeding dummy reveals that breast-feeding has little effect on other coefficients. In the age-interval 1-8 months regression coefficients for HIGHED and WORKED are almost the same in the two models. Differences in the age-interval 9-17 months are still below 1 per thousand, but show that breast-feeding is a (slight) suppressor variable for both education and working status. That is: women with lower education and women who have never worked breast-feed for longer periods, thereby affording some protection in the interval 9-17 months; and failing to account for that effect reduces apparent differences between educational and working groups.

Regression coefficients in the age-interval 18-36 months are an exception. After controlling for breast-feeding, mortality differentials by maternal education become slightly smaller. This is probably due to the selection process that is considered to be more severe among less educated women. Some children are breast-fed for very long durations because of their poor health status, which may be due to defective health care practices, insufficient economic resources for providing children with nutritious food or an unfavourable disease environment. Since these factors are associated with low level of maternal education, the failure to control for breast-feeding may increase the child mortality differentials by maternal education. It should be stressed again, however, that the differences in the regression coefficients between the models with and without the breast-feeding variable were found to be very small. For instance, in the interval 18-36 months the inclusion of breast-feeding gives a change in the HIGHED-coefficient of only slightly over 2 per thousand.

Table A.5 shows that the failure to control for full breast-feeding duration does not affect at all the regression coefficients of other socio-economic mortality determinants. Differences between the two models are as small as 0 to 3 per ten thousand, which indeed is negligible.

In conclusion, results presented in this annex show that not including breast-feeding has only minor effects on other regression coefficients in the Kenyan data set. It can be expected, therefore, that the results of this volume's analysis of mortality determinants are only slightly biased because breast-feeding was not introduced into the equations.

Table A.2. Proportion of children weaned at the beginning of the interval by mother's education

Age interval	0-4 years education	5+ years education
1-8 months	0.9	1.4
9-17 months	9.2	18.8
18-36 months	64.9	78.7

Table A.3. Proportion of children weaned at the beginning of the interval by activity status of the mother

Age interval	Never-in the labour force	Ever-in the labour force
1-8 months	1.0	1.3
9-17 months	9.5	18.6
18-36 months	66.1	73.7

Table A.4 Regression coefficients of education, activity status of mother and partial breast-feeding at the beginning of the interval on mortality probabilities during the interval (Kenya Fertility Survey: 1977-1978)

Variables	Age-interval 1-8 months		Age interval 9-17 months		Age interval 18-36 months	
	Partial breast-feeding not included	Partial breast-feeding included	Partial breast-feeding not included	Partial breast-feeding included	Partial breast-feeding not included	Partial breast-feeding included
HIGHED	-.0078	-.0081	-.0047	-.0054	-.0107	-.0083
WORKED	-.0056	-.0058	-.0045	-.0053	.0052	.0061
WEANED (FULL)	..	.0767	..	.0100	..	-.0194

Table A.5 Regression coefficients of education, activity status of mother and full breast-feeding at the interval on mortality probabilities during the interval (Kenya Fertility Survey: 1977-1978)

Variables	Age-interval 1-8 months		Age interval 4-12 months		Age interval 8-14 months	
	Full breast-feeding not included	Full breast-feeding included	Full breast-feeding not included	Full breast-feeding included	Full breast-feeding not included	Full breast-feeding included
HIGHED	-.0078	-.0079	-.0048	-.0048	-.0032	-.0035
WORKED	-.0056	-.0057	-.0057	-.0057	-.0110	-.0110
PWEANED	..	.0111	..	-.0031	..	.0099

Annex III

CLASSIFICATION OF OCCUPATIONS USED BY SEVERAL AFRICAN COUNTRIES

Nigeria

Non-manual workers

01 Teachers and instructors
02 Traditional professions
03 Other professional and administrative
04 Clerical workers
05 Religious services

Agricultural manual workers

10 Crop farmers
11 Gardeners
12 Livestock farmers
13 Farmers inadequately described
14 Agricultural labourers, other farm workers
15 Fishermen
16 Forestry (hunters, loggers)
17 Rubber tappers
18 Palm wine tappers
19 Nut and other collectors
20 Farmers with secondary agricultural occupation
21 Farmers with secondary non-agricultural occupation
22 Agricultural manual workers (other than farmer with secondary non-agricultural occupation)

Non-agricultural manual workers

30 Petty traders
31 Other sales workers
40 Drivers
41 Other transport and communication workers
51 Spinners
52 Tailors
53 Other textile and leather workers
54 Blacksmiths
55 Mechanics
56 Carpenters
57 Construction workers
58 Food and beverage processors
60 Mat-makers and other home handicraft workers
61 Other production workers
62 Other labourers
70 Domestic servants
71 Other service workers
72 Members of armed forces

Economically inactive persons

80 Housewives
81 Students
82 Children (less than 14 years)
83 Elders (older than 65 years)
84 Other adult person without occupation

Explanatory notes of some occupational groups

02 Traditional professions
Herbalists, osteopaths
Carvers, painters
Actors, musicians
Chiefs, other traditional officials etc.

