FACTORS INFLUENCING CHILD SURVIVAL IN ZAMBIA

by

Geoffrey Buleti Nsemukila

THESIS SUBMITTED FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN POPULATION STUDIES AS A REQUIREMENT OF THE UNIVERSITY OF LIVERPOOL, DEPARTMENT OF GEOGRAPHY

JULY - 1996

Dedication

TO THE ZAMBIAN CHILD

Acknowledgements

I wish to show my heartfelt gratitude to my supervisors Professor W.T.S. Gould and Professor R.I. Woods for their support, guidance and invaluable comments on this study. Without their understanding and patience, this study would not have been possible. My appreciation is also extended to Dr. Paul Williamson, Dr. David Siddle, Mr. Steve Reddy and Mrs. Sue Byrne, all of the University of Liverpool, for their advice and technical support. I also wish to thank my colleagues and staff of the Geography Department for creating such a congenial academic atmosphere and a pleasure to work with. My special thanks go to Omondi Ochola, Graham Root, Caitriona Ni Laoire, Mark Brown and Joseph Addison. I wish to express my appreciation to the continuous support and guidance of Professor Kwesi Gaisie, Dr. Eilidh Garrett and Dr. Stan Yoder. I also wish to acknowledge advice and support received from colleagues Dr. Tesfay Teklu and Dr. Akim Mturi. I am most grateful to my wife Mary Mumamba and my lovely sons Chabu and Bwalya for their unfailing patience and support. I am also grateful to the continuous encouragement of friends Wim Wouters and Rodrick Kalasa.

I am greatly indebted to the United Nations Population Fund (UNFPA) for financial support and to my employer the University of Zambia in facilitating my fellowship. I equally wish to acknowledge the administrative support of the British Council and especially the unfailing support of Julie Hankinson and Neena Patria. Lastly, and not least, I wish to thank all, who in different ways made my study possible.

Abstract

Both survey and census data show an overall increase in childhood mortality in Zambia since the 1980s. This study shows that childhood mortality patterns and trends are sharply influenced by both age and regional variations. Mainly influenced by the upsurge in infant and especially post-neonatal mortality, this analysis shows that rural childhood mortality had started to rise as early as the mid-1970s before the rise in urban mortality. The delay in urban mortality increase may be due to government policy that subsidised urban rather than rural living conditions. While the rise in mortality parallels the poor performance of Zambia's economy since the early 1970s and possibly worsened by the AIDS epidemic during the 1980s, the narrowing of mortality differentials between regions and social groups is due to the deterioration in survival chances of children from otherwise advantaged households.

Using children born during the five years prior to the ZDHS (1992) survey, the study demonstrates the power of an adapted Mosley-Chen framework in identifying mechanisms through which socio-economic and cultural factors influence child health and survival. A most important innovation, however, is the explicit introduction of intermediate behavioural factors to further explain socio-economic and cultural childhood mortality differentials, and expose certain behavioural patterns that are associated with high mortality risk. While neonatal mortality is strongly influenced by bio-demographic proximate factors, and child mortality is dominated by issues linked to child spacing

and to the socio-behavioural environment surrounding the household, the post-neonatal period is largely determined by behavioural and bio-demographic factors.

Table of Contents

List of Tables

List of Figures

CHAPTER ONE

INTRODUCTION:

THE SEARCH FOR A CONCEPTUAL FRAMEWORK

1.1 GENERAL INTRODUCTION

General child health and particularly mortality have been important areas of research among biomedical and social scientists for decades. Child survival studies have particularly become familiar in the developing countries where the death of more than one child out of every ten born before age five is the norm.

For Sub-Saharan Africa, with the world's highest level of childhood mortality, children's deaths have become basic indicators of a country's socio-economic situation, and particularly in assessing general quality of life. While there is general agreement that estimation of childhood mortality levels, structure and trends is fundamental to any assessment of the overall health situation of children, UNICEF has recently identified under-five mortality rate as the single most important indicator of the status of a nation's children (Bellamy, 1996). Moreover, and with almost all of the 15 countries with the worst under-five mortality rates coming from the Sub-Saharan African region, the rationale for this special attention is not far-fetched.

At the beginning of the 1980s, considerable concern was expressed that the pace of mortality decline in developing countries had slowed after an initial period of rapid decline from the mid-1940s (Gwatkin, 1980; Palloni, 1981; Ruzicka and Hansluwka, 1982; Ruzicka, 1983). According to Gwatkin (1980), the suggestion that emerged from findings at that time was that the remarkably rapid rate of mortality decline had begun to falter, giving way to a confused, diverse, ambiguous situation marked by unexpected slow downs in the pace of health improvements observed in many developing countries.

By 1993, the National Research Council (NRC) synthesis confessed that the optimism of childhood mortality transition to even lower levels in developing countries was slowly fading away as many countries started to experience stagnation and reversals in trends of mortality, especially in the periods of the 1970s and 1980s (Hill et al., 1993).

Although relatively little empirical work has investigated the issue of change in the pace of decline in childhood mortality, a few studies have addressed this issue recently (UN, 1988a and 1990; Hill and Pebley, 1989; Sullivan, 1991; Cleland, Bicego and Fegan, 1992).

Findings from the United Nations (1988), whose analysis was restricted to countries with mortality estimates that were deemed reliable after thorough evaluation, are mixed, with the pace of decline accelerating in some countries and decelerating in others.

The 25 year (1960-1985) period study by Hill and Pebley (1989) is sceptical of the conclusions of earlier studies of mortality decline, and concludes that percent declines had remained remarkably similar over the whole period.

Using both United Nations estimates and Demographic and Health Survey (DHS) data, Sullivan's estimates indicated significant increases in the pace of mortality decline between the two periods (1965-80 for UN and mid-1970s - late-1980s for DHS) in North Africa and South America, and that mortality remained approximately stable in the three countries surveyed in Asia.

As for Sub-Saharan Africa, the situation is even more confused as researchers blame data quality for unexpected observations in their estimates (Ruzicka, 1983; UN, 1988; Hill and Pebley, 1989; Sullivan, 1991; Cleland et al., 1992).

Although Hill and Pebley (1989) do observe in their paper that the number of cases for Africa and the Middle East are too small to support even impressionistic conclusions and that percent declines have remained remarkably similar over the period, they finally conclude that the decline in childhood mortality appears to have accelerated in Africa in spite of the poor economic performance of many countries in the region. Among the 26 Sub-Saharan African countries considered in their study, only 6 had information for the decade 1975-1985, amongst which Ghana and Uganda experienced a deceleration of mortality decline.

Another study by Cleland et al. (1992) decided to exclude Ghana and Kenya from the analysis on the basis of data inconsistencies. However, a study of DHS data for surveys conducted from 1986-1990 for 12 Sub-Saharan African countries found Uganda, Nigeria and Sudan to have had much smaller declines in under-five mortality for the period starting in the mid-1970s till late-1980s (Sullivan, 1991). Similarly, Uganda, Ghana and Nigeria have been identified as countries where childhood mortality has clearly stagnated or risen over the past two decades (Hill et al., 1993). This observation was earlier noted by Sullivan (1991) who cites the Nigerian example for reduced pace of decline and those of Ghana and Kenya as countries where no change has been apparent. The later signs, therefore, of some increase in childhood mortality and particularly post-neonatal mortality by recent DHS data in Kenya (1993), and Zimbabwe (1994) is disturbing (NCPD/Macro, 1994; CSO/Macro, 1995).

Despite lack of good quality demographic data to validate the confused situation in Sub-Saharan Africa, a scenario of deteriorating childhood and even adult mortality is possible only if demographers allow their judgement to be enhanced by information from complementary sources. As stated by Gwatkin (1980):

> *" ..... in the light of what is known about recent medical, social, and economic progress, it would be much more difficult to explain demographic data showing continuing widespread rapid mortality declines of the sorts earlier anticipated"* (p. 627).

The Zambian case is of considerable interest in this regard. Not only are one in every five Zambian children dying before their fifth birthday, but also Zambia has been identified as the 13th worst country in the world in terms of under-five mortality rate (Bellamy, 1996).

Even after thorough demographic data quality consistency and completeness checks are applied to the Zambian survey data (Gaisie, Cross, Nsemukila, 1993; Curtis, 1995), under-five mortality and particularly infant mortality have risen consistently for almost two decades.

Moreover, a longitudinal anthropological study from southern Zambia (1956-1991) demonstrates the increase in childhood mortality since the mid-1970s; a period defined in the study as that of economic decline (Clark, Colson, Lee, and Scudder, 1995). For purposes of developing child survival programme interventions, therefore, a study to investigate the socio-economic and cultural context surrounding children in Zambia is vital and timely.

1.2 A SEARCH FOR A CONCEPTUAL FRAMEWORK

Although many child survival studies have documented the magnitude of mortality differentials and disentangled the relative importance of different socio-economic variables to explain child mortality, they have had less success in determining the mechanisms through which these factors influence mortality, partially because they have lacked a theoretical framework to describe such interactions (Pebley, 1984).

Currently, there are numerous conceptual frameworks available for the design of studies on child survival (Ruzicka, 1983; Mosley and Chen, 1984; Mosley, 1985; Frenk and colleagues, 1991; Millard, 1994). The most comprehensive and systematic conceptual framework suggested so far has been developed by Mosley (1980, 1985) and further elaborated by Mosley and Chen (1984) (Ruzicka, 1989; Vallin, 1992). The framework focuses specifically on infant and child survival viewed as the consequence of a limited number of behaviourally mediated biological mechanisms.

For the purposes of this study we draw heavily from the Mosley-Chen (1984) and Mosley (1985) (i.e. Mosley-Chen) framework to which we have added some health transition and anthropological components as discussed by Frenk and colleagues (1991) and Millard (1994), respectively.

Despite such frameworks reflecting different disciplinary approaches and varying perceptions about society, they do agree on the following issues as summarised by Behm (1991):

a) Mortality is the ultimate biological expression of a process determined by basic social and economic structures of societies and that such conditions influence disease occurrence and its development resulting in death.

b) Structural determinants are mediated at the household level because growth and development of a child depend heavily on the quality of life within the family. These are conditions which generate biological risk factors directly responsible for child health.

This is similarly observed by Ruzicka (1983) who recommends a framework that should incorporate both biological and social variables since socio-economic determinants must operate through some biological mechanisms to produce varying levels and patterns of morbidity and mortality.

1.2.1 The Mosley-Chen Proximate Determinants Framework

The Mosley-Chen framework is a parallel approach to the widely used proximate determinants of fertility model introduced by

Davis and Blake (1965). It is based on the following assumptions:

a) Over 97 percent of new born infants can be expected to survive through to their fifth birthday under optimal conditions.

b) The probability of surviving during this period in any society depends on the interactions of social, economic, biological and environmental factors.

c) Socio-economic determinants must operate through more basic proximate determinants that in turn influence the risk of disease and the outcome of disease processes.

d) Nutrient deficiencies and specific diseases observed in a surviving population may be viewed as biological indicators resulting from operations of the proximate determinants.

e) Growth faltering and ultimately child death are the cumulative consequences of multiple disease processes, including their bio-social interactions.

The framework identifies 14 proximate determinants, sometimes known as intermediate variables, through which all socio-economic determinants must operate to influence child survival. These intermediate variables are grouped into the following five categories as shown in Figure 1.1:

i) **Maternal fertility factors** (age, parity and birth interval).

ii) **Environmental contamination** (air; food/water/fingers; skin/soil/inanimate objects; and insect vectors).

iii) **Nutrient deficiency** (calories; proteins; micro-nutrients ie. vitamins and minerals).

iv) **Injury** (accidental and intentional).

v) **Personal illness control** (personal preventive measures and medical treatment).

MOSLEY-CHEN FRAMEWORK (1984)

Operation of the Five Groups of Proximate Determinants on the Health Dynamics of a Population.

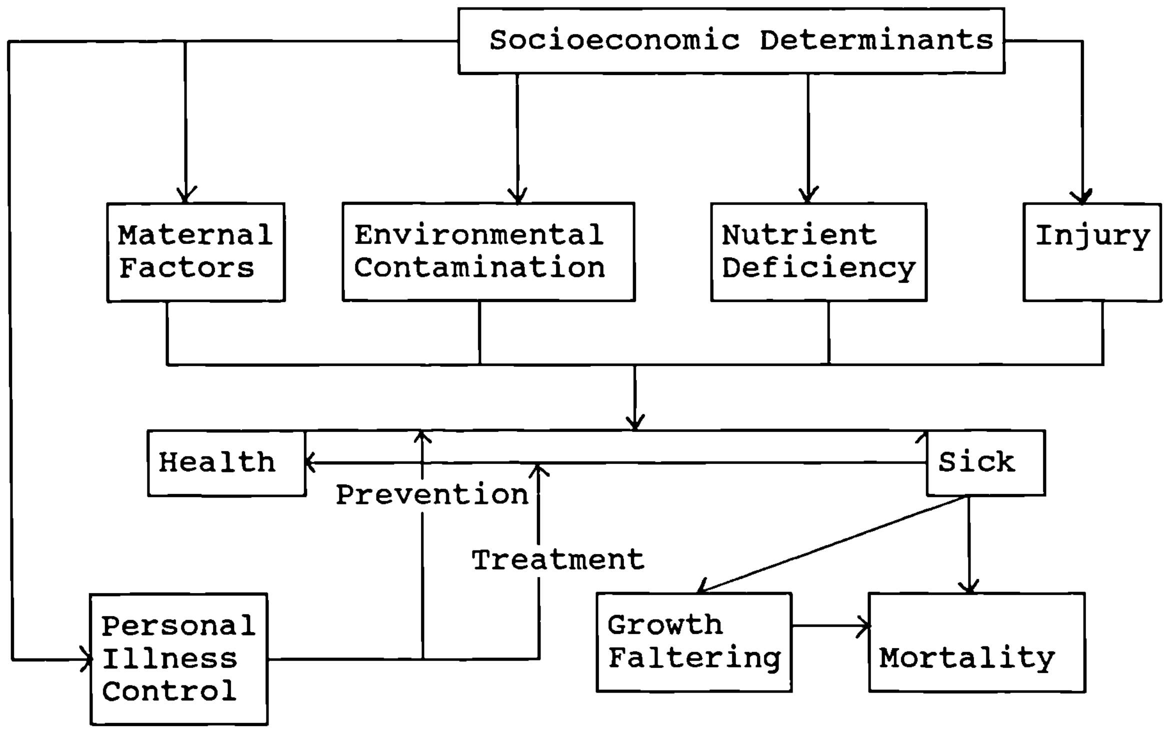


FIGURE 1.1

Socio-economic determinants, which in this framework are the independent variables, are categorised in 3 groups commonly used by social scientists.

1. **Individual-level variables** (Individual productivity of parents; and cultural factors such as

traditions/norms/attitudes).

2. **Household-level variables** (such as income/wealth)

3. **Community-level variables** (ecological setting; political economy and health systems).

The proposed dependent variable is a combined index of the level of growth faltering among survivors together with the level of mortality of the respective birth cohort. By such a combination the model reduces one bias common among medical researchers of focusing on the diseases or nutritional status of survivors and strengthens the exploratory power of social scientists who focus on death.

There is, however, increasing evidence that growth faltering is influenced by numerous factors and is currently being considered more as a non-specific health status measure (Mosley and Chen, 1984; Gray, 1989; Bicego and Boerma, 1991; Hobcraft, 1993).

In summary therefore, the Mosley-Chen model is based on the assumption that all social and economic determinants (in this case independent variables) must operate through intermediate variables (a set of biological mechanisms) to exert impact on child health determination and ultimately mortality.

1.2.2 **Re-defining a Conceptual Framework for Sub-Saharan Africa**

When assessing the impact of Primary Health Care (PHC) on infant and child mortality reduction with special reference to Africa and Asia in the mid-1980s, Mosley (1985) introduced the concept of *social synergy*. This concept, as distinguished from the biological synergy in the Mosley-Chen Model, is based on the observation that *the same social determinant, e.g. poverty, can operate independently on more than one intermediate variable to influence the risk of infant mortality*. Moreover, the resultant combined risk of such a process is greater than the simple sum of the operation of each intermediate variable.

According to Mosley (1985), social synergy has more than theoretical significance since it not only explains why some direct biomedical interactions have a much lesser impact than expected, but also explains the sometimes observed limited effect of direct medical interaction, and the often striking impact on child survival of social changes (such as maternal education) in the absence of major economic progress.

The Mosley-Chen Model has, therefore, been found to be useful not only for design of new surveys and for drawing together findings from existing studies, but also for designing additional studies to fill in the gaps in knowledge on processes of biological and social synergism (Ruzicka, 1989).

In dealing with child survival, later versions of the Model, especially Mosley (1985), are based on the malnutrition/ infection dyad, which is believed to be the principal medical cause of death. Although these versions keep the original underlying theme, the synergy between malnutrition and infection is becoming more central to the morbidity process leading to death especially with new and increasing evidence of cultural influences emanating from both macro and micro studies within Sub-Saharan Africa.

According to the malnutrition/infection theory, malnutrition weakens the body's capacity to resist infection whilst, infection in turn reduces appetite and metabolic functions. This vicious circle is most likely to be fatal if not interrupted by appropriate therapy (Mosley, 1985; Vallin, 1992).

Though systematic causes of childhood mortality through the malnutrition/infection dyad might be similar in Sub-Saharan Africa and the rest of the developing world, the proximate determinants are more likely to be distinctive in different cultures, a fact acknowledged by Mosley and Chen (1984).

While the evidence of improved survival chances of children with increasing education of the mother has been shown to be significantly strong across time and culture, there is currently new evidence of weaker association in several Sub-Saharan African countries (Hobcraft, 1993). Moreover, there is also increasing new evidence from DHS (Sullivan, 1991; Blacker, 1991; Barbieri, 1991; UN, 1991) and old data sets of the WFS (Tabutin and Akoto, 1992) of the importance of socio-cultural factors in Sub-Saharan Africa.

Cultural factors are especially significant in the way they influence household lifestyles and behaviour which in many respects are directly and indirectly related to the active promotion and protection of health and to interventions in the case of ill health (Ruzicka, 1989).

Many authors, and particularly Vallin (1992) have observed Sub-Saharan Africa over the past few decades as the best example of the Mosley-Chen's malnutrition/infection context especially that:-

> *levels of income are low, the food supply is insufficient and irregular, hygiene is poor, education is not developed, economic development is slow, the physical environment is hostile, and so on* (p. 417).

Mosley's recent attempt to put emphasis on practices related to nutrition, hygiene, infant care, fertility pattern, and attitudes towards disease through the concept of social synergy, is evident acknowledgement of cultural factors since such practices are a function of both individual and group behaviour.

Other writers have similarly observed that Mosley's new emphasis on practices which influence the biological mechanism of proximate determinants has clearly assigned the role of major independent variables to two fundamental phenomena: the quality of the practice (and hence the key role of maternal education) and the means available to implement the practice (household income, public service, etc.) (Vallin, 1992).

Generally, the issue of cultural practices have had little attention in previous demographic and bio-medical studies. Blacker (1991), for example, considers most attempts to explain the massive differentials that exist in Sub-Saharan African childhood mortality as concentrating on the apparent effects of a few somewhat crude indices of socio-economic development.

Moreover, there is little attention paid to health hazards in the environment or the ways in which traditional practices may either provide people with a valid defence against these hazards or open the door to their incursion (Blacker, 1991).

Development of the Mosley-Chen proximate determinants framework for child survival analysis in the 1980s has, therefore, strengthened research in identifying mechanisms through which socio-economic factors act to influence the risk of morbidity and mortality. The model has further helped in identifying pathways through which factors such as parental education influence child survival. Although the model identifies <u>individual factors</u> (as knowledge/beliefs, attitudes/values, and economic resources) and <u>community factors</u> (such as ecological setting, facilities and political/economic structure) as the major socio-economic determinants, recent studies are less clear in explaining how individual factors, particularly knowledge/beliefs and attitudes/values, influence child health and mortality through child care per se. For instance, how does maternal education fully explain its influence on child survival in a predominantly rural community where other members of the extended family (kinship) are equally responsible for child care and general kinship welfare and survival?

It should be acknowledged that social behaviour which is basically made up of cultural beliefs and attitudes, as seen in individual factors are difficult to measure, especially from conventional retrospective surveys such as World Fertility Survey (WFS) and Demographic and Health Surveys (DHS). However, such an effort has been made in determining knowledge, attitude and practice (KAP) of family planning which is a significant component of such surveys. It is therefore possible that such KAP approaches to child health, illness and death might give insight into issues on risk factors associated with illness and causes of child death. The Mosley-Chen framework has, therefore, been useful not only for design of new surveys and for drawing together findings from existing studies, but also for designing additional studies to fill in the gaps in knowledge on processes of biological and social synergism.

One major drawback to the investigation of cultural factors within the Mosley-Chen framework lies in designs of most child survival analyses which tend to avoid detailed breakdown of factors such as kinship, ethnicity, religion, region, etc., largely because they are cross-national and hence resort to generalisations that make little sense at national and programme intervention levels. These studies would limit detailed exploration of cultural linkages to issues such as practices involving hygiene, reproduction, breast feeding and nutrition; practices that might partially explain certain relationships between issues such as maternal education and child survival.

Another important drawback lies within the Mosley-Chen framework itself. Despite their significant linkage to different elements of both socio-economic and cultural sphere, individual and collective behaviours are not introduced explicitly in the model. Certain behaviours/lifestyles, such as crowding and those relating to breastfeeding, weaning and supplementation, are taken as socio-economic determinants and hence as independent variables instead of intermediate behavioural variables influenced by cultural factors such as ethnicity/kinship, religion and family size.

In recent years the DHS has collected some substantial socio-cultural information from which, when incorporated within this framework and with possible modifications, some expected insights might be realised on pathways through which socio-economic factors influence child survival.

Our modifications to the Mosley-Chen model are within the broader context of child care and welfare within Sub-Saharan Africa. Below are some of the modifications made:

MODIFIED CHILD-SURVIVAL FRAMEWORK

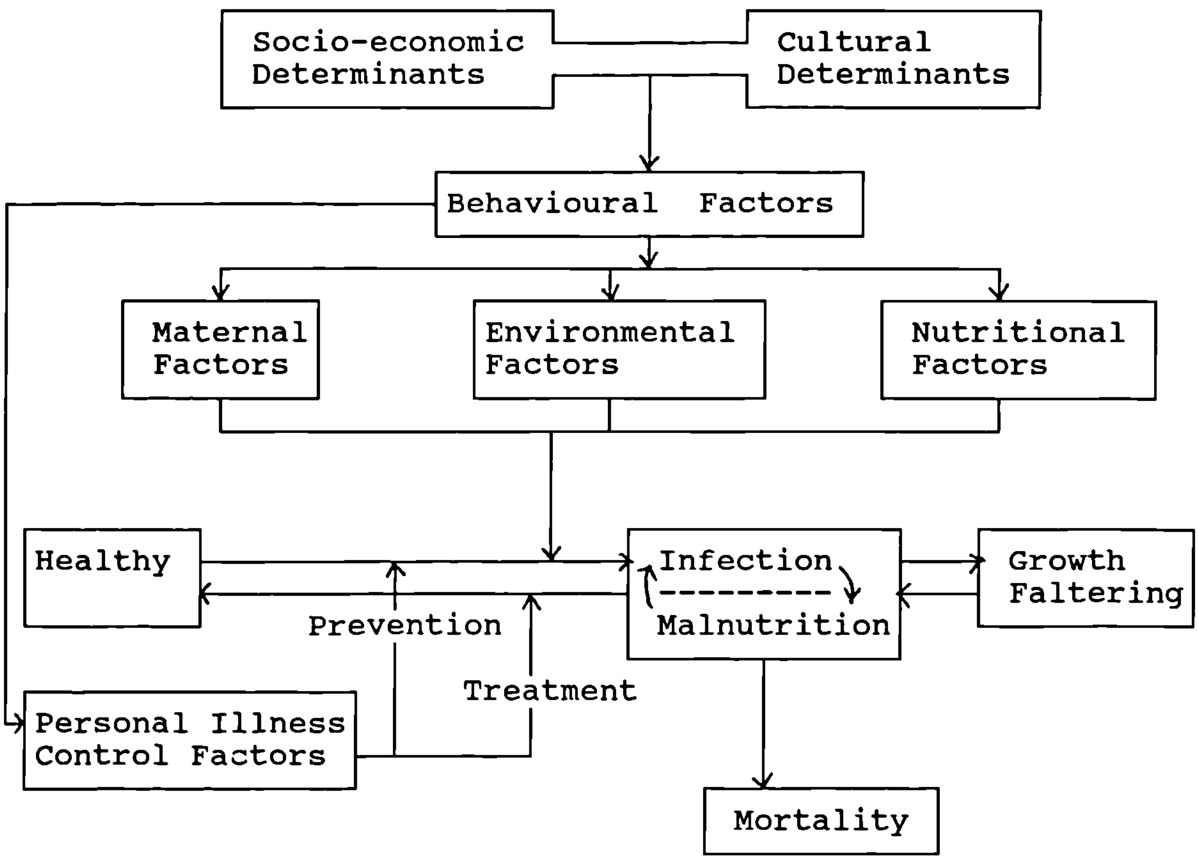


FIGURE 1.2

a) Re-emphasizing the relative importance of cultural factors within the socioeconomic determinants block. Although the Mosley-Chen model includes cultural factors in the independent variables of socioeconomic determinants, many analyses based on the framework have tended to ignore such factors. Behavioral variables linked to such factors will assist in the exploration of pathways within the child survival and parental education debate, for example. Establishing the link between economic processes and cultural factors within the context of general child care in Zambia will shed further light on the current child survival situation.

Based on her anthropological investigations in rural Mexico, Millard (1994) observed connections between economic factors and cultural systems, clearly showing that cultural influences are not limited to childrearing traditions. Whereas cultural systems shape practices of child care, they also interact with local, regional and international economic processes that distribute resources, and thus contribute to child survival. Distributional mechanisms in an economic system clearly affect child mortality and they do not operate independently of the cultural system (Millard, 1994).

b) The principal contribution to the modifications is in the explicit introduction of intermediate behavioral mechanisms within the broader context of child care. It is through the combination of such a mechanism with the proximate determinants (i.e. biomedical and environmental mechanisms) as presented by Mosley and Chen that socio-economic and

cultural factors influence child health and mortality.
The modification incorporates theories of proximate determinants within both epidemiological and health transition schools, of which two are identified by Frenk and colleagues (1991) as living conditions and life styles. The theories make a fundamental distinction between living conditions and life styles, with the former referring to the objective material situation in which the different social groups exist while the latter represent the manner in which those social groups translate their objective situation into patterns of behaviour. Although Frenk and colleagues consider the concept of life style as representing a conceptual bridge between cultural and behavioral patterns, life styles are considered, here, as behaviours that are shared by a social group such as a household or the entire kinship network, and these are the behaviours that form part of household/kinship survival strategies realised out of the existing and surrounding social and economic environment. Within this view, therefore, social risks (generated by living conditions), behavioral risks (generated within life styles) and biological risks (as discussed by Mosley and Chen) are significant elements in determining the epidemiological concept of *susceptibility* to infections/diseases. Hence, susceptibility is a phenomenon where intermediate behavioral mechanisms determined by socio-economic and cultural processes, converge with body structure and functions determined by biological and environmental

processes, termed as proximate determinants by Mosley and Chen. It is this susceptibility amongst living children (as pointed out later in the methodology) that can be measured by anthropometry and particularly child growth patterns.

An example of an intermediate behavioral variable is crowding. Crowding (which might equally be influenced by socioeconomic processes) can be influenced by cultural factors through kinship networking (possibly expressed through fosterage), which if combined with poor housing conditions would influence the balance between exposure to disease agents and individual susceptibility which in turn results from a complex network of risks as noted earlier.

Other identified behavioural variables within the intermediate behavioral mechanism include the following variables: child care by household members/maids, fosterage, breastfeeding, bottlefeeding, weaning, supplementation of liquids and solids, contraception and family planning, observation of certain taboos, home delivery of births, delivery by non-medical persons and relatives, use of home remedies for treatment, use of modern health services, etc.

Despite pointing out the important role of behavioural variables in the child survival debate, Mosley and Chen lump them together within the socio-economic block as independent variables.

c) As later discussed in Mosley's later work (1985), this model incorporates the malnutrition/infection effect on the biomedical proximate determinants. This is especially important in analyzing certain child care variables whose information from the DHS type of data comes from surviving children only. Furthermore, it enables the use of mother's health status through information on her nutritional status as an additional proximate determinant.

d) The new model also tries to emphasize the importance of age variation in the analysis of child survival, an issue not mentioned by the Mosley and Chen framework. While certain studies such as Millard's have either restricted their analysis to either infants or older children, others (Hobcraft, et al. 1984; Bicego and Boerma, 1991; Ahonsi, 1995) have demonstrated the significance of age variation with socio-economic determinants. They have particularly shown socio-economic differentials with increasing age of children.

e) Lastly, and since DHS type of surveys collect hardly any information on children's injuries, this study drops the injury block of proximate determinants from the framework.

In summary, therefore, these modifications to the Mosley-Chen framework are an attempt to explain the mechanisms associated with the "black box" in the social and biomedical science approach by introducing explicitly intermediate behavioural variables which are in turn influenced by both socioeconomic and cultural factors. These behavioural mechanisms in turn converge with biomedical and environmental mechanisms (proximate determinants) to produce mortality differentials among children.

1.3 GENERAL OBJECTIVES AND CONTEXT OF THE STUDY

The first objective of this study is to investigate, describe and demonstrate childhood mortality trends and patterns since Zambia's independence in the mid-1960s, in the light of evidence of deteriorating childhood mortality from both the Zambia Demographic and Health Survey and census (1980 and 1990) data. The study attempts to address both age-specific and place-specific childhood mortality variations that have largely been ignored in the debate over pace of childhood mortality decline.

The second objective is to identify most discriminating socio-economic, cultural, behavioural and bio-medical differentials in childhood mortality in Zambia during the 1987-91 period.

Within the modified Mosley-Chen framework, the third objective is to ascertain how individual, household and community factors within the socioeconomic and cultural mechanisms interact with behavioral and biomedical and environmental factors in shaping observed patterns in infant and child morbidity and mortality.

In line with the third objective, the fourth is to further ascertain how the selected socio-economic, cultural, behavioural and bio-medical factors influence children's growth patterns through analysis of anthropometric data. This also allows analysis of child care information that is otherwise only collected on surviving children.

In the context of the socio-cultural and public health situation in Zambia, the fifth objective is to elaborate the mechanisms through which socioeconomic and cultural factors and particularly social behaviour impinge upon child survival through general child care.

Lastly is the objective to assess the extent to which Demographic and Health Survey data enable analysis of socio-cultural and behavioral factor's influence on child survival.

In order to achieve these objectives, Chapter Two describes the Zambian study setting, and highlights the performance of Zambia's political economy since the mid-1960s. Chapter Three evaluates the data quality of the Zambia Demographic and Health Survey with the aim of identifying inconsistencies that may influence childhood mortality estimates. As a follow up to Chapter Two, Chapter Four attempts to investigate age-specific and place-specific childhood mortality levels, trends and patterns from the survey data, supplemented with both 1980 and 1990 census data. In this "time-series" analysis of childhood mortality, links between mortality trends and performance of Zambia's political economy, as seen in Chapter Two, are explored.
Within the conceptual framework of the modified child survival model, Chapters Five, Six, Seven and Eight identify the most discriminating socio-economic, cultural, behavioural and proximate variables, respectively. In order to demonstrate how the effects of identified socio-economic and cultural factors operate through both intermediate behavioural and proximate bio-

medical variables, Chapter Nine attempts to integrate findings from the Chapters Five, Six, Seven and Eight.

Chapter Ten, on the other hand, not only assesses the importance of information on child care practices and that of morbidity factors, but attempts to demonstrate the influence of selected socio-economic and cultural factors on children's growth patterns or growth faltering. In other words, Chapter Ten offers an alternative explanation to the analysis when children's nutritional status is taken as outcome variable.

Chapter Eleven provides a summary and overall contextualization of the study's major findings.

1.4 SUMMARY

Chapter One has provided a background to this study. Apart from raising some of the arguments that have been put forward recently on children's mortality situation in developing countries and the concern of the observed deterioration in children's health status for some countries such as Zambia, it has also reviewed the Mosley-Chen conceptual framework for purposes of adapting it within the Sub-Saharan African context. Within this framework, therefore, a modified version of the child survival model is adopted blended with ideas from both Health Transition and Anthropological schools of thought. The new model is then used as a guide for the subsequent data analysis in pursuit of the earlier stated study objectives.

CHAPTER TWO

THE ZAMBIAN STUDY SETTING

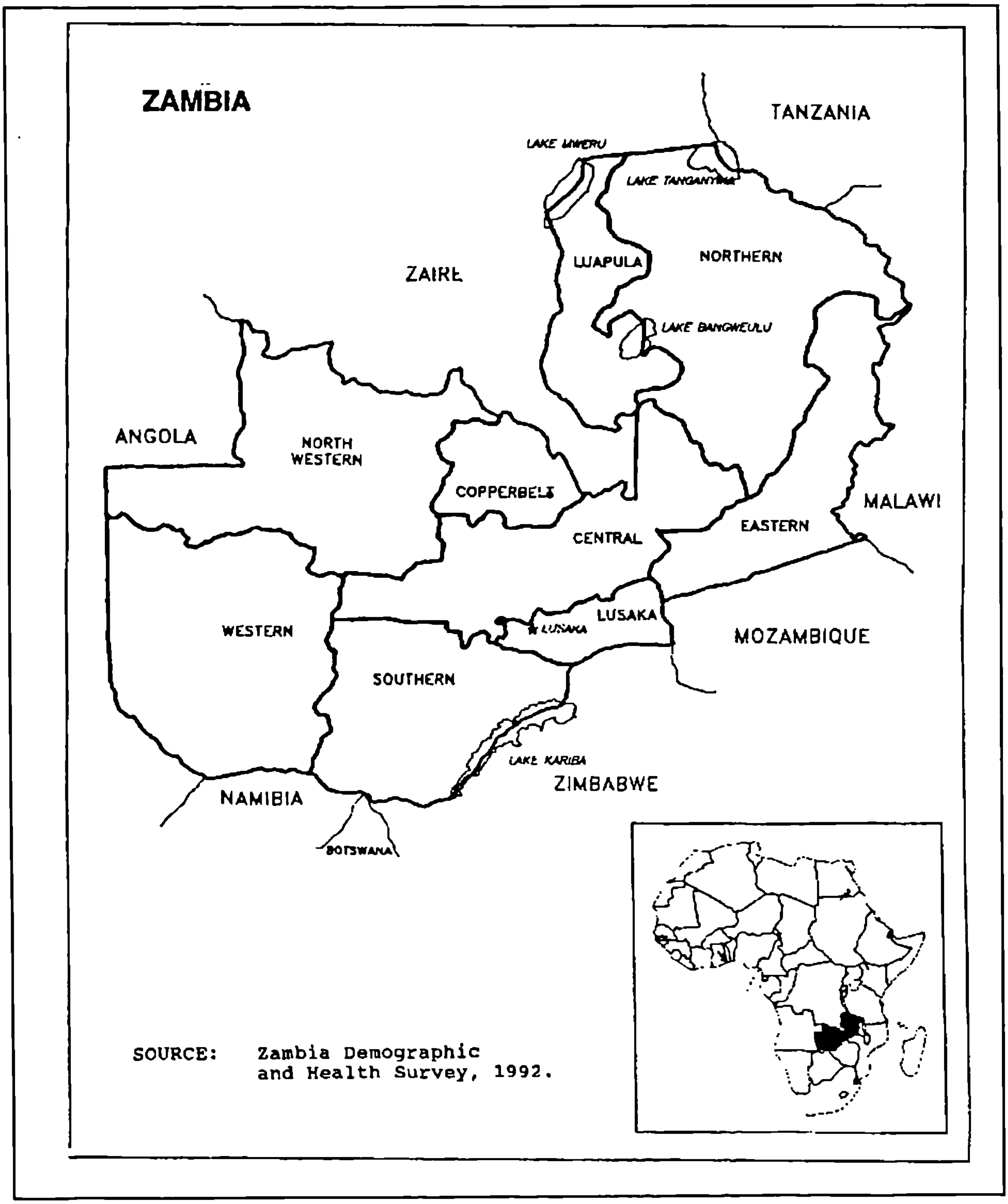
2.1 INTRODUCTION

Chapter Two contextualizes the study in a profile of a country known today as Zambia. Apart from describing its geography, people and culture, it shows the demographic features currently shaping Zambia's population growth, structure, and distribution. Furthermore, the chapter narrates the rise and fall of Zambia's political economy, accompanied by deterioration in health service delivery and social indicators with focus on overall child health and survival.

2.2 GEOGRAPHY

Zambia, situated in the southern half of Africa, covers an area of 752,612 square kilometres. The country is landlocked and surrounded by eight other countries: Zaire and Tanzania in the north; Malawi and Mozambique in the East; Zimbabwe and Botswana in the South; Namibia in the south-west and Angola in the west. The country's economic heartland lies some 2000 km and 1600 km from Maputo in Mozambique and Dar es Salaam in Tanzania, respectively, both ports on the Indian Ocean coastline.
Zambia lies mainly on the Great Central African plateau with an average altitude ranging between 1,000 and 1,300 metres. On the edges of the plateau are depressions that form Lakes Tanganyika,

Mweru and Bangweulu in the north, the Luangwa river in the East,



SOURCE: Zambia Demographic and Health Survey, 1992.

FIGURE 2.1

Kafue basin and alluvial plains of the Zambezi river in the west.

In the south is found one of the biggest man-made lakes, Kariba. Also located in the south are the Victoria Falls.
Both physical features are found on the Zambezi river that forms the border with Zimbabwe.
Zambia lies between 8 and 18 degrees latitude South and 22 and 34 degrees longitude East. Tempered by the latitude, Zambia has a tropical climate and vegetation that can be described by three distinct seasons namely: a cool dry winter which lasts from May to August with mean temperatures between 14^0c and 30^0c; a hot dry season during months of September and October; and the warm and wet season stretching from November to April.
With average annual precipitation of between 600mm and 1,400mm the north-eastern part of the country has highest rainfall in the range of 1,100mm to 1,400mm, while there is a systematic decrease in rainfall as one moves East and South with average annual rainfall ranging between 600mm and 1,100mm.
Both climatic and rainfall conditions give Zambia a woodland savannah type of vegetation with a mixture of various trees, tall grass, herbs and other woodlands mainly described as deciduous and usually found on the main plateau.
Administratively, Zambia is divided into nine provinces, each with its respective provincial centres. These are Central, Copperbelt, Eastern, Luapula, Lusaka, Northern, North-Western, Southern and Western. These provinces are further divided into 57 districts.