03 Other professional and administrative
Engineers, surveyors, research workers, technicians
Agronomists, veterinarians
Physicians, dentists, nurses, pharmacists, health officers
Technical officers, writers, accountants, administrators, managers etc.

04 Clerical workers
Cashiers, auditors, typists
Machine operators, other clerks etc.

11 Gardeners
Market gardeners, gardeners, plantation and nursery workers etc.

12 Livestock farmers
Livestock farmers, cattle-hands etc.

31 Other sales workers
Wholesale merchants, commercial travellers, buyers, shop assistants, commission agents etc.

41 Other transport and communication workers
Candemen, locomotive drivers, hand-carters, telephone operators, postmen, messengers, bus conductors, other transport workers etc.

51 Spinners
Cotton-combers, machine- and hand-spinners

53 Other textile and leather workers
Hat-makers, mattress makers, seamsters, upholsterers, shoe-makers, other leather workers etc.

55 Mechanics
Watchmakers, jewelers, machine-fitters
Mechanics, repairmen
Electricians, radio technicians etc.

57 Construction workers
Sheet metal workers, plumbers, welders
Saw operators and other wood workers
Masons, painters
Brick-makers and bricklayers
Other construction workers (excepting road construction which should be classified as 62)

58 Food and beverage processors
Millers, bakers, brewers
Butchers, other food processors

60 Mat makers and other home handicraft workers
Mat-makers, potters, soap-makers etc.

61 Other production workers
Pressmen, bookbinders
Miners
Other skilled or semi-skilled workers

62 Other labourers
Unskilled

71 Other service workers
Policemen, fire-fighters, customs officers, watchmen
Cooks, waiters
Cleaners, launderers, barbers
Photographers, sportsmen
Hospital and hotel workers

Sierra Leone

1 Professional, technical and related workers
Doctors
Nurses
Teachers
Engineers
Lawyers
Athletes
Physical and agricultural science
Clergy
Arts and social science workers

2 Administrative, executive and managerial workers
Directors
Managers
Assistant Secretaries
Senior civil servants
Elected administrative and executive officers

3 <u>Clerical workers</u>
Typists
Clerks
Stenographers
Bookkeepers
Cashiers
Clerks in Government and industry

4 <u>Sales workers</u>
Wholesale
Retail
Petty traders
Salesmen
Shop assistants
Street vendors
Marketing officers of insurance
Real estate securities and services

5 <u>Farmers, fishermen, hunters, loggers and related workers</u>
Farmers, farm managers and other farm workers
Hunters and trappers
Loggers, other forestry workers and palm wine tappers

6 <u>Miners, quarrymen and related workers</u>
Drillers and sinkers
Blasters
Machine operators
Diamond diggers
Mine labourers
Well-drillers

7 <u>Workers in transport and communication operations</u>
Ship crews
Crews of inland water boats
Aircraft crews
Railway crews
Road transport drivers and conductors
Traffic inspectors, controllers, supervisors and dispatchers
Telephone and telegraph operators and supervisors
Postmen and messengers

8 <u>Craftsmen, production process workers and labourers</u>
Textile workers
Tailors and seamstresses
Shoe- and sandal-makers and repairers
Blacksmiths and other metal workers
Watch-repairmen
Fitters
Mechanics-repairmen
Electricians
Carpenters and joiners
Painters

8 **Craftsmen, production process workers and labourers (continued)**
Bricklayers
Masons and other construction workers
Pressmen, binders and other printing workers
Oil-makers, bakers, food and beverage workers
Cigarette-makers, freight-handlers, craftsmen, labourers

9 **Service, sports and recreation workers**
Police and othe law enforcement workers, armed forces, guards, stewards, cooks, waiters, building caretakers, cleaners, barbers, launderers, dry-cleaners and pressers
Other service and recreation workers