2.3 PEOPLE, SOCIETY AND CULTURE

Zambia's population, estimated at 9.6 million in 1996, is made up of people almost all within the Bantu-speaking family and descendants of relatively recent Congolese migrants to the area during the 1500-1800 period. Many of these groups came to present day Zambia from the Luba-Lunda kingdoms of present day Zaire and Congo.

According to ethnographic data, Zambia has 72 tribes whose people speak a multitude of languages and dialects the major ones being the Bemba, Nyanja, Tonga, Lozi, Luvale, Kaonde and Lunda. Recent language information from the 1990 census show Bemba as the most spoken at almost 40 percent, followed by Nyanja at 20 percent. These two languages are followed by Tonga (15 percent), North-western languages (i.e. Lunda, Luvale and Kaonde) at 9 percent, and Lozi or Barotse at 8 percent.

All the 80 identified languages and dialects are Bantu of which seven are recognised as official vernacular. These are Bemba, Tonga, Nyanja, Lozi, Luvale, Lunda and Kaonde. English was adopted after Zambia's independence in 1964 as the official language of government and business.

It is also noted that members of all the ethnic and linguistic groups can still be found near ancient villages such as the Bembas in Northern and Luapula Provinces, Nyanjas in Eastern Province, Tongas in Southern Province and much of the Barotse in Western Province. However, many of these languages are also found in many of Zambia's provinces. There are mixtures of these linguistic groups especially along the line of rail cutting across four provinces of Copperbelt, Central, Lusaka and Southern. In the majority of these ethnic groups, children belong to the mother's side of the family, although patrilineal families are also found in certain tribes such as the Mambwe in the North. Although many people trace their descent primarily through the line of women (matrilineal), this descent does not imply that women are dominant figures in social and political leadership; rather the mother's eldest brother generally wields family authority (Simson, 1985). Instead, there is a tendency for men to dominate household and community decision making and ownership of assets and have relatively much greater access to land and credit. Despite roles of child care, farming and many other household activities, women's role has been that of subordinates to men.

While these ethnic groups share similar traditions, contemporary Zambian society is a mix of traditional and modern cultures and behaviours. They also have a diversity of beliefs and practices, many associated with vital events of birth, marriage and death. Living in extended family systems, families support a wider family unit including not only parents and children, but also grandparents, cousins, nephews and other relatives living in the same household. This family system is vital in providing security to families at times of need and stress such as funerals, famine and also in economic activities such as farming and social tasks of child care.

Although both men and women participate in farming, women also take turns in cooking, cleaning, washing and are also responsible to ensure food preparation. In most cases older women are given responsibilities of looking after younger children.

Although urban living has made it more difficult for extended families to follow the pattern of contiguous households, it is not unusual for predominantly urban nuclear families to live with nephews, nieces and even friends within one household. Moreover, for peri-urban areas where women have increasingly had to search for petty income earning opportunities and in the absence of older women looking after young children, it is common to see infants strapped to the backs of working mothers, often in unhygienic circumstances, such as crowded and sprawling open markets. Not only are children exposed to the risk of infection, but there are no facilities for attending to the needs of young children (GRZ/UNICEF, 1995).

Among some of the customs, beliefs and practices is the general and common use of traditional medicines. Often patients in hospitals take such medicines alongside modern medicines. This is demonstrated in the Zambia Demographic and Health Survey (1992) where almost 60 percent and 35 percent of children suffering from acute respiratory infection and diarrhoea, respectively, were treated with home and other remedies (Gaisie, et al., 1993).

While many surviving ancient beliefs in supernatural beings, gods and spirits are still in existence, many Zambians are predominantly christian with most of them tending to identify themselves with some variety of Protestantism or Catholicism. According to the DHS, Protestants and Catholics make up around 69 percent and 28 percent of Zambia's population, respectively. Other religious groups make the remaining 3 percent. It should be noted, however, that belief in witchcraft remains widespread and can have a major influence on people's behaviour and practices (GRZ/UNICEF, 1995).

2.4 DEMOGRAPHIC BACKGROUND

Zambia's population grew from 4.1 million in 1963 to 5.7 million in 1980 at an annual rate of 3.2 percent. By 1990, Zambia's population was estimated at 7.4 million.

Although Zambia is a sparsely populated country by international standards, the growth in population has increased the population density from 5.6 persons per square kilometre in 1969 to almost 10 persons by 1990. While the majority of Zambians continue living in rural areas away from the modern urban environment, Zambia is one of the most urbanised countries in Sub-Saharan Africa. In 1963 roughly 20 percent of the population lived in urban areas and by 1990 around 40 percent of Zambia's population was estimated to be residing in the urban areas (CSO, 1992).

Although urbanisation varies considerably between provinces with about 90 and 85 percent of the populations of the Copperbelt and Lusaka Provinces living in urban areas, respectively, the line of rail provinces (Copperbelt, Central, Lusaka and Southern) are believed to share about 55 percent of Zambia's total population.

The rapid growth rate of the urban population results mainly from a high natural increase in urban population, the rural-urban migration of largely the 1969-80 intercensal period which was estimated at 6.0 percent, and the inclusion of new townships over the period. It was revealed from the 1980 census, for example, that about 78 percent of Zambia's urban population lived in large urban areas with each one of them accommodating a population of more than 60,000.

Higher levels of natural increase were thought to result from high and persistent levels of fertility and declining mortality levels. Moreover, the growth pattern in Zambia's population has meant a structure where children under the age of 5 make up around 17 percent of the population. Furthermore, children aged less than 15 and those adults with at least 65 years of age constitute around 49 percent and 3 percent of Zambia's population, respectively.

As the DHS data show, mortality levels and especially those of children remained constant before the 1980s and the trends have since reversed, as later confirmed by the 1990 census. According to both the 1980 and 1990 census, total fertility rate declined from 7.2 in 1980 to 6.7 in 1990. This decline in total fertility rate is also supported by the DHS which estimated Zambia's fertility in 1991 at 6.5 children per woman.

Although fertility is higher for women in rural areas (7.0) compared to urban women (6.3), fertility levels are highest in Luapula and Northern Provinces and lowest in Lusaka Province.

As for mortality levels and trends, however, the observed decline of the 1960-80 period has reversed. Between the 1960s and 1980, the Crude Death Rate (CDR) declined from around 20 per thousand to around 14 per thousand in 1980. Since then the 1990 census has shown some increase to 18 deaths per 1000 persons; an increase of almost 30 percent in a decade. Similarly, the two censuses have indicated an increase in infant mortality from 97 per 1000 births in 1980 to 123 per 1000 in 1990. Recent studies using data from the DHS have demonstrated an increase in infant mortality as early as the mid-1970s which started in rural areas. Particularly significant are the increases in post-neonatal mortality from rural areas and overall increase for both rural and urban childhood mortality during the 1980s (Gaisie, et al., 1993; Nsemukila, 1994). Childhood mortality is lowest in urban areas of Zambia; it is highest in the most remote rural provinces of Luapula, Northern and Eastern.

2.5 ZAMBIA'S POLITICAL ECONOMY

Zambia's economy, like that of many Sub-Saharan African countries, is shaped by the past colonial legacy prior to the 1960s. As part of a Federation of Rhodesia and Nyasaland, the Zambian economy (Zambia then known as Northern Rhodesia) was founded on exploitation of her agricultural and mineral resources, and using the population as a reservoir of cheap labour. As a way of releasing traditional labour from the rural subsistence economy, an introduced poll tax forced male labour into seeking employment in the agricultural and mining areas along the line of rail. Apart from depriving traditional rural agriculture of the necessary labour for long-term development, copper mining was developed as a foreign-owned enclave to supply export markets and little was done to establish domestic manufacturing and to orient the people to the operation and ownership of production, as was the case for Southern Rhodesia, now Zimbabwe.

After independence in 1964, therefore, the new Zambian government was faced with the task of not only redressing the imbalances in income distribution and economic power held mostly by non-Zambians, but also to promote economic growth. Zambia's mineral wealth was then seen as national income that should be used to address social imbalances (World Bank, 1994). In its First National Development Plan (FNDP; 1966-71), the new government proclaimed its commitment to a brand of socialism and then invested heavily in social welfare programmes aimed at improving the lives of many Zambians.

Although Zambia's economic and political history since the mid-1960s can be divided into two main periods (from independence through the centralised socialist economy of the 1970s to the attempts at reform in the 1980s ending with the liberalisation of the political and economic systems in 1991), this section divides this 27-year period into three main parts: 1964-72, 1973-80, and 1981-91.

a) **1964-1972**

The first eight years after Zambia's independence is considered as the most successful period in the country's political and economic history. The high and stable price of copper on the world market enabled the new government to embark on activities to diversify the industrial economy and especially to give priority to provision of physical and social infrastructure.

According to early economic indicators at the time, the manufacturing sector, although far weaker than the mining sector, had expanded with an overall contribution to Gross Domestic Product (GDP) rising from 6.1 percent in 1964 to 11 percent in 1972 (Burdette, 1988). In the case of the education sector, in a country where less than 0.5 percent of the 4 million people had even full primary education at independence, enrolments in primary schools increased from 378,600 in 1964 to 858,191 in 1974; an increase of 127 percent in 10 years. Moreover, enrolments for secondary education increased by 373 percent during the same period.

As for the health sector, the number of hospitals had increased by more than 50 percent by 1972, with most of the new institutions being government-run hospitals. Many of these institutions were located outside the line of rail, unlike at independence when most of the 48 hospitals serving a population of around 4 million were located along the line of rail with ten of them run exclusively for mining personnel by the mining companies (Burdette, 1988).

By 1972, the government had extended a substantial amount of basic infrastructure, such as health facilities and schools, to even the most remote parts of the country, although it later failed to maintain them.

b) **1973-1980**

Even though the government managed to provide social services in the form of health and education for its population, the economy always balanced narrowly on the prosperity of the copper mines. Whereas the mines contributed only 34 percent to government revenue in 1963, the sector was contributing around 64 percent by the end of the 1960s. The reforms undertaken to diversify the economy from copper mining had failed to make the economy more self-sustaining, and when mineral revenue declined, government public finance contracted. Between 1974 and 1983, government revenue had shrunk by 30 percent. The first shock was earlier, in 1971/72, when the price for copper temporarily plummeted cutting the government's revenue by almost a third. This was Zambia's first experience of a balance-of-payments deficit since independence. However, this economic shock could be traced back to 1970 when copper output fell by almost 23 percent from the 1969 output level (Seshamani, 1992).

To maintain its expenditures on many of the activities of the first eight years of independence, the government resorted to borrowing in order to balance its budget. In fact, the first stabilisation package agreed upon between the Zambian Government and the International Monetary Fund (IMF) was as early as 1973. The package included a stand-by agreement to halt declines in external reserves and correct the budget deficit resulting from the terms of trade deterioration following the decline in copper prices (World Bank, 1994).

In 1973 and 1974, the economy was subjected to external shocks of oil and copper prices. The hikes in the price of oil from 1973, for example, increased the oil bill by 287 percent between 1970 and 1975. By 1975 Zambia's terms of trade fell to 54 percent relative to the year before and a comfortable balance-of-payments position of 1974 went into deficit with government revenues from minerals dropping to less than 20 percent of the previous level.

In 1976/77, therefore, a second IMF stand-by-program was agreed with conditionality focused on demand management and included such measures as a 16 percent ceiling on domestic credit expansion; a wage freeze; and reduction of the government deficit. This was followed by a third and larger IMF programme agreed in 1978-80 which included limiting domestic credit expansion to 18 percent, and a 10 percent devaluation of the Kwacha's nominal value (World Bank, 1994).

Compounded by the later oil shock of 1979, Zambian private and public firms were unable to purchase the imports that they needed without resorting to more loans and external borrowing. By 1980, Zambian exports were able to purchase no more than 60 percent of what they had bought in the budget surplus year of 1974. By this time, the economy had registered negative growth while becoming increasingly indebted.

An additional political problem during this period, and often ignored by many economic analysts, was the government's commitment to the liberation struggles in Rhodesia and apartheid South Africa. By providing the base for one of the two Zimbabwean nationalist armies and hosting the African National Congress of South Africa, Zambia became a target for military attacks and economic destabilisation by both Rhodesian and South African regimes (GRZ/UNICEF, 1995). Zambia's geographical location made it even worse when the international community imposed sanctions against both Rhodesia and South Africa.

c) **1981-1991**

Zambia entered the 1980s in economic crisis and the period is characterised by a series of alternating policies designed to restructure the economy in a crisis. The perception that the decline was an established long-term trend only dawned in the 1980s when the country's economic problems had already assumed the proportion of a crisis (Seshamani, 1992).

It was during the period 1983-85 that a more comprehensive IMF/World Bank Structural Adjustment Programme (SAP) was first attempted and covered a much wider range of structural policies and involved two stand-by-facilities for the 1983-84 and 1984-85 periods, complemented by the World Bank Structural Adjustment lending which focused on the promotion of non-traditional exports (World Bank, 1994).

With earlier introduction of price decontrols in 1982, annual rate of inflation rose from 13 percent in 1982 to 53 percent in 1986. And when the government attempted to reduce subsidies for the staple food of maize meal in urban areas, riots broke in 1986 and again in 1990 leading to unprecedented popular demands for political change.

Although the government dropped the IMF/World Bank Structural Adjustment Programme replacing it with the New Economic Recovery Programme (NERP) in 1987 which essentially meant a return to the old policies of economic control, by June 1989 the government went back for a new adjustment package with both IMF and World Bank.

With pressure from within Zambia and from the donor Community, the ban on opposition parties which had been enforced in 1972 was lifted in July 1990, paving way for a general election in October 1991 won by a new party, the Movement for Multi-Party Democracy (MMD). Since the election, the new MMD government embarked on aggressive political and economic reforms.

d) **Economic Implications for Social Indicators**

The socio-economic implications of Zambia's economic performance were enormous. Since the mid-1970s Zambia's per capita national income and many social indicators had fallen dramatically, and meant that living standards for an average Zambian have been falling for more than 20 years.

Although Zambia had made gains in school enrolment and life expectancy in the first decade of independence, those improvements stalled and in the case of childhood mortality, the rates reversed between 1975 and 1990.

According to a World Bank poverty assessment report, Zambia's formal sector employment, which was almost 24 percent of the labour force in 1980, declined to under 10 percent by 1990. Formal sector employment as a percentage of the total labour force peaked at 29.1 percent in 1974 and fell to less than 10 percent in 1988, further implying that while one in three Zambians had a job in the formal sector in 1974, less than one in ten had such jobs a decade later. Moreover, formal sector employment was declining amidst a rapidly increasing labour force.

By 1991 the decline in per capita income had pushed 67 percent of Zambians below the poverty-datum line. Real earnings from the formal sector which had risen by 2.7 percent annually during the 1965-70 period disappeared by 1975 when real wages fell sharply.

TABLE 2.1 AVERAGE ANNUAL REAL EARNINGS OF EMPLOYEES BY SECTOR (Index 1975 = 100)

SECTOR	1965	1970	1975 4qtr	1977 June	1979 2qtr	1980 2qtr	1986 2qtr	1991 Dec.	1992 March
Agriculture Forestry and Fishing	90	139	100	111	118	119	136	48	22
Mining and Quarrying	110	126	100	71	63	62	36	34	22
Manufacturing	100	111	100	78	72	71	37	25	23
Construction	84	119	100	78	0	0	0	46	30
Transport and Communications	75	102	100	69	0	0	0	26	20
Services*	99	103	100	76	73	69	40	26	20
Total	97	111	100	77	73	72	44	30	21

Notes * - Service excludes personal service until 1991. For 1991 and 1992, it is an average of the earnings in the two types of services distinguished by CSO.
2qtr - 2nd Quarter
4qtr - 4th Quarter

SOURCE: World Bank, Zambia Poverty Assessment. World Bank, Washington D.C., November, 1994.

In 1991, for example, and as demonstrated by Table 2.1, average real earnings in the form of wages and emoluments were only 30 percent of the 1975 level with a low of 25 percent for the manufacturing sector (World Bank, 1994). By 1992, inflation had hit over 200 percent per annum.

2.6 HEALTH POLICY AND CHILD HEALTH PERFORMANCE

2.6.1 Zambia's Health Policy

Although Zambia had no comprehensive health policy before the health reforms of 1992, the country's basic objective as noted in earlier Development Plans was to ensure that every citizen was living within easy reach of a health unit. The initial objective was to cover 80 percent of the population within 12 kms of reach with other aims targeted at providing every district with a hospital and obtaining an overall equitable geographical distribution of the health resources (Simson, 1985).

In 1981, and only three years after the Alma Ata Primary Health Care Conference, Zambia's Ministry of Health adopted a strategy for the implementation of Primary Health Care (PHC) in the country. But even before the implementation of PHC, Zambia's overall health service delivery indicators were better than many countries in Sub-Saharan Africa. Between 1964 and 1981, the number of hospital and health centre beds doubled and 75 percent of Zambians were living within 12 km of a health centre. Particularly important was the distribution of these health services to remote rural areas. For a highly urbanised country in Sub-Saharan Africa, for example, not only was more than 30 percent of the total health care expenditure spent in the rural areas by 1983, Zambia had one of the highest number of hospital beds per 1000 persons at 2.6 compared to some countries such as Kenya and Nigeria at 1.3 and 0.8 per 1000 population, respectively. Even at Zambia's rural area level of 1.7 beds per

1000 population relative to the urban level of 5.8, the country was much better provided than many of its neighbours. In 1989 the population per physician was 7,154, and that of population per nurse was 744. By 1991, 34 percent of the rural population lived within 4 km of the nearest health facility. While 30 percent lived over 10 km from the nearest centre, almost 90 percent of the urban population was located within 4 km from the nearest health centre. However, it should be noted that a short distance to health centres might not necessarily mean quality access to formal health care.

With the collapse of the Zambian economy, the Government has been unable to maintain the health infrastructure built mainly during the 1970s. The health care service has definitely deteriorated, as later illustrated by child health performance.

In line with the economic structural adjustment programme, the new Government commenced health reforms in 1992 with the overall vision of providing Zambians with equity of access to cost-effective, quality health care as close to the family as possible. With this vision in mind, the Ministry of Health has embarked on decentralising health care decisions away from corridors of Central Government to the communities at district level. The irony is that these measures are being taken at a time when the country's reserves have dried up.

2.6.2 Child Health Performance

As Zambia's political economy disintegrated since the mid-1970s, child health indicators have fallen along with economic indicators. This is especially demonstrated by the health statistics that have been compiled from hospitals and health centres from all over Zambia. Particularly significant is the rise in the percentage of children born at less than 2500 grammes, a level considered as underweight. Between 1976 and 1988, for example, underweight levels in children increased by over 200 percent (Figure 2.2). Similarly, and during the same period the proportion of children with malnutrition increased by almost 55 percent.