Sudan

Commerce

01 Butcher - no shop
02 Grocer - no shop
03 Greengrocer - no shop
04 Grain-seller - no shop
05 Drinks, cigarettes and snuff-seller - no shop
06 Handicraft-seller
07 Nut, milk, kisra and prepared food seller
08 Travelling salesman - clothes, kitchenwares, children's shoes, perfumes, etc.
09 Livestock merchant
10 Construction materials merchant
11 Butcher - shop
12 Grocer - shop
13 Greengrocer - shop
14 Grain-seller - shop
15 Drinks, cigarettes and snuff-seller - shop
16 Pharmacist
17 Other merchant, shopkeeper - fishermen
18 Wholesale
19 Water-seller
96 Errand-boy, shop attendant, assistant to shopkeeper

Farming (Cultivation and animal husbandry)

Irrigated farming

20 Tenant
21 Agricultural worker
56 Cotton-picker
00 Weika picker (in the Rughwas)
22 Sharecropper
23 Other (Wakil, worker in family garden, sharecropper garden)

Farming (Cultivation and animal husbandry) (continued)

Animal husbandry

24 Herd-owner, husbandman
25 Shepherd
26 Cow-milker, grass-carrier
27 Other

Rain-fed cultivation

28 Cultivator
29 Agricultural worker
30 Other

Artisans and handicrafts and small-scale production

Artisans

31 Blacksmith
32 Carpenter
33 Brickmaker
34 Usta (building construction foreman)
35 Tailor
36 Shoemaker, shoe repairs
37 Other artisan - painter, baker, electrician, auto repairs, mechanic, radio-repairman

Handicrafts

38 Straw-weaver
39 Embroiderer
40 Other
97 Tulba - Construction worker or errand-boy, shop assistant to artisans or handicraftsmen

Small-scale production

63 Mill-owner
64 Alcohol, beer producer
65 Subcontractor
66 Other - yoghourt-maker, ropemaker

Production

Public industry

41 Administrator
42 Official/clerk - accountant
43 Technician
44 Skilled worker - driver, electrician
45 Unskilled worker
46 Other

Production (continued)

Agricultural corporations

47 Administrator
48 Official/clerk - accountant
49 Technician
50 Skilled worker - driver, electrician
51 Unskilled worker
52 Other
53 SAMAAD-SGB representation among tenants

Private industry

57 Administrator
58 Official/clerk - accountant
59 Technician
60 Skilled worker - driver, electrician
61 Unskilled worker
62 Other

Services

Public services: hospitals, railways, irrigation.

67 Administrator
68 Official/clerk - accountant
69 Technician
70 Skilled worker - driver, electrician
71 Unskilled worker
72 Other

Private services: corporations, Gezira Transport Company etc.

77 Administrator
78 Official/clerk - accountant
79 Technician
80 Skilled worker - driver, electrician
81 Unskilled worker
82 Other

Public agencies Ministries, Councils, Unions, Schools, Banks, Sudan Development Corporation etc.

87 Administrator
88 Official/clerk - accountant
89 Technician
90 Skilled worker - driver, electrician
91 Unskilled worker
92 Other - member of public councils
93 Lecturer
94 Police, firemen, soldier
55 Teacher, headmaster

Abroad

73 Technician
74 Skilled worker
75 Unskilled worker, agricultural worker
76 Other - police, official/clerk, baker, dentist, gardner

Other (small) services

83 Bus, lorry, box taxi driver
84 Fakhi - religious man
85 Bus, lorry, box taxi-driver
86 Others - carriage-owner, barber, hairdresser, porter, optical technician, midwife, servant
98 Bus, lorry, box taxi owner-driver
54 Driver's assistant, errand-boy

Annex IV

DEFINITION OF URBAN AREAS

Region/Country	Definition
Africa	
Ghana	Localities with 5,000 or more inhabitants
Kenya	Localities with 10,000 or more inhabitants
Lesotho	Includes Maseru and other urban areas greater than 450 inhabitants
Liberia	Localities with 2,000 or more inhabitants
Nigeria	Towns with 20,000 or more inhabitants
Asia	
Indonesia	Cities administratively defined, with size, density, non-agricultural activities and level of public services taken into account
Nepal	Localities with 10,000 or more inhabitants
Republic of Korea	Municipalities with 50,000 or more inhabitants
Sri Lanka	Urban councils and municipal councils as defined by Minister of local government
Thailand	Municipalities with 50,000 or more inhabitants
Latin America	
Chile	Populated centres having definite urban characteristics owing to presence of certain public and administrative services
Jamaica	Kingston and seven other urban areas with a minimum size of 10,000 (1974)
Peru	Minimum of 100 houses grouped together at a distance of less than 30 meters, or a district capital if less than 100 houses

REFERENCES

Anker, R and J. Knowles. "An empirical analysis of mortality differentials in Kenya at the macro and micro levels", Economic Development and Cultural Change, vol. 29, No. 1 (1980).

Auster, R. and others. "The production of health: an exploratory study", Journal of Human Resources, vol. 4, No. 4 (1969).

Barrett and Jozan. "Migrants and health", background paper prepared for the Office of Dissemination of Statistical Information (unpublished manuscript), World Health Organization (1982).

Baum, S. and E. E. Arriaga. "Levels, trends, differentials and causes of infant and early childhood mortality in Latin America", World Health Statistics Quarterly, vol. 34, No. 3 (1981).

Behm, H. "Final report on the Research Project on Intant and Childhood Mortality in the Third World", Infant and Child Mortality in the Third World (CICRED, Paris, 1983).

__________. "Socio-economic determinants of mortality in Latin America", Population Bulletin of the United Nations, No. 13 (United Nations publication, Sales No. E.81.XIII.4).

__________. La mortalidad en los primeros años de vida en países de la América Latina, Costa Rica 1968-1969 (Centro Latinoamericano de Demografía, San José de Costa Rica), diciembre de 1976, Serie A, No. 1024.

__________ and F. Brizuela de Ramírez. La mortalidad en los primeros años de vida en países de la América Latina, Paraguay 1967-1968, San José de Costa Rica, Centro Latinoamericano de Demografía, abril de 1977, Serie A, No. 1027.

__________ and M. Correa. La mortalidad en los primeros años de vida en países de la América Latina, Chile 1965-1966, San José de Costa Rica, Centro Latinoamericano de Demografía, junio de 1977, Serie A, No. 1030.

__________ and F. de Moya. La mortalidad en los primeros años de vida en países de la América Latina, República Dominicana 1970-1971, San José de Costa Rica, Centro Latinoamericano de Demografía, mayo de 1977, Serie A, No. 1028.

__________ and A. E. Escalante. La mortalidad en los primeros años de vida en países de la América Latina, El Salvador 1966-1967, San José de Costa Rica, Centro Latinoamericano de Demografía, febrero de 1977, Serie A, No. 1026.

__________ and A. Ledesma. La mortalidad en los primeros años de vida en países de la América Latina, Perú 1967-1968, San José de Costa Rica, Centro Latinoamericano de Demografía, mayo de 1977, Serie A, No. 1029.

________ and J. Olinto Rueda. La mortalidad en los primeros años de vida en países de la América Latina, Colombia 1968-1969, San José de Costa Rica, Centro Latinoamericano de Demografía, setiembre de 1977, Serie A, No. 1032.

________ and D. A. Primante. La mortalidad en los primeros años de vida en países de la América Latina, Honduras 1969-1970, San José de Costa Rica, Centro Latinoamericano de Demografía, setiembre de 1978, Serie A, No. 1038.

________. "Mortalidad en los primeros años de vida en la América Latina", Notas de población (San José de Costa Rica) Año 6, No. 16. abril de 1978.

________ and L. Rosero. La mortalidad en los primeros años de vida en países de la América Latina, Ecuador 1969-1970, San José de Costa Rica, Centro Latinoamericano de Demografía, junio de 1977, Serie A, No. 1031.

________ and E. Vargas. La mortalidad en los primeros años de vida en países de la América Latina, Guatemala 1968-1969, San José de Costa Rica, Centro Latinoamericano de Demografía, marzo de 1978, Serie A, No. 1037.

________ and J. Vallin. "Mortality differentials among human groups", in S. H. Preston (ed.), Biological and Social Aspects of Mortality and the Length of Life (Ordina Editions, Liège, 1982).

________, K. Hill and A. Solíz. La mortalidad en los primeros años de vida en países de la América Latina, Bolivia 1971-1972, San José de Costa Rica, Centro Latinoamericano de Demografía, febrero de 1977, Serie A, No. 1025.

Behrman, J. and B. Wolfe. "The impact of health and nutrition on the number of surviving children in a developing metropolis" (mimeograph), 1979.

Benjamin, B. Social and Economic Factors Affecting Mortality (Marton, Paris, 1965).

Boulier, B. and V. Paqueo. "On the theory and measurement of the determinants of mortality" (unpublished manuscript, Princeton University, 1981).