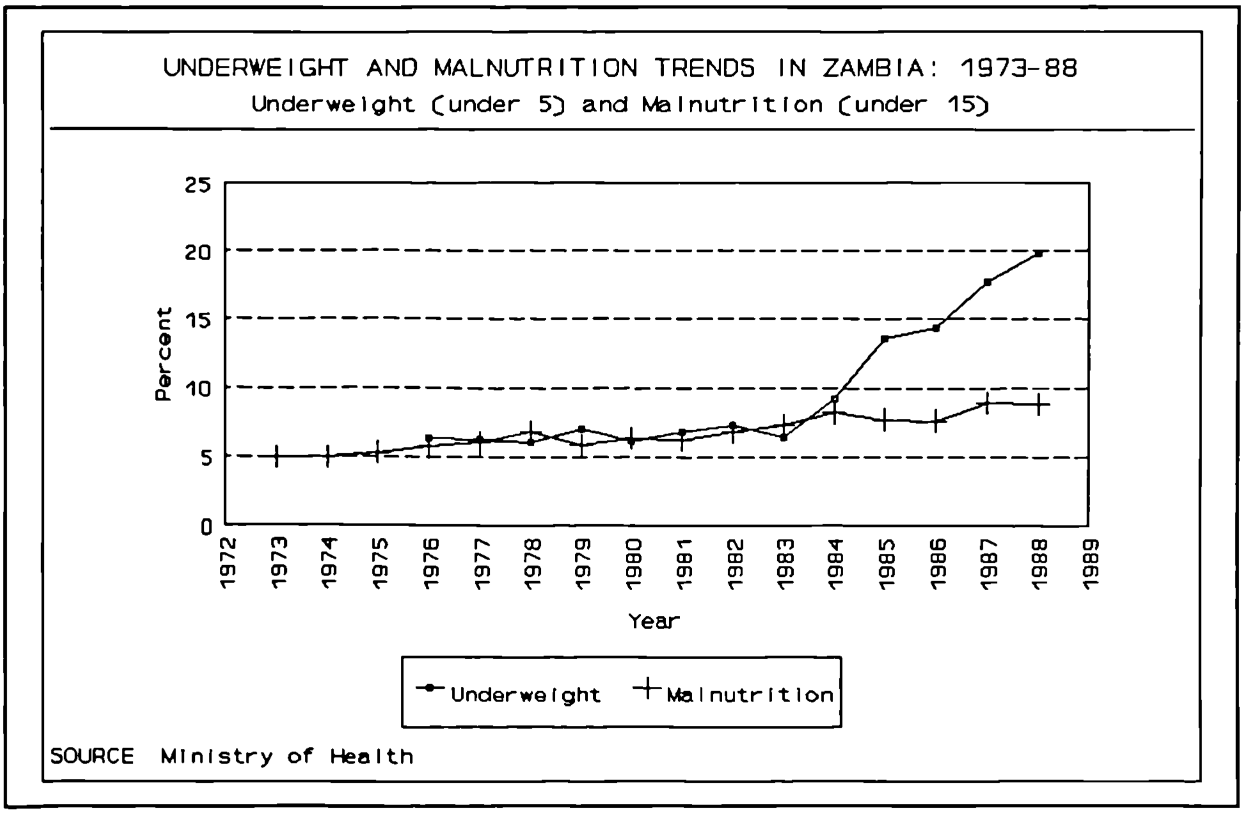


FIGURE 2.2

The deterioration in the nutritional levels of children is equally supported by trends in childhood causes of death which might also reflect the inability of health services to save children's lives. This is especially the case when two major causes of death, diarrhoea and malaria, are considered.

As can be shown by Figure 2.3, the case fatality rate (i.e. ratio

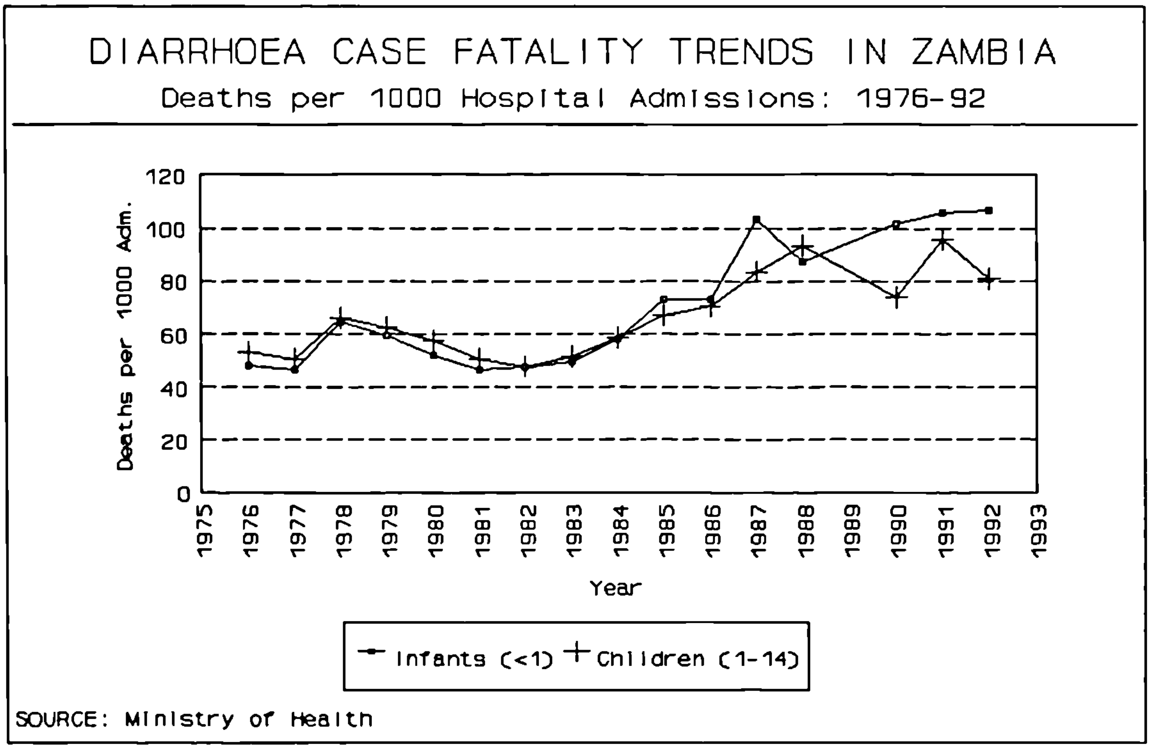


FIGURE 2.3

between deaths and admissions resulting from a specific cause) for diarrhoea in infants rose from 48.2 per 1000 admissions in 1976 to 106 deaths per 1000 admissions in 1991, an increase of almost 120 percent in 15 years. While the increase in case fatality might suggest the inability of health services in saving children's lives, it could also mean that many patients are possibly presented at hospitals when their conditions are most serious.

Similarly, substantial increases in malaria hospital deaths in children aged below 15 years were noted between the mid-1970s and the early years of the 1990s. The trend is clearly demonstrated by Figure 2.4 where malaria case fatality increased from 9 deaths per 1000 admissions in 1976 to 47 deaths per 1000 hospital admissions in 1991. Again, an increase of over 400 percent in 15 years. A number of reasons have been advanced for such increases

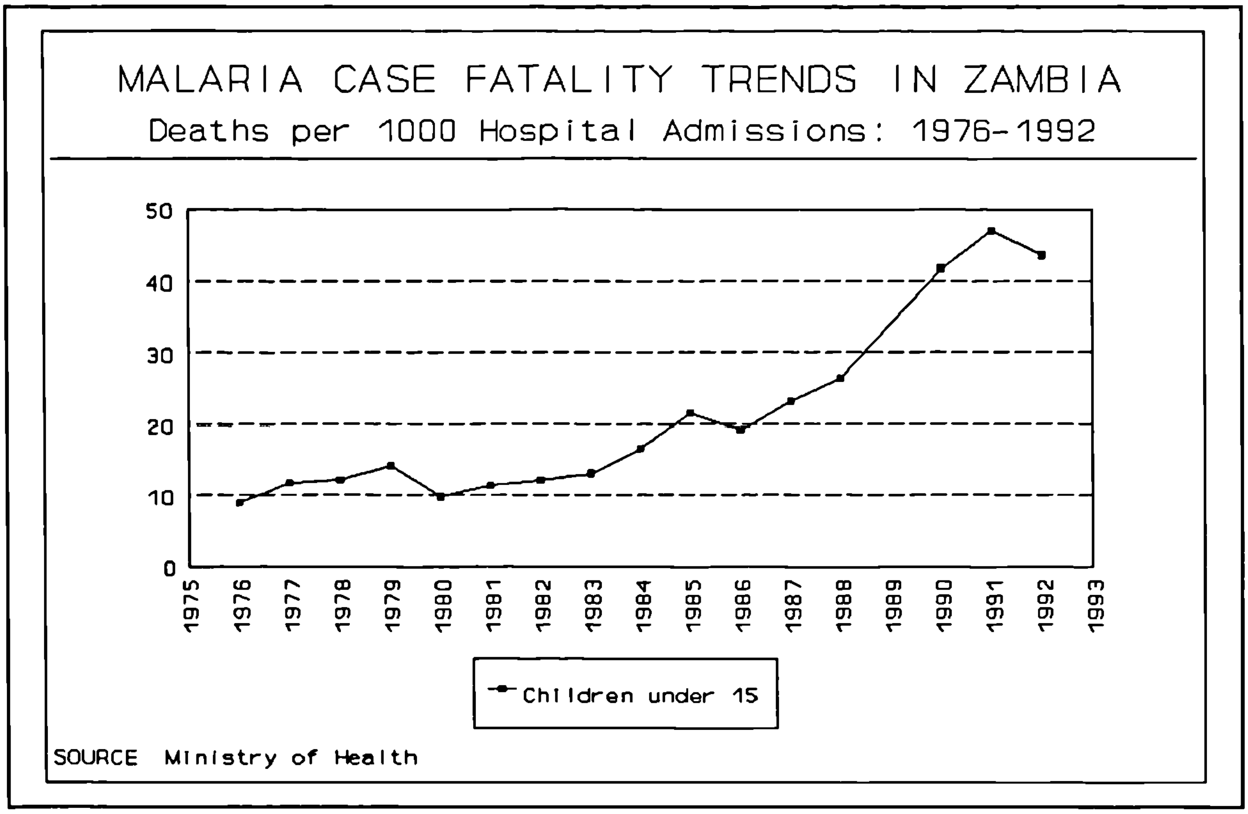


FIGURE 2.4

which include emergence of new malaria strains that are resistant to many existing drugs, the general deterioration in health and medical infrastructure and increasing household poverty resulting from declining real income. Compounding the deterioration in children's health status and especially in the 1980s are possible effects of the AIDS epidemic.

Recent studies using both DHS and census data (1980 and 1990) have also illustrated the deterioration in the survival status of children in the last two decades. Although under-five mortality levels declined from 25 percent in the mid-1960s to around 16 percent by the end of 1970s, overall mortality had started to increase by the mid-1980s. Moreover, and on the basis of census data, under-two mortality increased during the intercensal period by 29 percent and 33 percent in urban and rural areas of Zambia, respectively (Nsemukila, 1994).

2.7 SUMMARY

It is true that Zambia has changed over the years from being one of the most prosperous countries in Sub-Saharan Africa to one of the poorest, with social indicators reflecting its low levels of economic development.

A good summary of this chapter, perhaps, should come from one of the conclusions drawn from a recent World Bank poverty assessment exercise for Zambia:

> *Average income and earnings have fallen dramatically since the late 1970s or early 1980s (depending on the indicator chosen). These declines have led to increased poverty with the most severe increase in urban areas as wage incomes were hit relatively the hardest. The income distribution has become more equal as the advantage of urban areas was eroded, everyone has become poorer and the worst hit were the emerging middle classes. The increase in poverty has been accompanied by deteriorating social indicators (e.g. infant mortality rates have increased, school enrolments have fallen). Social indicators have fallen as the increasing population in poverty increased demands on social sector delivery systems and as the fiscal squeeze of the 1980s combined with over-centralised and ineffective service delivery system caused supply of services to deteriorate. The general deterioration has made Zambia comparable to its peers in low-income countries, whereas it used to outshine most of the comparators in the early 1970s.* (World Bank, 1994, p 28)

CHAPTER THREE

DATA AND DATA QUALITY

3.1 INTRODUCTION

Within the methodologies of the World Fertility Survey (WFS) and recently the Demographic and Health Survey (DHS), assessment of survey data quality has become a necessary component in general demographic data analysis.

In order to indicate the analytical limitations imposed on the study, and to place some level of confidence on conclusions drawn from sample data, it is essential that data evaluation precedes any substantive analysis.

Although the Demographic and Health Survey (DHS) data and particularly those relating to child survival are considered of good quality, they still suffer from a number of deficiencies which could easily distort the interpretations of results (Arnold, 1990). There is sufficient evidence from both the WFS and DHS that retrospective survey data contain both sampling and non-sampling errors that may impose analytical limitations on the data. This is especially important in Sub-Saharan Africa, and Zambia in particular, where there are limited sources of data. Moreover, while personal attributes such as mother's education are important in determining knowledge of dates, culture and society might condition an individual's attachment or disattachment to age and date concepts (Bicego and Boerma, 1994). Although sampling errors can be evaluated statistically, non-sampling errors are impossible to avoid and difficult to evaluate statistically (IRD, 1990). Among the non-sampling errors which may be present are omission of births and deaths, misreporting of dates of birth and ages at death, and misreporting of mother's own birth dates.

This chapter, therefore, focuses on Zambia Demographic and Health Survey (ZDHS) data and attempts to assess non-sampling errors that may have a significant impact on mortality estimates produced from the subsequent analyses. On the other hand, the extent of sampling errors would be considered in subsequent chapters through computation of standard errors for mortality rates. Considering the difficulty of direct data quality assessment, this chapter examines whether the data for this study can lead to plausible estimates of childhood mortality through undertaking internal consistency and plausible checks.

In addition, the analysis examines certain external consistency checks using data from both the 1980 and 1990 censuses and from a Contraceptive Prevalence Survey of 1988.

3.2 DATA COLLECTION

The Zambia Demographic and Health Survey (ZDHS) data were collected between 18th January and 15th May, 1992 by the University of Zambia in collaboration with the Central Statistical Office (CSO) and the Ministry of Health (MOH) as part of the worldwide Demographic and Health Survey programme. Financial and technical support came from US Agency for International Development (USAID) through Macro International, United Nations Population Fund (UNFPA), Norwegian Agency for Development (NORAD) and the Zambian Government (GRZ).

The ZDHS sample was selected from 4240 census supervisory areas (CSA) which are stratified into urban and rural areas within the nine provinces of Zambia. The sample is a three-stage stratified one which is not self-weighting at national level since some provinces were over sampled to enable regional fertility and mortality estimates (for more detail see Gaisie et al.(1993) and IRD, 1987). Two types of questionnaires were used for this survey: the household questionnaire and the individual questionnaire. The household questionnaire listed usual members and visitors of selected households, and further collected basic information on the characteristics of households and their members. Amongst these characteristics include age, sex, household composition and educational levels.

The individual questionnaire, on the other hand, collected information from eligible women. Eligible women included all women aged 15-49 who either slept in the household the preceding night or who were usual residents of the household. Information from those women was collected on the following issues:

Background characteristics;

Reproductive histories;

Knowledge and use of family planning methods;

Antenatal and delivery care;

Breastfeeding and weaning practices;

Vaccination and health of children under five years of age;

Marriage and Nuptiality;

Fertility preferences;

Husband's background and respondent's work; and

General awareness of Acquired Immuno-deficiency-Syndrome (AIDS).

The analysis of this study is therefore based on the birth histories of 7,060 women of reproductive age group 15-49 from 6,209 households across the country.

Information on pregnancy, breastfeeding, immunisation and health of children were collected on births since January 1987, that is five years before survey date.

3.3 DATA QUALITY OF ZAMBIA DEMOGRAPHIC AND HEALTH SURVEY

3.3.1 Introduction

This section is divided into three sub-sections: age distribution of women; coverage of vital events; and reporting of event dates. These categories pertain to the major non-sampling errors associated with misreporting of respondents' own age, misreporting of children's dates of birth and death and complete omissions of such vital events. Relevant consistency and plausible checks are examined within respective sections to assess the limitations of the survey data.

3.3.2 Age Distribution of Women in the Sample.

One problem which is often not considered in the evaluation of sample data quality is that of age distribution of women and particularly for those women considered eligible for interview (i.e. those in the reproductive age range of 15-49). It is therefore important that the age distribution of the sample of women is comparable to other sources of data such as censuses and other surveys.

Overall, the ZDHS sample of women compares well to the distribution of women from both the 1980 and the 1990 census (Table 3.1). There are three main ways through which such distribution might be distorted from what is expected.

First, there is omission of eligible women by way of household non-response either by women missing from home or extreme cases where household respondents completely refuse to respond to the interview. It is always difficult to quantify and assess the effect of non-response errors on demographic estimates relating to childhood mortality since no information is available from households in which interviews were not conducted. Nevertheless, demographic estimates will only be affected if eligible women who are missed differ systematically in their demographic characteristics from those who are interviewed. Levels of non-response at household levels in Sub-Saharan Africa and in DHS data in general have always been low and reasonable. At less than 4 percent household non-response level, our study sample is reasonable at current DHS levels (Arnold, 1990).

Secondly, there are always problems associated with age misreporting of eligible women by both responsible household respondents and individual eligible women themselves. Age is an important element within the household questionnaire since eligibility of women respondents depends on it. Household information is normally given by a knowledgeable respondent in the household who may not necessarily know the exact age of certain household members. This is often the case for non-family household members or/and visitors present at time of interview. Misreporting of age is also common among eligible respondents themselves especially among the uneducated and older women. Such age errors may result from age heaping on certain digits and rounding of certain numbers. This results in women being shifted across ages. Use of five year age groups tends to minimize such displacements across single ages. Since five-year age groups tend to smooth such age variations, distribution of women in such categories should show the expected pattern of decline with increasing age of women. This is the case in Table 3.1, except for the suspect age groups of 45-49 and 50-54 (to be discussed later).

Thirdly, there is the distortion of age distribution of women by interviewers through eligibility status by way of residence and age of a woman. In this study, like many DHS surveys, a de facto criterion was used to determine the eligibility of women for individual interview. Those women who spent the night before the interview in a sample household were eligible if they met the age criterion. This procedure is often abused by interviewers in an attempt to reduce work load by saying that some women did not stay in the household the previous night. This attempt to alter eligibility based on residency is common among some Sub-Saharan African countries for surveys conducted in the period 1985-1989 (Arnold, 1990). Moreover, some women are pushed into the 50-54 age category in an attempt to make them ineligible. Although there is little evidence to suggest such abuse in the Zambian case (Gaisie et al., 1993), there is evidence of displacement among women within age groups 45-49 and 50-54 as noted from Table 3.1 and further supported by Table 3.2 where some women are pushed into the 50-54 age group.

TABLE 3.1 AGE DISTRIBUTION OF ELIGIBLE WOMEN AS PER CENT OF 10-54 AGED WOMEN.

AGE GROUP	PERCENTAGE DISTRIBUTION OF WOMEN		
	1980 CENSUS	1990 CENSUS	ZDHS 1992
10 - 14	22.8	21.7	24.0
15 - 19	18.3	20.3	20.2
20 - 24	15.4	16.0	14.5
25 - 29	10.6	11.9	11.8
30 - 34	9.4	9.2	9.1
35 - 39	7.7	6.3	6.5
40 - 44	6.7	5.8	5.1
45 - 49	5.1	4.6	3.9
50 - 54	4.2	4.2	4.9

This is often done by interviewers in an attempt to lessen the load of interviewing eligible women. On the other hand, the distortion at the upper age boundary may be due to intentional over-estimation of a woman's age or probably due to age heaping on age 50. These are two difficult effects to separate within a single survey.