Brass, W. and others. The Demography of Tropical Africa, Office of Population Research Series (Princeton University Press, Princeton, 1968).

Butz, W. P., J. DaVanzo and J.-P. Habicht. Biological and Behavioral Influences on the Mortality of Malaysian Infants (1982).

Caldwell, J. C. "Education as a factor in mortality decline: an examination of Nigerian data", Population Studies, vol. 33, No. 3 (1979).

________ and P. McDonald. "Influence of maternal education on infant and child mortality: levels and causes", Proceedings of the International Population Conference, International Union for the Scientific Study of Population, Manila 1981, vol. 2 (Ordina Editions, Liège).

Carvajal, M. and P. Burgess. "Socioeconomic determinants of fetal and child deaths in Latin America: a comparative study of Bogota, Caracas and Rio de Janeiro", Social Science and Medicine, vol. 12 (November 1978).

Carvalho, J. A. M. "Regional trends in fertility and mortality in Brazil", *Population Studies*, vol. 28, No. 3 (1974).

________ and C. Wood. "Mortality, income distribution and rural-urban residence in Brazil", *Population and Development Review*, vol. 4, No. 3 (1978).

Chase, H. "White-non-white mortality differentials in the United States", *Health, Education and Welfare Indicators*, vol. 3, No. 1 (Washington, D.C., June 1965).

Chen, L. C. and others. "Estimating and partitioning the mortality impact of several modern medical technologies in basic health services", *Proceedings of the International Population Conference*, International Union for the Scientific Study of Population, Manila 1981, vol. 2 (Ordina Editions, Liège).

Cochrane, S. H., D. J. O'Hara and J. Leslie. "The effects of education on health", World Bank Working Papers No. 405 (Washington, D.C., 1980).

Condran, G. and E. Crimmins. "Mortality differentials between rural and urban areas of states in the northeastern United States 1890-1900", *Journal of Historical Geography*, vol. 6, No. 2 (1980).

DaVanzo, J. and D. L. P. Lee. "The compatibility of child care with labor force participation and non-market activities: preliminary evidence from Malaysian time budget data", Rand Paper, P-6126.

Davis, K. "Cities and mortality", *Proceedings of the International Population Conference*, International Union for the Scientific Study of Population, Manila 1981, vol. 3 (Ordina Editions, Liège).

Denison, E. F. and W. K. Chung, *How Japan's Economy Grew So Fast: The Sources of Postwar Expansion* (The Brookings Institution, Washington, D. C., 1976).

Ebanks, G. E. "Some correlates of infant mortality: Trinidad and Tobago, Guyana and Jamaica", paper presented at the Annual Meeting of the Population Association of America, Pittsburgh, April 1983.

Epstein, T. S. "The social context of education and health", *Health Policy and Education*, vol. 2 (1982).

Ewbank, D., R. Henin and J. Kekovole. "An integration of demographic and epidemiologic research on mortality in Kenya", *in Determinants of Mortality Change and Differentials in Developing Countries: The Five-Country Case Study Project* (United Nations publication, to be issued).

Farah, A. A. and S. H. Preston. "Child mortality differentials in Sudan", *Population and Development Review*, vol. 8, No. 2 (June 1982).

Feachem, R. "The water and sanitation decade", *Journal of Tropical Medicine and Hygiene*, vol. 84, No. 2 (1981).

Federici, N. and others. "Urban-rural differences in mortality 1950-1970", World Health Statistics Report, vol. 29, Nos. 5-6, (1976).

Fernando, D. F. S. "Factors influencing the infant mortality rate in Sri Lanka", Journal of Biosocial Science, vol. 13, No. 3 (1981).

Fetter, G. C. "A comparative study of attitude of Christian and of Muslim Lebanese villagers", Journal for the Scientific Study of Religion, vol. 4, No. 1 (Fall 1964).

Frenzen, P. and D. Hogan. "The impact of class, education and health care on infant mortality in a developing society: the case of rural Thailand", Demography, vol. 19, No. 3 (August 1982).

García y Garma, I. O. "Some factors associated with infant mortality in Mexico", Infant and child mortality in the third world (Paris, CICRED and World Health Organization, 1983).

Gilbert, A. and J. Gugler. Cities, Poverty and Development: Urbanization in the Third World (Oxford University Press, Oxford, 1982).

Giles, H. F. "Differential life expectancy among white and nonwhite Americans: some explanations during youth and middle age", in R. C. Manuel (ed.), Minority Aging (Greenwood, Westport, Connecticut, 1982).