Although the distortion is further clarified through computation of both age and sex ratios in Table 3.2, there is little evidence of severe age displacement at the lower age boundary of 10-14 and 15-19 in this study. Errors have been observed before at that level within some Sub-Saharan African surveys (IRD, 1990; Arnold, 1990).

TABLE 3.2 AGE AND SEX RATIOS TO DETECT AGE DISPLACEMENT AMONG ELIGIBLE WOMEN FROM BOUNDARY AGE CATEGORIES: ZDHS, 1980 AND 1990 CENSUS COMPARED.

SOURCE OF DATA	AGE RATIOS FOR FEMALES			
	10-14	15-19	45-49	50-54
1980 Census	97	97	95	105
1990 Census	99	105	95	108
1992 ZDHS	102	103	84	121
		SEX RATIOS		
1980 Census	100	92	107	107
1990 Census	99	94	95	92
1992 ZDHS	89	98	113	76

Note: Age ratio = $\frac{Fp_x}{1/3(Fp_{x-1} + Fp_x + Fp_{x+1})} \times 100$

Where Fp_x is female population at age *x*.
Sex ratio = Males/Females x 100.

An attempt by Rutstein and Bicego (1990) to simulate the effects that excluding eligible women based on age and residence status has on demographic estimates shows under-five mortality rates to be unaffected by such exclusion of eligible women; except in cases of extreme assumptions. Moreover, only changes to fieldwork procedures can reduce such bias.

3.3.3 Coverage of Vital Events

Three major problems often associated with coverage of vital events are: coverage of live births, coverage of deaths, and complete omission of both births and deaths.

i) <u>Coverage of Live Births</u>

According to Goldman and colleagues (1985), the extent to which a survey succeeds in recording all births occurring to each respondent's life time is one crucial criterion of data quality assessment. This is especially true in developing country surveys where coverage of such events is rarely complete. Moreover, omission of such events is the most serious error that may be found in survey data (Rutstein, 1984).

Within the issue of birth omission are two crucial sources of such an error. First is underreporting of live birth, usually thought to relate to respondent characteristics such as age, educational level, and to characteristics of births which include residence, sex and survival status of births in question. In other words, underreporting of births is common among children living away from their parents and especially those who died several years in the past. Second is the confusion resulting from the definition of a live birth. This is particularly common to those children who died within a few hours of birth and most unlikely to be considered a live birth. Occurrence of such omissions might distort mortality levels, trends and differentials since the number of births is an important input in the computation of childhood mortality estimates.

One way of assessing such omissions is by inspecting increments in the mean number of children ever born (parity) across age groups of respondents, as attempted in Table 3.3.

Comparing the study results with those of the 1980 and 1990 censuses and the 1988 Contraceptive Prevalence Survey further illustrates the standing of ZDHS data to other data sources.

TABLE 3.3 MEAN NUMBER OF CHILDREN EVER BORN TO ALL WOMEN (15-49); 1980 CENSUS, 1990 CENSUS, CPS (1988) AND ZDHS (1992) COMPARED.

DATA SOURCE	MEAN PARITY BY MOTHER'S AGE GROUP						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
1980 Census	0.3	1.8	3.7	5.4	6.4	6.9	6.6
1988 CPS	0.5	1.8	3.3	5.0	6.5	7.8	8.2
1990 Census	0.2	1.3	2.8	4.6	5.9	6.9	7.1
1992 ZDHS	0.3	1.6	3.1	4.8	6.4	7.4	8.1

It should be noted, however, that the 1980 census mean parities were underreported by older women especially those in the 45-49 age groups since the mean number of children ever born should increase monotonically with age of the mother. This observation is based on the assumption that older women tend to underreport more than they overreport births. Moreover, lower parity and especially amongst older women signals omission of some children. According to Goldman et al (1985), the possibility of a woman reporting still births as live births or adopted children or children of her husband by another wife as her own children is recognised, though such incidence are not considered high enough to make a significant difference to the means. With high levels of fosterage and kinship networks within Sub-Saharan Africa, however, such possibilities cannot easily be ruled out especially among polygynous households. In Zambia, for example, fosterage and polygyny are widely practised at 25 and 18 percent, respectively (Gaisie, et al., 1993).

TABLE 3.4 MEDIAN AGE AT FIRST BIRTH ACCORDING TO CURRENT AGE FOR WOMEN AGED 20-49

CURRENT AGE OF MOTHER	WOMEN WITHOUT BIRTH PERCENT	MEDIAN AGE AT FIRST BIRTH
15 - 19	72.8	*
20 - 24	20.4	19.1
25 - 29	8.2	18.8
30 - 34	4.0	18.2
35 - 39	2.0	18.2
40 - 44	1.4	18.6
45 - 49	1.4	18.3

* Less than 30 percent of women in age group 15-19 have had a birth by age 17.5.

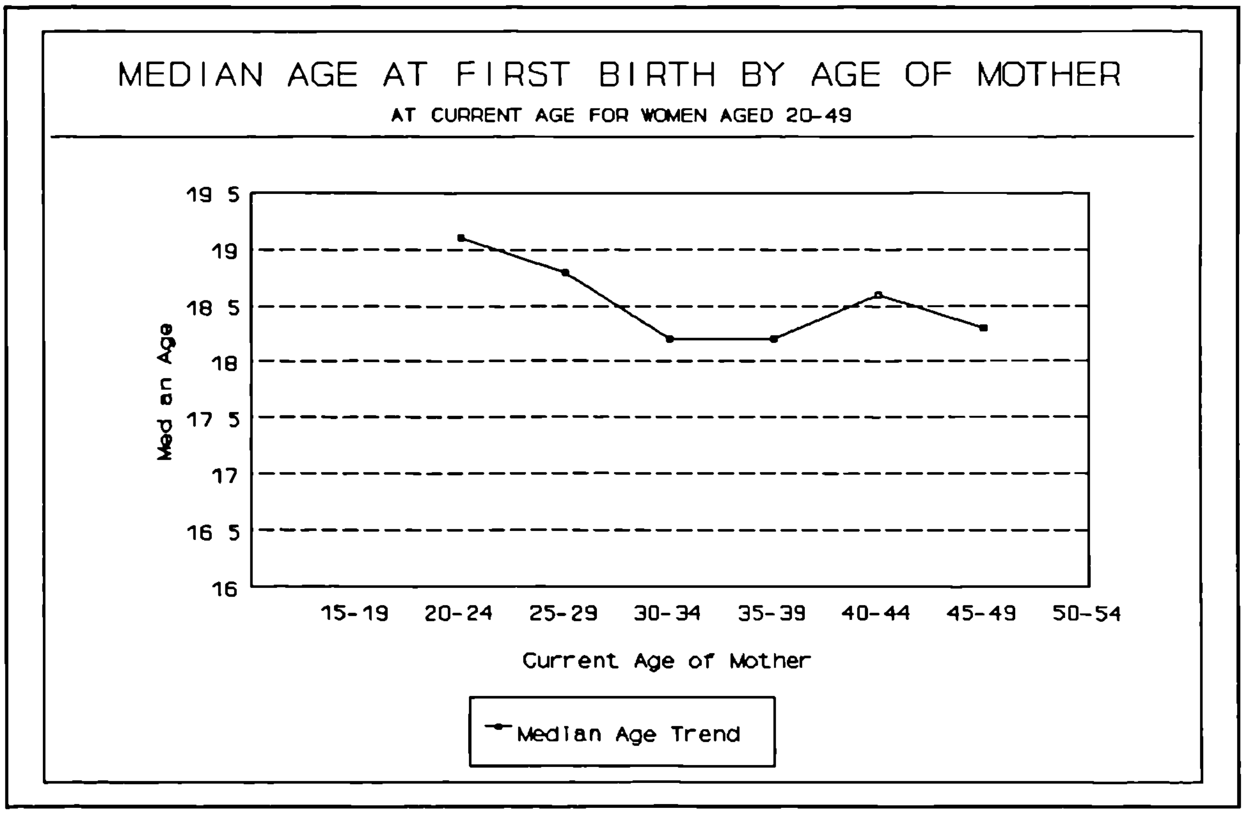


FIGURE 3.1

Observed higher levels in median age for older women aged 40-44 and 45-49 in Table 3.4 and illustrated further by Figure 3.1, indicate possibility of errors due to omissions and/or misplacement of first births by those older women. This, again, is based on the assumption that median age at first birth must decline with increasing age of the mother. However, apart from the two observations on the last two age groups, the median age at first birth follows an expected pattern of increase with younger ages of the respondents.

Analysis of sex ratios at birth by calendar years in Table 3.5 further indicates some levels of selective omission of male births.

TABLE 3.5 SEX RATIO AT BIRTH BY PERIOD OF BIRTH 1972 - 1991

PERIOD OF BIRTH	NUMBER OF BIRTHS		SEX RATIO (Percent)
	MALE	FEMALE	
1972 - 1976	1661	1677	99.0
1977 - 1981	2160	2194	98.5
1982 - 1986	2661	2804	94.9
1987 - 1991	2719	2698	100.9
TOTAL: 1972-1991	9201	9373	98.2

Although such omissions are within acceptable range and are fairly constant (with exception of 1982-1986), they reaffirm other DHS observations in some Sub-Saharan African countries such as Botswana and Uganda over male birth omissions (Arnold, 1990). Moreover, such male omissions are also noted from the Zambian 1990 census results (CSO, 1995).

ii) Coverage of Deaths

Like issues relating to live birth coverage, underreporting of dead children, and particularly those who died several years before the survey, is one other significant source of error, as discussed in previous sections. Underreporting of dead children is most serious among older women due to memory lapse. This is true among child deaths occurring very early in infancy. For instance, selective underreporting of neonatal deaths often results in an abnormally low ratio of deaths under a week old to all neonatal deaths. Also true is the low ratio of neonatal to infant mortality that might indicate some underreporting of neonatal deaths. A ratio of less than 25 percent is often used as a yardstick for measuring levels of death underreporting especially among neonates (Rutstein and Bicego, 1990). Analyses of these ratios are presented in Table 3.6 where results suggest minor levels of underreporting of early childhood deaths.

TABLE 3.6 MEASURES OF AGE UNDERREPORTING AT DEATH FOR FIVE-YEAR PERIODS: 1972-1991.

PERCENTAGE OF DEATHS	FIVE YEAR PERIODS (1972-1991)			
	1987-91	1982-86	1977-81	1972-76
Ratio of Neonatal Deaths occurring Under 7 Days*	67.4	57.5	48.7	55.2
Ratio of Neonatal to Infant Deaths**	42.4	42.1	40.2	44.1

Notes: * (0-6 days deaths/0-30 days deaths) x 100
** (Under 1 month deaths/under 1 year deaths) x 100

This is possibly true of some deaths in the period 1977-81. It could also be said that some deaths were pushed backwards to the period 1972-1976 through displacement of death dates, a discussion developed in the next section.

An alternative method of examining the extent of underreporting of early childhood deaths is by assessing the plausibility of childhood mortality patterns. This is done by examining such patterns on the basis of background characteristics of children and their parents such as sex, birth order, residence and education levels of their mothers.

TABLE 3.7 PATTERNS OF CHILDHOOD MORTALITY RATES BY BACKGROUND CHARACTERISTICS: 1981 - 1991.

BACKGROUND CHARACTERISTICS	INFANT MORTALITY RATE	CHILD MORTALITY RATE
	SEX	
Male	106	91
Female	90	85
	BIRTH ORDER	
1	122	105
2-3	96	93
4-6	86	75
7+	94	85
	RESIDENCE	
Urban	78	79
Rural	116	97
	AGE OF MOTHER AT BIRTH	
Less than 20	123	110
20-29	92	85
30-39	87	76
40-49	102	80
	EDUCATION OF MOTHER	
No Education	115	101
Primary	99	92
Secondary	82	65
Higher	52	23

Table 3.7 and Figures 3.2 and 3.3 clearly illustrate both infant and child mortality levels according to expected patterns. It has frequently, and almost universally, been observed that infant mortality is relatively high for mothers below age 20, and high for older women, while lower levels are shown for middle aged mothers.

This is further supported by graphical observations in Figure 3.2 for mortality patterns associated with children's birth order, although mortality pattern from 19th century Sweden is more U-shaped than the Zambian pattern.

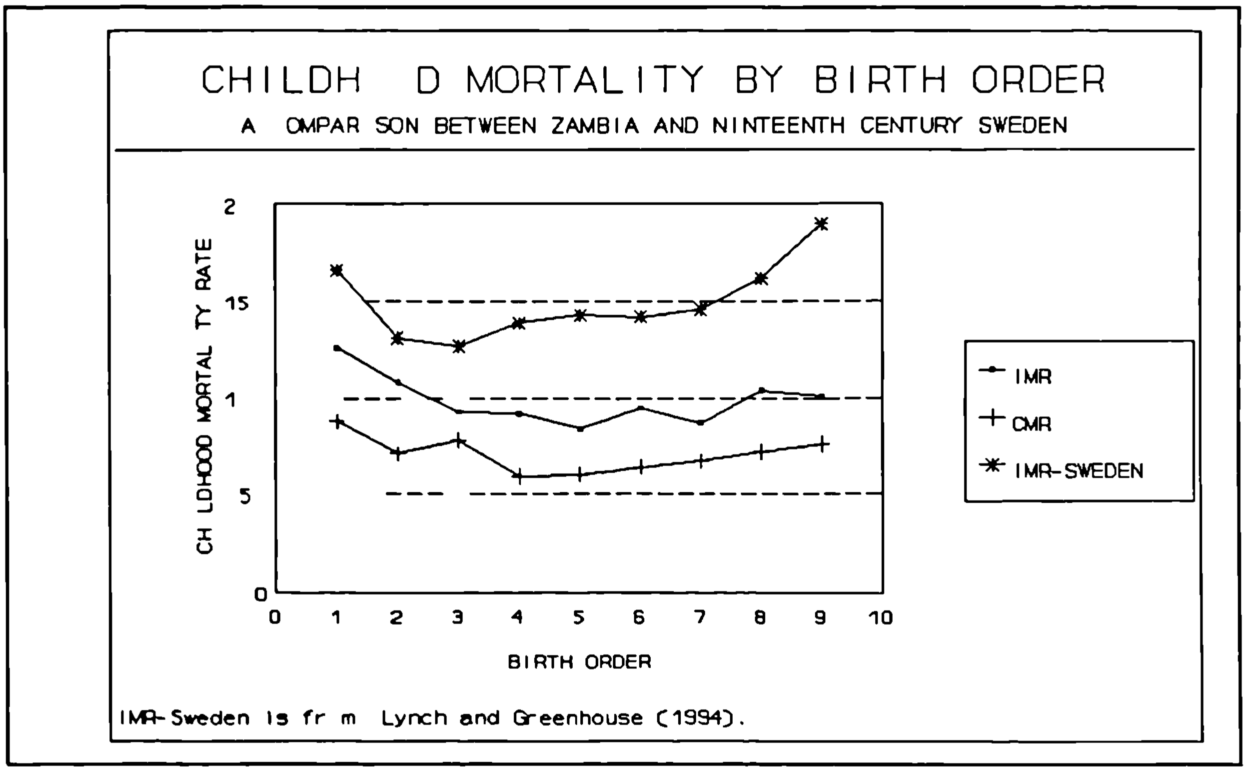


FIGURE 3.2

While small levels of underreporting may be expected for developing countries such as Zambia, age patterns of mortality are plausible, giving data users some confidence of good quality data. Caution should be taken, however, since deviations from expected patterns suggest that events are unlikely to be

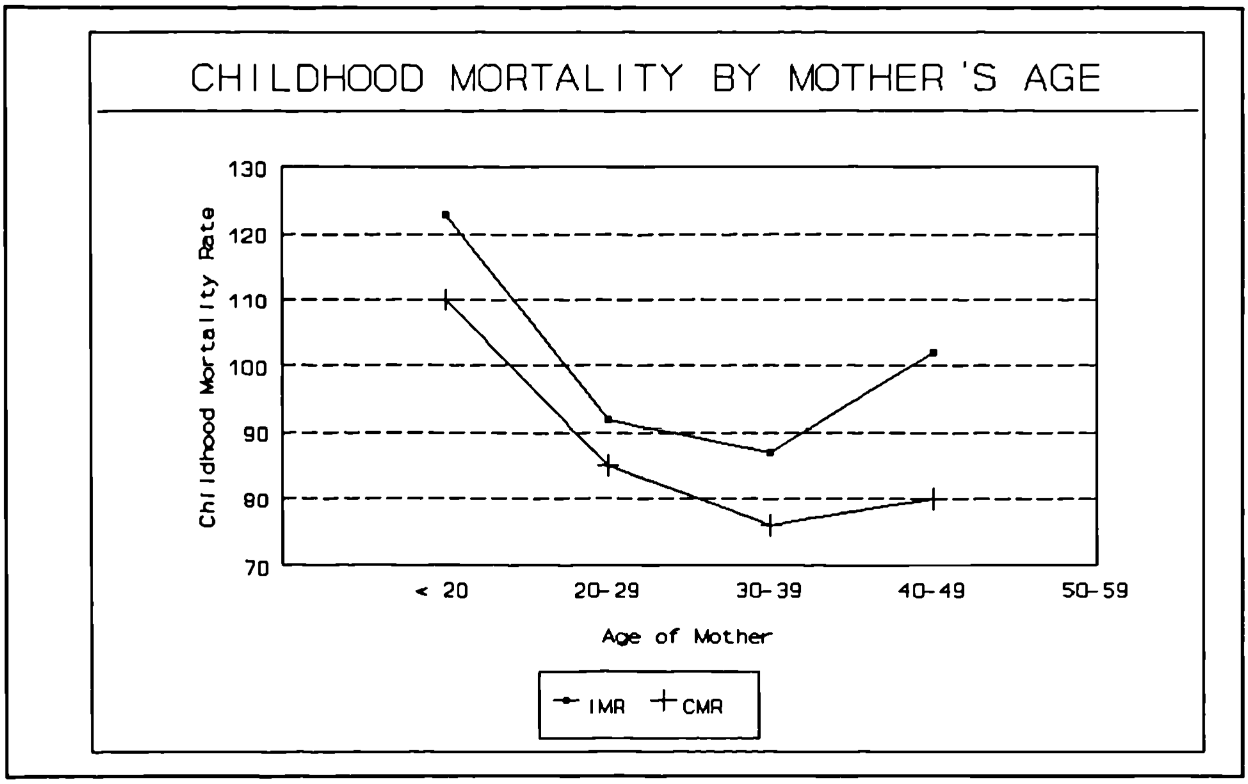


FIGURE 3.3

completely reported. On the other hand, absence of such deviation does not necessarily imply that the quality of reporting is high. Most important, however, is that departures from expected patterns are not necessarily due to data problems but may be due to genuine features of an existing mortality pattern in the population. Behind the rationale for internal consistency checks is the assumption that mortality rates typically follow well-established patterns and that deviation from these expected patterns may be indicative of defective data (Curtis, 1995). Furthermore, it is often hypothesized that children who die at very young ages are those most likely to be underreported in retrospective surveys and that an abnormally low ratio of neonatal to infant mortality would be observed (Curtis, 1995). In her recent assessment of the quality of DHS-II survey data, Curtis (1995) observed a steady increase in neonatal mortality over a period of 15 years prior to the survey in Zambia, and that, contrary to expectations, this increase has been accompanied by an increase in the ratios of early neonatal to neonatal deaths. Apart from asserting that such an increase reflected some improved reporting of early neonatal deaths in the more recent period, she suggests that there may have been some omission of early neonatal deaths in the more distant periods. Contrary to this suggestion, the previous Chapter indicated how such a mortality pattern could be genuine in circumstances where deterioration in prenatal care and maternal reproductive health may increase the risk of neonatal deaths. Moreover, in populations such as those in Zambia's Copperbelt, where the copper mining company provides almost universal prenatal and postnatal care for its labour force, a lower ratio of neonatal to infant deaths is possible. Even when compared to other regions in Zambia, the Copperbelt has the lowest neonatal to infant mortality ratio at 32 percent.

iii) <u>Complete Omission of Births and Deaths</u>

Apart from bias resulting from non-response, there are structural and survey design biases that often characterise retrospective surveys such as the DHS.