Gordon, J. and others. "The second-year death rates in less developed countries", American Journal of the Medical Sciences, vol. 254, No. 8 (1967).

Gourou, P. The Tropical World (Longman, London, fifth edition, 1980).

Gray, R. H. "The decline of mortality in Ceylon and the demographic effects of Malaria control", Population Studies, vol. 28, No. 2 (1974).

Gupta, S. K. C. and S. R. K. U. Rao. "Child-loss experience in a rural area", Journal of Family Welfare (India), vol. 23, No. 1 (1976).

Gwatkin, D. R. "Indicators of change in developing country mortality trends: the end of an era?", Population and Development Review, vol. 6, No. 4 (1980).

__________ and S. K. Brandel. "Reducing infant and child mortality in the developing world, 1980-2000", Overseas Development Council Working Paper No. 2 (1981).

Haines, M. R. "Mortality in Nineteenth Century America: estimates from New York and Pennsylvania census data, 1865 and 1900", Demography, vol. 14, No. 3 (August, 1977).

Harrington, J. "Economic development and mortality in infancy and childhood: Comments from the West African case", Population Planning Working Paper No. 10 (Ann Arbor, Department of Population Planning, School of Public Health, 1974) (mimeographed).

Hobcraft, J. and others. "Socioeconomic factors in infant and child mortality: a cross-national comparison", paper presented at the Annual Meeting of the Population Association of America, San Diego, May 1982.

_________, J. W. McDonald and S. Rutstein, "Child-spacing effects on infant and early child mortality", Population Index, vol. 45, No. 4 (1983).

Hogan, H and S. Jiwani. "Differential mortality", in R. A. Henin (ed.), The Demography of Tanzania, vol. 4 (Bureau of Statistics, Dar-es-Salaam, c. 1975).

Isaac, B. L. and W. E. Feinberg. "Marital form and infant survival among the Mende of rural Upper Bambara Chiefdom, Sierra Leone", Human Biology, vol. 54, No. 3 (1982).

Iwugo, K. O. "Sanitation technology options for developing countries (with special reference to Africa)", Public Health, vol. 95, No. 4 (1981).

Knodel, J. and A. Chamratrithirong. "Infant and child mortality in Thailand: levels, trends and differentials as derived through indirect estimation techniques", Papers of the East-West Population Institute, No. 57 (1978).

_________ and H. Kintner. "The impact of breast feeding patterns on the biometric analysis of infant mortality", Demography, vol. 14, No. 4 (November 1977).

Lindenbaum, S. "The influence of maternal education on infant and child mortality in Bangladesh", International Centre for Diarrhoeal Disease Research Manuscript (Bangladesh, 1983).

Marsden, P. D. "The Sukuta Project: a longitudinal study of health in Gambian children from birth to 18 months of age", Transactions of the Royal Society of Tropical Medicine and Hygiene, vol. 58 (1964).

Martin, L. G. and others. "Co-variates of child mortality in the Philippines, Indonesia and Pakistan: an analysis based on hazard models", Population Studies, vol. 37, No. 3 (1983).

Meegama, S. A. "Socio-economic determinants of infant and child mortality in Sri Lanka: an analysis of post-war experience", World Fertility Survey Scientific Report, No. 8 (Voorburg, The Hague, International Statistical Insitute, 1980).

Mhloyi, M. "The relative impact of breastfeeding on infant and child mortality", unpublished manuscript, Population Studies Centre, University of Pennsylvania (1982).

Morley, D. and others. "Factors influencing the growth and nutritional status of infants and young children in a Nigerian village", Transactions of the Royal Society of Tropical Medicine and Hygiene, vol. 62, No. 2 (1968).

Mosley, W. H. "Will primary health care reduce infant and child mortality? A critique of some current strategies with special reference to Africa and Asia", paper presented to the seminar on Social Policy, Health Policy and Mortality Prospects, International Union for the Scientific Study of Population, Paris, February 28-March 4, 1983.

________ and L. C. Chen. "An analytical framework for the study of child survival in developing countries", in W. H. Mosley and L. C. Chen (eds.), Child Survival: Strategies for Research, Population and Development Review, a Supplement to Vol. 10 (1984).

Mott, F. L. "Infant mortality in Kenya: evidence from the Kenya Fertility Survey", World Fertility Survey Scientific Report, No. 32 (1982).

Nag, M. "Impact of social development and economic development on mortality: a comparative study of Kerala and West Bengal Center for Policy Studies", Working Paper, No. 78 (Center for Policy Studies, the Population Council, Inc., New York, December 1981).