One such bias is known as selection bias since only surviving women can be interviewed in the survey. This means that no information is collected on the childhood mortality experiences of women who have died. Since it is believed that the death of the mother increases the risk of death for her children, this selection bias is likely to reduce overall estimates of infant and child mortality (Curtis, 1995). Although the magnitude of this bias is believed to be small in populations with low adult mortality, the Zambian situation with a high prevalence of AIDS may be affected to the point of influencing overall childhood mortality downwards. This is especially the case with paediatric AIDS where deaths are missed because the mother herself might have died way back prior to the survey; and most likely from AIDS itself.

The second survey design bias is in the form of truncation where only women aged up to age 49 years are interviewed. This means that many births to such women are largely originating from mothers who were young themselves at the time of birth of earlier children. This bias is likely to affect trend data especially that births to younger mothers have been associated with increased risk of death. This bias is minimised by the procedure of restricting analysis to births born in the five-year period prior to the survey. Moreover, the magnitude of this bias on mortality estimates will depend on the magnitude and form of the relationship between maternal age and overall childhood mortality in the population (Curtis, 1995).

Other structural biases are related to multiple births and the practice of fosterage, both common features of Sub-Saharan Africa. Because the DHS does not collect information on still births, underreporting of deaths may affect mortality estimates associated with multiple births since still births are common among twins. Amongst births in the five-year period prior the Zambian survey, multiple births accounted for almost four percent of the total births. While the overall level of fosterage is highest in Sub-Saharan Africa and is clearly age-dependent (i.e. it is rare during infancy and increases during the second, third, fourth and fifth year of life), fostering only affects the quality of data on feeding, morbidity and treatment patterns, and immunisation. Moreover, the accuracy of information also depends on how long the biological mother has been physically separated from her children. This bias is, nevertheless, unlikely to influence general childhood mortality estimates.

3.3.4 Reporting of Event Dates

This section presents some of the most serious errors commonly found in almost all surveys from developing countries, especially among the lowly educated and older women who might not attach a lot of importance to numerical figures. It is evident from many countries that most disadvantaged women are not sure of the dates of births and deaths, and hence interviewers are given intensive training in probing and use of local calendars, historical events and birth charts in an effort to obtain the most accurate information possible (Goldman et al., 1985). Among the errors associated with information coming from the birth history sections include the following:

i) Lack of completeness in reporting of event dates;

ii) Displacement of birth dates; and

iii) Misreporting of death dates.

Although checking the proportion of events for which actual month and year of occurrence were reported seems the most useful preliminary step in considering completeness of reporting, missing information for this study was almost negligible. Complete reporting of both month and year of birth and the age at death in the 15 years prior survey was nearly universal at over 99 per cent and compares well with Latin America and the Caribbean, as well as Botswana, Uganda and Zimbabwe; countries within the DHS-I programme (Arnold, 1990). It is often shown from various assessments of event reporting that much of the missing information on date of birth depends crucially on the survival status of a child. Although missing information is apparently common on dead children for many Sub-Saharan African countries a recent assessment of DHS-II surveys shows Zambia as having the least proportion with incomplete information on date of birth by survival status of children (Curtis, 1995).

Much more problematic is the displacement of birth dates resulting from miscalculations of year of birth by both mothers and interviewers. Age heaping and digit preference is especially common everywhere. Most notably are digits associated with 0 and 5 and in certain cases *even* as opposed to *odd* numbers. Equally important is the deliberate shifting of births across age groups by interviewers, which tends to concentrate births in the period 5-14 years prior survey. This procedural problem is expected to be much more serious for those surveys in the DHS-II programme where there is substantial amount of interviewing for children born five years prior survey. Like the case of shifting eligible women to ineligible status by interviewers (see section 3.3.2), there has been indications in this study to shift children to periods before January 1987, in an attempt to reduce prolonged interviews on health and breastfeeding sections.

Table 3.8 presents birth-year ratios in an attempt to detect the displacement of birth dates.

TABLE 3.8 BIRTH YEAR RATIOS FOR DETECTING DISPLACEMENT OF BIRTH DATES

CENTRED ON PERIOD		SURVIVAL STATUS 5 YEARS PRIOR SURVEY	
Five Years Prior Survey	Six Years Prior Survey	Dead	Living
95	110	94	96

Note: Birth Year ratio *x* years prior survey

$$= \frac{Bx}{.5(B_{x-1} + B_{x+1})} \times 100$$

where Bx = number of births *x* years prior survey.

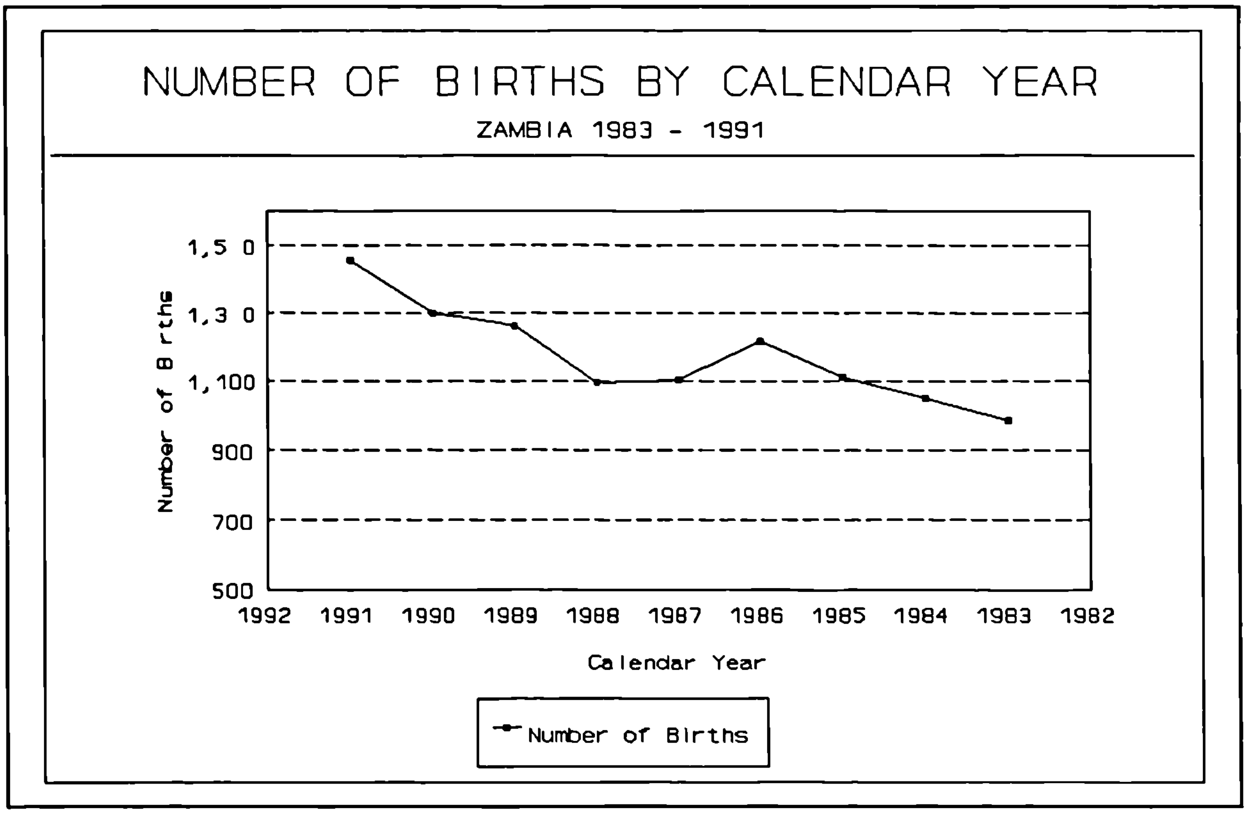


FIGURE 3.4

Birth ratios are used here to measure the relationship between number of births *x* years before survey to average number of births in two adjacent years. A ratio should approximate 100 in the absence of age displacement. While Table 3.8 clearly shows some deficit of births in the period after January 1987 indicating some surplus in 1986, Figure 3.4 further clarifies the shifting of births to the sixth year before survey. However, there is no evidence of substantial displacement differentials by survival status of children in the 5 years prior to survey.

TABLE 3.9 INDEX OF HEAPING OF DEATHS AT 12 MONTHS OF AGE BY YEAR PRIOR SURVEY

YEARS PRIOR SURVEY	INDEX OF HEAPING
0-4	1.4
5-9	1.7
10-14	2.3
15-19	2.3
0 - 19	1.8

Note: Index of heaping = $\frac{(4xD12)}{(D10+D11+D13+D14)}$
where D12 includes all deaths reported at 12 months.

Amongst all DHS-I and DHS-II countries considered by Curtis (1995) in her analysis of the displacement of births by survival status, Zambia has the least difference in birth ratios for surviving and dead children at 1.9 compared to Tanzania, Egypt and Jordan at over 3.0. Unlike Table 3.9, Curtis's analysis is based on 0-24 years prior to survey.

One other source of error whose analysis has not been attempted in this study is that of miscalculating year of birth by either the child's mother or the interviewer by disregarding whether that child has already had a birthday in the year of interview.

This is particularly common for surveys conducted in the early months of the year (Rutstein and Bicego, 1990). Analyses involving such errors are difficult especially when one is not sure of how much age imputations are done by interviewers during fieldwork.

A final problem concerns the misreporting of death dates. This error is common among death dates which are far back in time and easily forgotten by mothers who are less certain about dates of birth for their dead children. The problem of date displacement is much more serious for dead children than for surviving children even though questions asked about dead children are fewer relative to those of surviving children. According to Arnold (1990), three reasons have been advanced for such results. First, interviewers are often uncomfortable to probe further on dead children. Secondly, mothers might be less certain about children's birth dates hence giving interviewers flexibility to determine such date. Lastly, programmes used for data entry and imputations in DHS generally assume dead children with unknown years of birth to be too old to be included in the health and breastfeeding section, except for cases where a previous birth of the same woman was eligible for that section.

Overall on the quality of data by completeness of information on age at death by period in which the death occurred, analysis of both DHS-I and DHS-II reveals, again, that Zambia is one of the few countries with most complete information on age at death (Curtis, 1995). However, it must be stressed that complete information does not necessarily mean accurate information.

3.4 CONCLUSION

Comparing this analysis of data quality to that of earlier DHS surveys, improvements in the quality are noted and can be partially explained by the integration of the Sullivan, Rutstein and Bicego recommendations from their 1990 analyses of general DHS data quality, particularly for childhood mortality estimation. Illustrations of plausibility of our childhood mortality rate patterns further supports our views on data quality of this particular study.

While problems associated with general underreporting of births, age misreporting and shifting of older women out of eligible age groups are likely to influence mortality estimates in this study and especially mortality trends, much of the subsequent analysis is based on births in the five year period prior survey where age misreporting are believed to be low. Moreover, and for analysis of general childhood mortality trends, the DHS data is supplemented by both census and CPS survey data.

Overall, the quality of the DHS-II mortality data appears to be comparable to or better than the data from earlier retrospective surveys such as the WFS and DHS-I. Moreover, this assessment of the quality of DHS-II data demonstrates that the Zambian survey compares well and even better than many of its contemporaries.

CHAPTER FOUR

CHILDHOOD MORTALITY LEVELS, TRENDS AND PATTERNS

4.1 INTRODUCTION

Chapter Four aims to investigate general childhood mortality levels, trends and patterns in Zambia between the mid-1960s and early 1990s. Within this aim is an attempt to explore links between the childhood mortality trend and the performance of Zambia's economy as earlier discussed in Chapter Two.
To achieve this aim, therefore, the chapter is divided into three main sections. The first section presents the methodological procedures employed in estimating childhood mortality from both survey and census data. While the second section explores general age-, national-, and regional-specific patterns of mortality, the third section attempts to investigate the hypothesis that mortality differentials have narrowed between regions and social groups during the 25 year period under study. Moreover, Chapter Four prepares a base on which subsequent chapters on the major determinants of childhood mortality in Zambia are discussed.

4.2 ANALYTICAL APPROACH

Two approaches to the analysis of early childhood mortality trends from the mid-1960s to the early 1990s, namely direct and indirect methods of mortality estimations, have been adopted for this particular chapter.

4.2.2 Direct Estimation of Childhood Mortality

The focus of this chapter and indeed the entire study is on early childhood mortality during the first five years of life. Since children under five years of age are influenced by different age-specific causes of death, the interval between birth and five years of age can be sub-divided into neonatal (first month of life), post-neonatal (difference between infancy and neonatal period) and child (period between 12 and 60 months). Direct calculation of early childhood mortality rates requires data from birth histories in which all the women interviewed are asked about their children's date of birth, survival status, and age at death for those who died.

To measure mortality in the age categories presented above, the analysis uses period measures derived from children belonging to different cohorts. Hence mortality rates are period measures that are based on all deaths in a particular year over the number of births in the same calendar year. Due to problems of censoring, calculations of child mortality (4q1) and under-five mortality (5q0) rates do not go as far as 1990 because of fewer deaths amongst older children, especially after 1986. For periods beyond 1986, therefore, infant and under-two mortality rates are used to describe early childhood mortality trends. To smooth annual mortality trends, a 3-point moving average technique has been applied to all mortality rates derived from the survey data and presented in Figures 4.2, 4.3, 4.4, 4.5 and 4.6.

4.2.3 Indirect Estimation of Childhood Mortality

Our second approach is based on indirect techniques of estimations earlier developed by Brass in the 1960s and further modified by Sullivan and Trussell in the 1970s (Brass, 1975; Sullivan, 1972; Trussell, 1975).

For Sub-Saharan Africa and indeed Zambia, without a vital registration system, indirect estimates of mortality provide by far the most plentiful source of information particularly on early childhood mortality.

In this study, therefore, much of the analyzed data based on this technique comes from both the 1980 and 1990 census, and supplemented by the Contraceptive Prevalence Survey (CPS) of 1988.

The idea behind the employment of census data is to supplement the mainstay analysis based on the birth histories from the Zambia Demographic and Health Survey (ZDHS, 1992). This would further enable both assessment and evaluation of estimates based on the direct techniques of analysis as noted earlier.

The indirect technique is based on the Trussell variant of the Brass child survival method. A series of mean proportions of children ever born who have since died, as reported by women in the 15-49 age range, are converted into probabilities of survival and further into infant and child mortality rates.

The method was applied using MortPak-Lite, a PC based computer programme developed by the United Nations (UN, 1988). Resulting survival probabilities were based on the South model of the Coale-Demeny family of model life tables. Although previous census analyses for Zambia have been based on the North model, there is no convincing justification for the use of the North model (characterised by lower infant relative to child mortality) since the model does not reflect Zambian mortality patterns in the first five years of life. This study, on the other hand, uses the South model characterised by both high infant and child mortality. The use of the South model is supported by mortality patterns from the Zambia Demographic and Health Survey data. Moreover for Sub-Saharan Africa, infant mortality rate is relatively higher than child mortality, an observation also noted by Cochrane and Farid (1989) using World Fertility Survey (WFS) data and increasingly becoming evident from most countries of Sub-Saharan Africa participating in the Demographic and Health Survey (DHS) programme (Barbieri,1991). Hence Cantrelle's (1974) observation of the *tropical pattern of mortality* (characterised by lower infant than child mortality) using Senegalese data and further supported by Gaisie's (1975) Ghanian data, may by no means describe the age pattern of the entire Sub-Saharan African childhood mortality, and is by no means dominant for the region and Zambia in particular. As for Zambia, there is increasing evidence of relatively higher infant than child mortality (UNECA/CSO, 1982; CSO, 1985; Gaisie, Cross and Nsemukila, 1993). In this indirect approach, conversion of mortality measures *xqo* into 5q0 is adopted using the Brass logit system with the *general* standard. The *general* standard is different from the so called *African* standard also proposed by Brass (UN, 1983) and used by Carrier and Hobcraft in developing a set of stable population models for developing countries (Carrier and Hobcraft, 1971).

Ironically, this analysis avoids the use of the *African* standard since it is characterised by lower infant and relatively higher child mortality, a pattern different from the observed Zambian mortality pattern and those of many Sub-Saharan African countries recently observed from the DHS surveys.

Although the Zambian observed mortality pattern exhibits the expected pattern of higher infant than child mortality (4q1), when compared to directly derived measures child mortality seems to be grossly underestimated, while infant mortality is over estimated, an observation also noted in other studies (Hill, 1985, 1991, 1993; UN, 1988). It is possible that census respondents tend to shift some children to ages below 12 months. Furthermore, the analysis avoids the use of infant mortality estimates derived from the census for reliability reasons since infant mortality rate cannot be measured reliably with the Brass child-survival estimation technique as applied here. This is because the measure depends heavily on the age patterns of mortality embedded in the selected model. Secondly, the measure is strongly associated with the proportion of children dead among the youngest women aged 15-19. Children born to this age range suffer relatively higher risk than children born to older women. Moreover, the estimate is based on the relatively small number of births reported by mothers aged 15-19.

The choice of using both under-two and under-five mortality estimates is based on the fact that they vary much less with different choices of model life tables and somehow overcome problems of age misstatements which further distort categorization of measures into infant and child mortality rates.

Despite both direct and indirect measures showing similar trends in childhood mortality for the period in question, one clear observation is that the indirect estimates are consistently and significantly higher than the direct estimates. This has also been observed by earlier studies on early childhood mortality (Rutstein, 1984; Cochrane and Farid, 1989; Hill, 1993).

4.3 GENERAL LEVELS AND TRENDS IN CHILDHOOD MORTALITY

Overall, the four major sources of childhood mortality data, namely the 1980 census, the Contraceptive Prevalence Survey (1988), the 1990 census and the Zambia Demographic and Health Survey (1992), show a general decline of under-five mortality

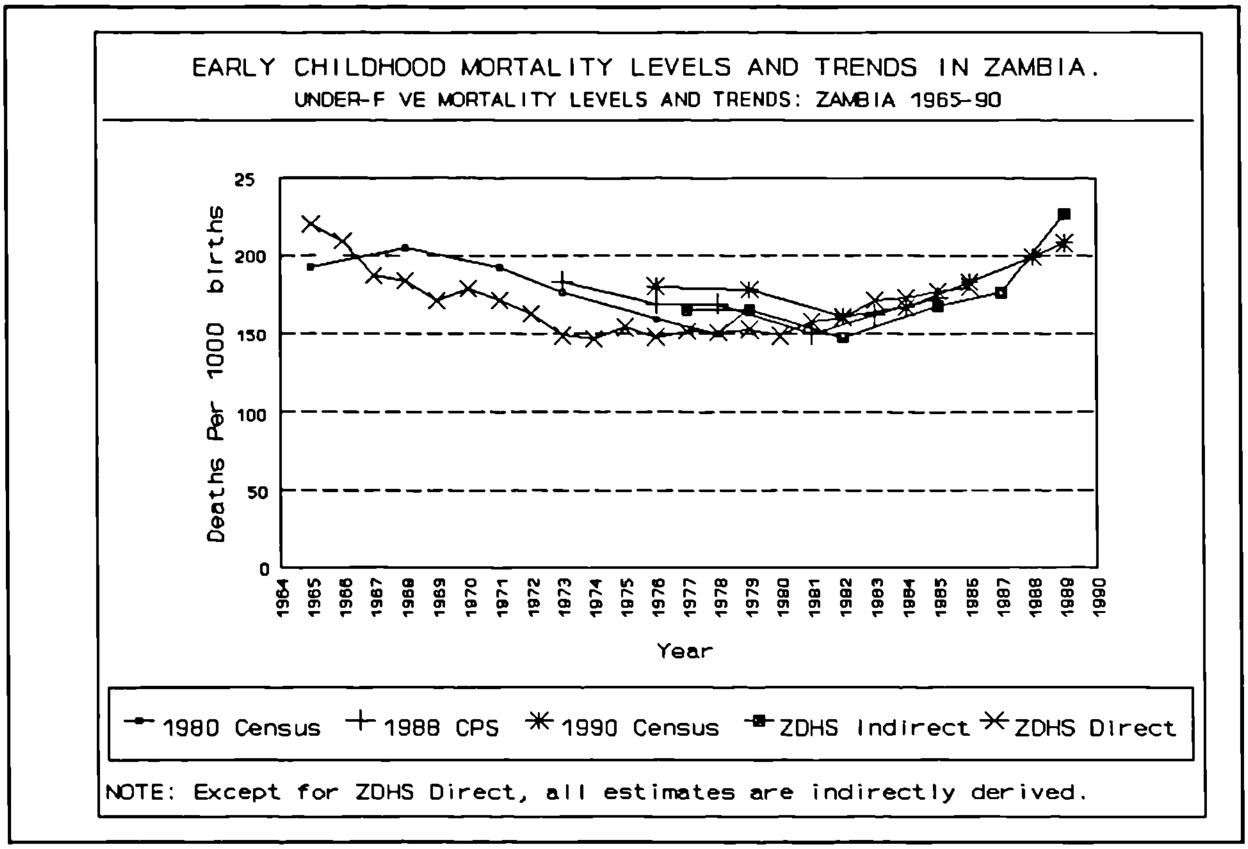


FIGURE 4.1

levels from around 220 per 1000 births in the mid-1960s to about 150 per 1000 towards the end of the 1970s. By the mid-1980s, under-five mortality started to rise, as shown in Figure 4.1. For instance, between the inter-censal period of 1980-90, under-five mortality increased by about 46 percent.

It should be noted from Figure 4.1, however, that except for ZDHS direct, all other measures have been indirectly derived.

4.3.1 National Levels and Trends

To assist in the discussion of national levels and trends, Figure 4.2 presents infant, child (4q1), under-two (2q0) and under-five

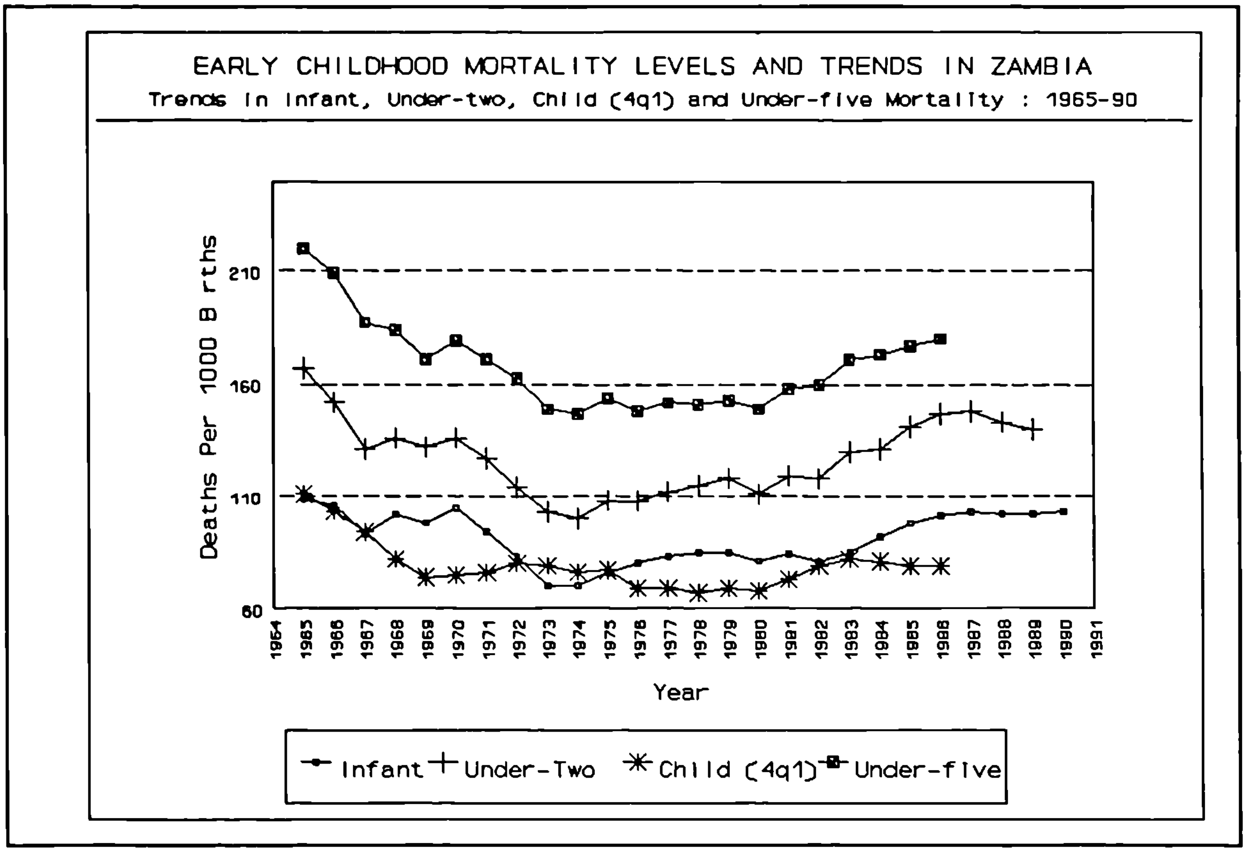


FIGURE 4.2

mortality trends between 1965 and 1990.

For purposes of this discussion, the 25-year period is divided into three parts on the basis of earlier discussions in Chapter Two. The first part is period between 1965-1973, a period characterised by economic success. The second part is period between 1973-1980 which is characterised by economic decline, and third is the 1980-1990 period characterised by deepened economic crisis.

During the period of success (1965-73), under-five mortality declined from around 220 deaths per 1000 births in 1965 to about 149 deaths per 1000 births in 1973, a mortality decline of 32 percent. In the period that followed, 1973-80, characterised by economic decline, the trend in under-five mortality remained stable around 150 deaths per 1000 births. Thereafter during years of deepened economic crisis, under-five mortality increased from 149 per 1000 in 1980 to about 180 per 1000 in 1986; an increase of over 20 percent. By the end of the 1980s, Zambia's under-five mortality levels had reverted to those of the early 1970s.

Although under-two mortality declined by 38 percent during the period of success, the increase in mortality had already started during the period of economic decline. Under-two mortality increased from about 100 per 1000 in 1974 to around 111 per 1000 in 1980. This increase in mortality continued even in the crisis years of the 1980s. For example, between 1980 and 1986, under-two mortality increased by almost one-third.

Even though both infant and child mortality declined at different rates during the years of success, the trends were different during years of economic decline. While child mortality continued to decline, infant mortality increased from around 70 per 1000 in 1973 to about 81 per 1000 in 1980. However, between 1980 and 1986, infant and child mortality increased by 25 and 8 percent, respectively.

It is clear from Figure 4.2, therefore, that the observed increase in under-two mortality since the mid-1970s was largely influenced by increases in infant mortality.

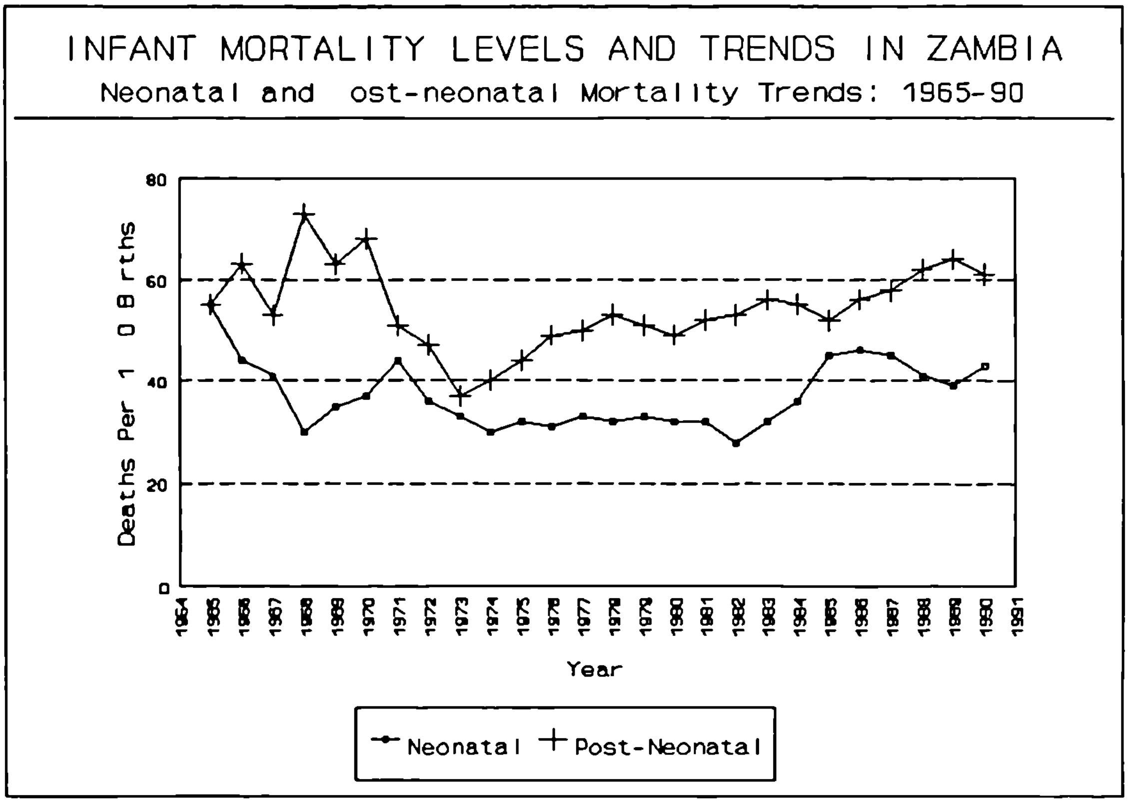


FIGURE 4.3

Prompted by increases in infant mortality, Figure 4.3 presents mortality trends by both neonatal and post-neonatal as components of the first year of life. However, caution must be taken with trends of the 1960s due to fluctuations possibly caused by age misreporting. While both neonatal and post-neonatal mortality declined by 40 and 33 percent, respectively, during the period of success, neonatal mortality remained stable at around 30 per 1000 until the first few years of the 1980s when the rate started to increase. As for post-neonatal mortality, the increase had already started in the mid-1970s. Between 1974 and 1990, post-neonatal mortality increased by 53 percent.

What these national mortality estimates show, therefore, is that infant mortality rate had started to increase in the period of economic decline, mainly influenced by increases in post-neonatal mortality as opposed to neonatal mortality that in fact remained rather stable until the mid-1980s. The period of deepened economic crisis in the 1980s is characterised by general increases in all early childhood mortality estimates.

Although neonatal mortality levels are largely influenced by existing maternal and child health factors, post-neonatal mortality is influenced by both health care factors and the socio-economic environment surrounding children's households. Moreover, it is during the post-neonatal period that children are introduced to feeding and other child care practices that are largely influenced by their parents' socioeconomic status.

4.3.2 Rural-Urban Mortality Trends and Patterns

Geographical disparities in under-five mortality within developing countries can be very great indeed. A number of studies have shown such disparities in the countries of Sub-Saharan Africa (Behm, 1979; Blacker, 1979; Dyson, 1982; Hill, 1985; 1991; 1993). Although such regional variations may sometimes reflect the geographic distribution of ethnic groups, many such variations may be relevant in explaining differences in both economic and natural environments (Dyson, 1982). A study by Cochrane and Farid (1989) found infant mortality in most African countries to be lowest in major urban areas, higher in other urban areas and higher still in rural areas. They, however, found Nigerian metropolitan infants with no added advantage in survival over those living in other urban areas. Similarly, they found infants born in rural areas of Kenya, Lesotho and Mauritania to have the same chances of survival as those in non-metropolitan urban areas.

On the other hand the Brazilian cities seem to give another version of urban childhood mortality pattern. Studies based on both 1970 and 1980 census data show higher urban than rural early age mortality (Dyson, 1982). While Carvalho and Wood (1978) have shown middle and upper income groups in urban Brazil to have lower childhood mortality levels, but for the bulk of the population on lower incomes, the reverse is true. Among certain explanations for such observations are that urban poor often have very limited access to medical services, suffer from crowding as well as poor toilet and water facilities, and may also practice less breastfeeding than rural populations (Dyson, 1982).

One significant problem relating to the study of urban differentials in under-five mortality is the usual aggregation of data for all urban areas combined which may hide the fact that mortality in the appalling slum conditions of large cities may sometimes actually be higher than levels in rural areas. This problem is evident in many data sets from the Demographic and Health Survey programme where difficulties may arise in analyzing desegregated urban data.

To investigate rural-urban mortality levels and trends, Figure

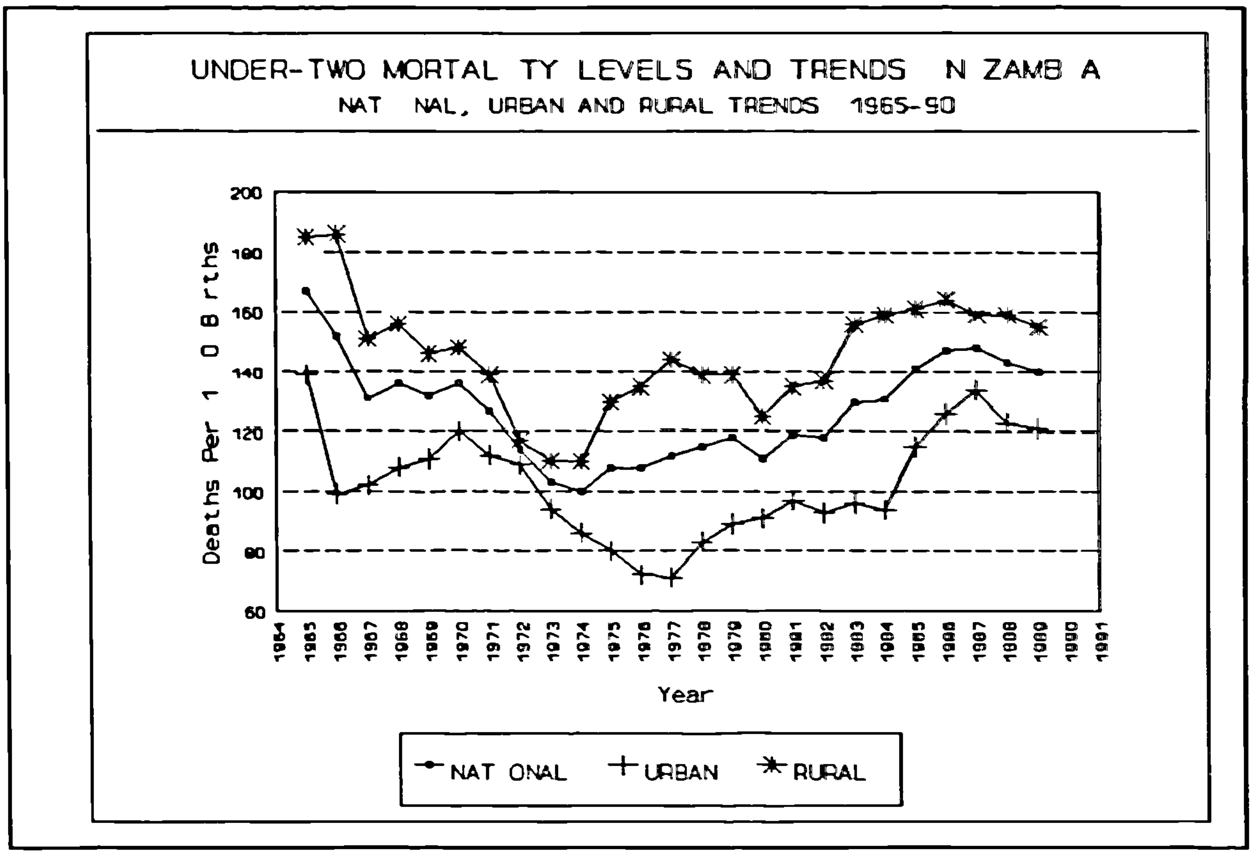


FIGURE 4.4

4.4 presents trends in mortality for children aged less than two years of age for the 25-year period. Like earlier estimates, there is a general decline in under-two mortality in both rural and urban areas during the 1965-73 period. Even though the national estimates show increasing under-two mortality of about 11 percent between 1974 and 1980, rural and urban estimates had opposing trends. While rural mortality increased from around 110 per 1000 in 1974 reaching a peak of 144 per 1000 in 1977 and then showed signs of decline up until 1980, the urban mortality declined to its lowest level of 71 per 1000 in 1977 and thereafter started to increase towards the end of the 1970s.

In about a decade after its lowest level of 1977, under-two mortality increased by almost 90 percent by 1987. For both rural and urban areas, the beginning of the 1980s were characterised by a general increase in under-two mortality.