Newman, P. "Malaria eradication and its effects on mortality levels: a comment", Population Studies, vol. 23 (1969).

Nortman, D. L. and E. Hofstatter. Population and Family Planning Programs (Population Council Fact Book, Ninth Edition, New York, 1978).

Orubuloye, E. O. and J. C. Caldwell. "The impact of public health services on mortality: A study of mortality differentials in a rural area of Nigeria", Population Studies, vol. 29, No. 2 (1975).

Palloni, A. "Design problems and data collection strategies in studies of mortality differentials: developing countries", in J. Vallin, J. H. Pollard and L. Heligman (eds.), Methodologies for the Collection and Analysis of Mortality Data (Ordina Editions, Dolhain, Belgium, 1984).

________. "Mortality in Latin America: emerging patterns", Population and Development Review, vol. 7, No. 4 (1981).

Patel, M. "Modelling determinants of health", International Journal of Epidemiology, vol. 10, No. 3 (1981).

Pernia, E. M. "Population growth and urbanization", in Population of the Philippines, United Nations, Economic and Social Commission for Asia and the Pacific, Country Monograph Series No. 5 (Bangkok, 1978).

Perrenard, A. "Les aspects socio-économiques de la mortalité différentielle des enfants dans le passé", Proceedings of the International Population Conference, International Union for the Scientific Study of Population, Manila 1981, vol. 2 (Ordina Editions, Liège).

Preston, S. H. "Causes and consequences of mortality decline in less developed countries during the Twentieth Century", in R. E. Easterlin (ed.), Population and Economic Change in Developing Countries (Chicago Press, Chicago, 1980).

________. Mortality Patterns in National Populations (Academic Press, New York, 1976).

Preston, S. H. "Resources, knowledge and child mortality: a comparison of the U.S. in the late nineteenth century and developing countries today", prepared for International Population Conference, International Union for the Scientific Study of Population, Florence, Italy, June 1985.

________ (ed.). The Effects of Infant and Child Mortality on Fertility (Academic Press, New York, 1978).

________, M. R. Haines and E. Pamuk. "Effects of industrialization and urbanization on mortality in developed countries", Proceedings of the International Population Conference, International Union for the Scientific Study of Population, Manila 1981, vol. 3 (Ordina Editions, Liège).

Puffer, R. G. and C. V. Serrano. "Patterns of mortality in childhood", Scientific Publication No. 50 (Pan-American Health Organization, Washington, D.C., 1973).

Ratcliffe, J. "Social justice and the demographic transition: lessons from India's Kerala State", International Journal of Health Service, vol. 8, No. 1 (1978).

Reid, J. "Black America in the 1980's", Population Bulletin, vol. 37, No. 4 (Population Reference Bureau, Washington, D.C., 1982).

Roberts, G. W. Fertility and Mating Patterns in West Indian Populations (Unwin Brothers Limited, England, 1975).

Roberts, R. E. "Modernization and infant mortality in Mexico", Economic Development and Cultural Change, vol. 21, No. 4 (1973).

Rochester, A. Infant mortality: Results of a Field Study in Baltimore, Maryland Based on Births in One Year, Bureau Publication No. 119 (United States Department of Labor, Children's Bureau, Government Printing Office, Washington, D.C., 1923).

Rodgers, G. B. "Income and inequality as determinants of mortality: an international cross-section analysis", Population Studies, vol. 33, No. 2 (July 1979).

Rosenzweig, M. R. and T. P. Schultz. "Child mortality and fertility in Colombia: individual and community effects", Center Discussion Paper, 380 (Economic Growth Center, Yale University, New Haven, 1981).

________ and T. P. Schultz. "Market opportunities, genetic endowments and intra-family resource distribution: child survival in rural India", American Economic Review, vol. 72, No. 4 (September 1982).

________ and K. Wolpin. "Governmental interventions and household behavior in a developing country: anticipating the unanticipated consequences of social programs", Journal of Development Economics, vol. 10, No. 2 (1982).

Rowland, M. G. M. "Dietary and environmental factors in child mortality in the Gambia and Uganda", paper presented at a conference on Medical Aspects of African Demography, Peterhouse, Cambridge, 17-18 September 1979.

Ruzicka, L. T. and T. Kanitkar. "Infant mortality in greater Bombay", Demography India, vol. 2, No. 1 (1973).

Sawyer, D. O. and E. S. Soares. "Child mortality in different contexts in Brazil: variation in the effects of socio-economic variables", Infant and Child Mortality in the Third World (Paris, CICRED and World Health Organization, 1983).

Schultz, T. P. "Interpretation of relations among mortality, economics of the household and the health environment", Economic Growth Center Discussion Paper No. 318 (Yale University, New Haven, 1979).

Shin, E. H. "Economic and social correlates of infant mortality: a cross-sectional and longitudinal analysis of 63 selected countries", Social Biology, vol. 22, No. 4 (Winter 1975).

Sloan, F. Survival of Progeny in Developing Countries: An Analysis of Evidence from Costa Rica, Mexico, East Pakistan and Puerto Rico (Rand Corporation, Santa Monica, California, 1971).

Sulaiman, I. Child Mortality in Nigeria: Levels and Socioeconomic Differentials (Ph.D. dissertation in demography, University of Pennsylvania, 1984).

Taubman, P. and S. Rosen. "Healthiness, education and marital status", Working Paper No. 611 (National Bureau of Economic Research, Cambridge, Massachusetts, December 1980).

Taucher, E. "La mortalidad en Chile, desde 1955 a 1975: tendencias y causas", Notas de población, vol. 6, No. 18 (December 1978).

Tawiah, E. O. "Levels, patterns, trends and differentials in infant and early childhood mortality, Ghana 1960 and 1971" (Doctoral dissertation, Duke University, 1979).

Thapa, S. and R. D. Retherford. "Infant mortality estimates based on the 1976 Nepal Fertility Survey", Population Studies, vol. 36, No. 1 (March 1982).

Trussell, T. J. and C. Hammerslaugh. "A hazards-model analysis of the covariates of infant and child mortality in Sri Lanka", Demography, vol. 20, No. 1 (1983).

________ and S. H. Preston. "Estimating the covariates of childhood mortality from retrospective reports of mothers", Health Policy and Education, vol. 3, No. 1 (1982).

United Nations. Department of International Economic and Social Affairs. Population Division. Determinants and Consequences of Population Trends, vol. I (Population Studies No. 50; ST/ESA/SER.A/50). Sales No. E.71.XIII.5.

________. Determinants of Mortality Change and Differentials in Developing Countries: The Five Country Case Study Project (Population Studies No. 94; ST/ESA/SER.A/94).
Sales No. 85.XIII.4.

________. Manual X. Indirect Techniques for Demographic Estimation (Population Studies No. 81; ST/ESA/SER.A/81).
Sales No. E.83.XIII.2.

________. Levels and Trends in Mortality since 1950 (Population Studies No. 74; ST/ESA/SER.A/74).
Sales No. E.81.XIII.3).

U.S.A. National Center for Health Statistics. Infant and Perinatal Mortality in Denmark, Vital and Health Statistics Series 3, No. 9 (Washington, D.C., 1967).

Vallin, J. "World trends in infant mortality since 1950", World Health Statistics Report, vol. 29, No. 11 (World Health Organization, Geneva, 1976).

Vallin, J. "Socio-economic determinants of mortality in industrialized countries", Population Bulletin of the United Nations, No. 13, August 1981 (United Nations publication, Sales No. E.81.XIII.4).

Wainerman, C. H. and Z. Recchini de Lattes. El Trabajo Femenino en el Banquillo de los Acusados. La Medición Censal en América Latina (The Population Council and Editorial Terra Nova, Mexico, 1981).

Ware, H. "Effects of maternal education, women's roles and child care on mortality", in W. H. Mosley and L. C. Chen (eds.), Child Survival: Strategies for Research, Population and Development Review, a Supplement to Vol. 10 (1984).

Weber, A. F. The Growth of Cities in the Nineteenth Century (Cornell University Press, Ithaca, 1963), first edition, 1899.

Williams, J. S. "Infant and child mortality in Burma by ethnic group", Eugenics Quarterly, vol. 13, No. 2 (1966).

Woodbury, R. M. Causal factors in infant mortality, Bureau Publication No. 142 (United States Department of Labor, Children's Bureau, Government Printing Office, Washington, D.C., 1925).

World Health Organization. "Main findings of the comparative study of social and biological effects on perinatal mortality", World Health Statistics Report, vol. 31, No. 3 (1978).

________. "Childhood mortality in the Americas", WHO Chronicle, vol. 28 (1974).

________. "Community water supply and sewage disposal in developing countries", World Health Statistics Report, vol. 26, No. 11 (1973).

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