Although urban mortality levels have been generally lower than those in rural areas, three important observations can be made

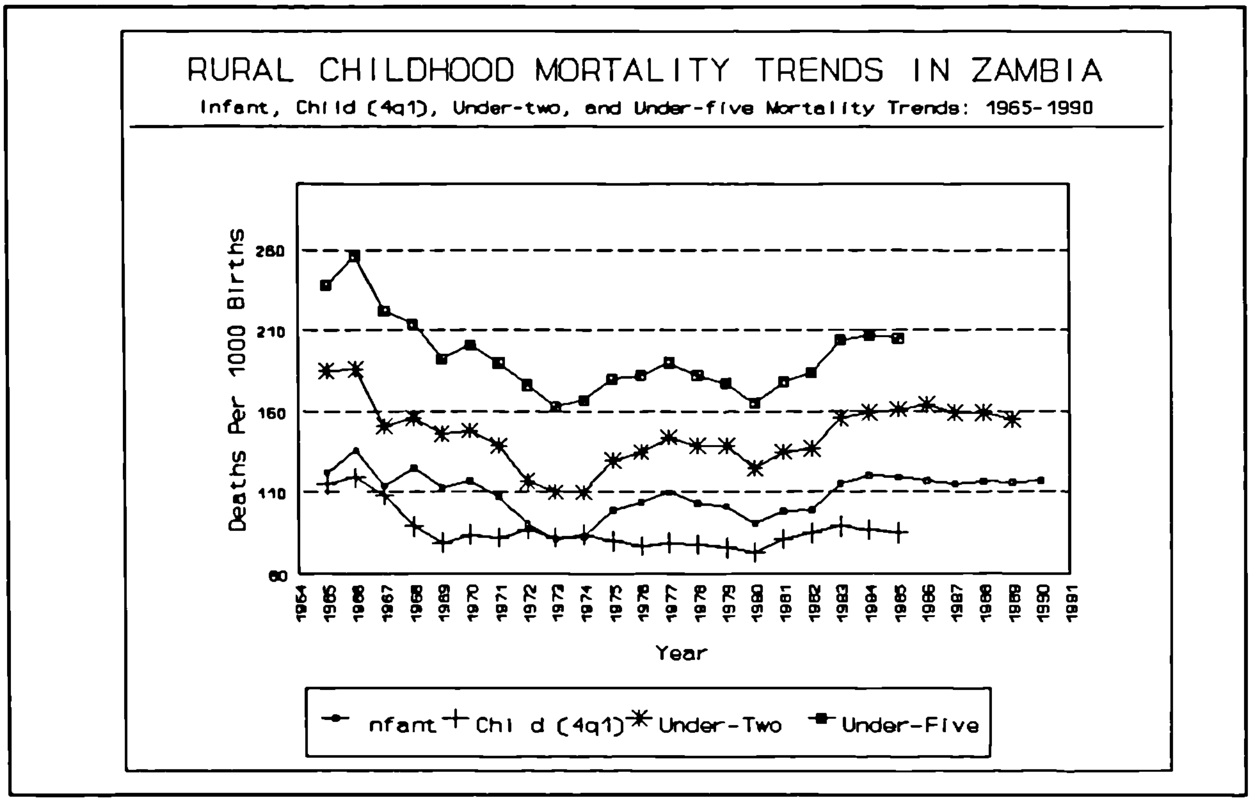


FIGURE 4.5

from Figures 4.5 and 4.6 showing mortality patterns within rural and urban areas, respectively.

The first observation is that childhood mortality started to increase in rural areas around the mid-1970s, while those in urban areas started later in the 1970s; an average delay in the mortality upsurge of about four years. One possible explanation for the urban delay in mortality upsurge lies in government policy that continuously cushioned urban living conditions especially through subsidies while the rural population received the full impact of economic recessions during years of economic decline.

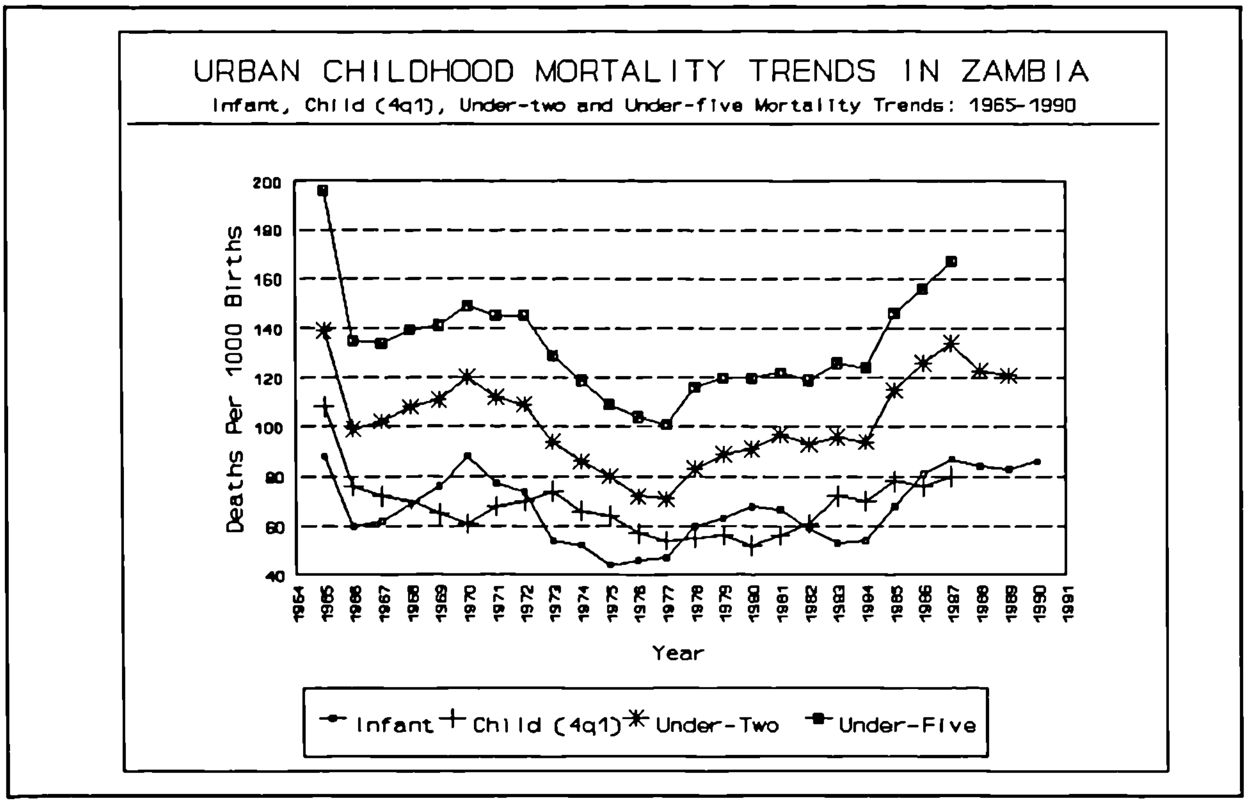


FIGURE 4.6

The second observation is that while rural mortality was largely influenced by increase in infant mortality by mid-1970s and that child mortality continued to decline, both infant and child mortality had started to increase by the end of the 1970s in urban areas.

The third observation is that throughout the study period infant mortality has been consistently higher than child mortality in rural areas, whereas no dominant pattern emerges from urban Zambia; both infant and child mortality keep interchanging throughout the period.

4.3.3 Provincial Mortality Levels and Trends

The analysis in this section is based on results from both 1980 and 1990 censuses, and the ZDHS (1992) survey data.

According to the United Nations (1982), there are a number of problems in attempting to interpret regional differentials. Firstly, there are the small sample sizes which in most cases are subject to large errors. In this case, the Zambian survey has sufficient cases to enable some regional estimates of mortality. Secondly, there is the possibility that different models should be used for different sub-groups of a population when making indirect estimates. For comparison reasons, however, a single model for all the nine provinces of Zambia is used.

Finally, the indirect methods used assume that sub-populations are closed to general migration in each of the countries, and that the bias from internal migration would typically be to raise urban mortality estimates relative to those prevailing in rural areas. This is based on the assumption that rural mortality is always higher than urban mortality. Such assumptions, however, would depend on age-specific migratory flows and as noted earlier, it is not always that rural mortalities remain higher than those in urban areas. The reverse is also true as demonstrated in earlier urban mortality studies of nineteenth century England and Wales (Woods and Woodward, 1984). Moreover, childhood mortality levels in some rural provinces such as North-Western compare favourably well with urban provinces as will be illustrated later.

As early as the mid-1980s and using data from the 1969 census, Hill (1984) observed childhood mortality estimates for the mid-1960s to show a clear general pattern of highest mortality in the rural off-line of rail provinces, lowest mortality in the two most urbanized provinces (Copperbelt and Lusaka), and an intermediate level in Southern Province. She found infant mortality rates for that period to have ranged between 82 per 1000 in Copperbelt and 175 per 1000 in Eastern Province with a national average of 121 per 1000. She further observed the systematic differences in trends with the urbanized provinces showing marked recent declines in infant and childhood mortality, and with rural provinces only having very gradual declines or even none at all. She, however, noted two puzzling anomalies that were equally present in the 1974 sample census.

Firstly, there was exceptionally high infant mortality found in Eastern Province (175 per 1000 in the mid-1960s) compared to other rural provinces such as Western, Luapula and Northern Provinces (148, 141 and 141 respectively).

Secondly is the relatively low infant mortality (98 per 1000) found in North-Western Province, and also combined with a marked previous decline similar to the urban provinces, rather than the more gradual decline found in the other rural provinces.

Using under-two mortality estimates instead of infant mortality, this study finds great similarities with Hill's observations. Although Eastern Province continued to have high childhood mortality in the 1970s and the 1980s, Luapula Province had the highest mortality level during the same period. For instance, while under-two mortality in Eastern Province is estimated at 162 and 210 per 1000 in the late 1970s and late 1980s, respectively, Luapula's under-two mortality is estimated at 165 and 220 per 1000 in 1978 and 1988, respectively.

Like Hill's study, this analysis finds North-Western Province with relatively lower under-two mortality estimated at 108 and

132 per 1000 in 1978 and 1988, respectively.

TABLE 4.1 PROVINCIAL LEVELS AND TRENDS IN UNDER-TWO MORTALITY IN ZAMBIA: DEATHS PER 1000 BIRTHS AND PERCENT CHANGE ESTIMATES FROM 1980 AND 1990 CENSUSES.

PROVINCE	UNDER-TWO MORTALITY 1978 (1980)	1988 (1990)	PERCENT CHANGE
Central	117	142	+21.4
Copperbelt	107	146	+36.4
Eastern	162	210	+29.6
Luapula	165	220	+33.3
Lusaka	107	140	+33.0
Northern	129	183	+41.9
North-Western	108	132	+22.2
Southern	111	131	+18.0
Western	146	189	+29.5
Urban Zambia	111	143	+28.8
Rural Zambia	134	178	+32.8
National	123	161	+30.9

Moreover, evidence from the 1990 census shows North-Western Province to have the lowest under-two mortality, second only to Southern Province at 131 per 1000.

The study also shows a general trend in mortality where the once leaders in low mortality levels in the 1960s (and especially those based in the urban areas) have lost their lead to Southern and North-Western Provinces. This is further demonstrated by Table 4.2. While Copperbelt and Lusaka Provinces always occupied the first two positions in terms of lower childhood mortality in the 1960s, they have lost the lead to Southern and North-Western Provinces, respectively. What is most surprising, however, is that North-Western Province, like other rural provinces such as Luapula, Northern, Eastern and Western, is one of the poorest rural provinces in Zambia.

TABLE 4.2 PROVINCIAL LEVELS AND TRENDS IN UNDER-FIVE MORTALITY IN ZAMBIA: DEATHS PER 1000 BIRTHS AND PERCENT CHANGE ESTIMATES FROM 1980 AND 1990 CENSUSES.

PROVINCE	UNDER-FIVE MORTALITY 1973 (1980)	1984 (1990)	PERCENT CHANGE
Central	134	154	+14.9
Copperbelt	125	126	+ 0.8
Eastern	236	229	- 5.0
Luapula	242	220	- 9.1
Lusaka	168	128	-23.8
Northern	187	193	+ 3.2
North-Western	195	146	-25.1
Southern	180	143	-20.6
Western	218	220	+ 0.9
Urban Zambia	149	126	-15.4
Rural Zambia	201	196	- 2.5
National	175	161	- 8.0

One possible explanation for North-Western's lower childhood mortality can be found in the region's age-specific mortality patterns as shown by results from the ZDHS survey.

Table 4.3 shows North-Western Province as the only region with relatively low post-neonatal than neonatal mortality. While the province has one of the highest levels of neonatal mortality possibly influenced by inadequate maternal and child health services in the first month of life, the lower post-neonatal mortality might explain the overall low level of infant mortality since much of the increase in Zambia's infant mortality was largely influenced by the increase in post-neonatal mortality. Moreover, North-Western Province has one of the lowest child mortality (4q1) estimates. These low levels in mortality might be possibly explained by certain feeding practices and general child care.

TABLE 4.3 PROVINCIAL UNDER-FIVE MORTALITY LEVELS AND PATTERNS: ZAMBIA DEMOGRAPHIC AND HEALTH SURVEY 1992, 1981-1991

PROVINCE	CHILDHOOD MORTALITY RATES				UNDER-FIVE
	Neonatal	Post-neonatal	Infant	Child	
Central	40	52	92	82	167
Copperbelt	22	47	69	81	144
Eastern	60	73	133	131	247
Luapula	46	117	163	84	233
Lusaka	32	45	77	69	141
Northern	61	78	139	131	252
North-Western	53	49	102	70	165
Southern	34	37	71	69	134
Western	63	83	146	100	231
Urban Zambia	32	46	78	79	151
Rural Zambia	47	69	116	97	201
National	40	58	98	88	178

Overall, and as demonstrated earlier by Table 4.1, all Zambia's provinces have shown consistent increase in under-two mortality with Northern, Copperbelt, Luapula and Lusaka having some of the highest increases at 42, 36, 33, and 33 percent, respectively, during the intercensal period 1980-90.

The increase in mortality in Copperbelt and Lusaka Provinces is striking since these are the most urbanised and modernised regions in Zambia. For Lusaka Province, however, the 1980 Census analysis by the Central Statistical Office (1985) showed higher under-five mortality in more urbanised than rural areas and suggested that those results were perhaps indicative of inequalities in the provision of health services between communities such as squatter compounds and surrounding middle and higher income residential areas. The pattern was earlier reflected in the Lusaka-Keembe study where under-five mortality for squatter areas were more than five times the level in high income residential areas (UNECA/CSO, 1985). As for infant mortality levels, the squatter areas of Lusaka were almost three times higher than affluent residential areas. Copperbelt, on the other hand, exhibits an expected urban pattern with under-five mortality being higher in rural than urban areas (Nsemukila, 1994).

4.4 INEQUALITIES IN CHILDHOOD MORTALITY LEVELS AND TRENDS

This section attempts to investigate the inequalities in childhood mortality between areas and specific social groups as overall mortality increased in Zambia since the 1970s.

In their paper on "Socio-economic inequalities in childhood mortality: the 1970s and the 1980s", Cleland and colleagues (1992) concluded that socio-economic disparities in children's survival chances had not narrowed between the 1970s and 1980s. They further claimed that, in some cases, the disparities had widened. For Zambia, therefore, where overall childhood mortality has increased since the 1970s, this study offers an opportunity to investigate patterns of mortality disparities by socio-economic status. Moreover, the World Bank poverty assessment exercise on Zambia claims that income distribution has become more equal and that the advantage of urban areas has been eroded with the worst hit being the emerging middle classes (World Bank, 1994).

To investigate these claims, this study uses evidence from both the ZDHS survey and both the 1980 and 1990 census data. Childhood mortality under the age of two is used to explore differentials by rural-urban, place of residence and mother's education.

4.4.1 **Evidence from Survey Data**

Using the survey data, the period 1965-1991 has been divided into the following four sub-groups: 1965-75, 1976-80, 1981-85 and 1986-91. The concept of *relative risk* (i.e. comparison of two groups using their ratio rather than their difference) in under-two mortality is used here to illustrate changes between areas and socio-economic groups.

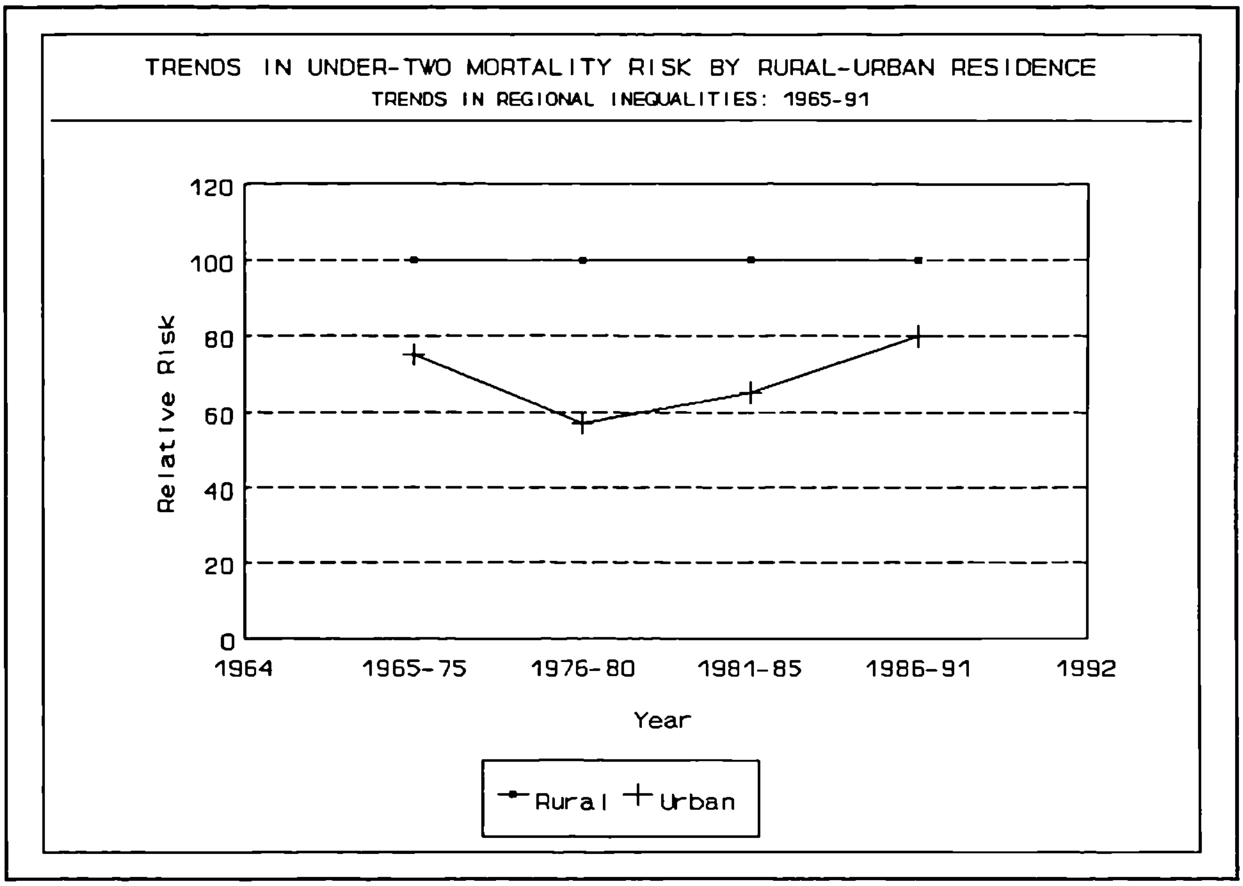


FIGURE 4.7

Figure 4.7 presents the trend in relative risk for mortality between rural and urban areas using rural as reference category. Although the mortality ratios widen between rural and urban children between 1965 and 1976, there is a consistent narrowing of risk between the two areas since the 1970s. The ratio of the difference between rural and urban areas narrows from 43 percent in the 1976-80 period to less than 20 percent in the 1986-91 period.

These observations are equally supported by ratios between places of residence categorised as cities, towns and villages.

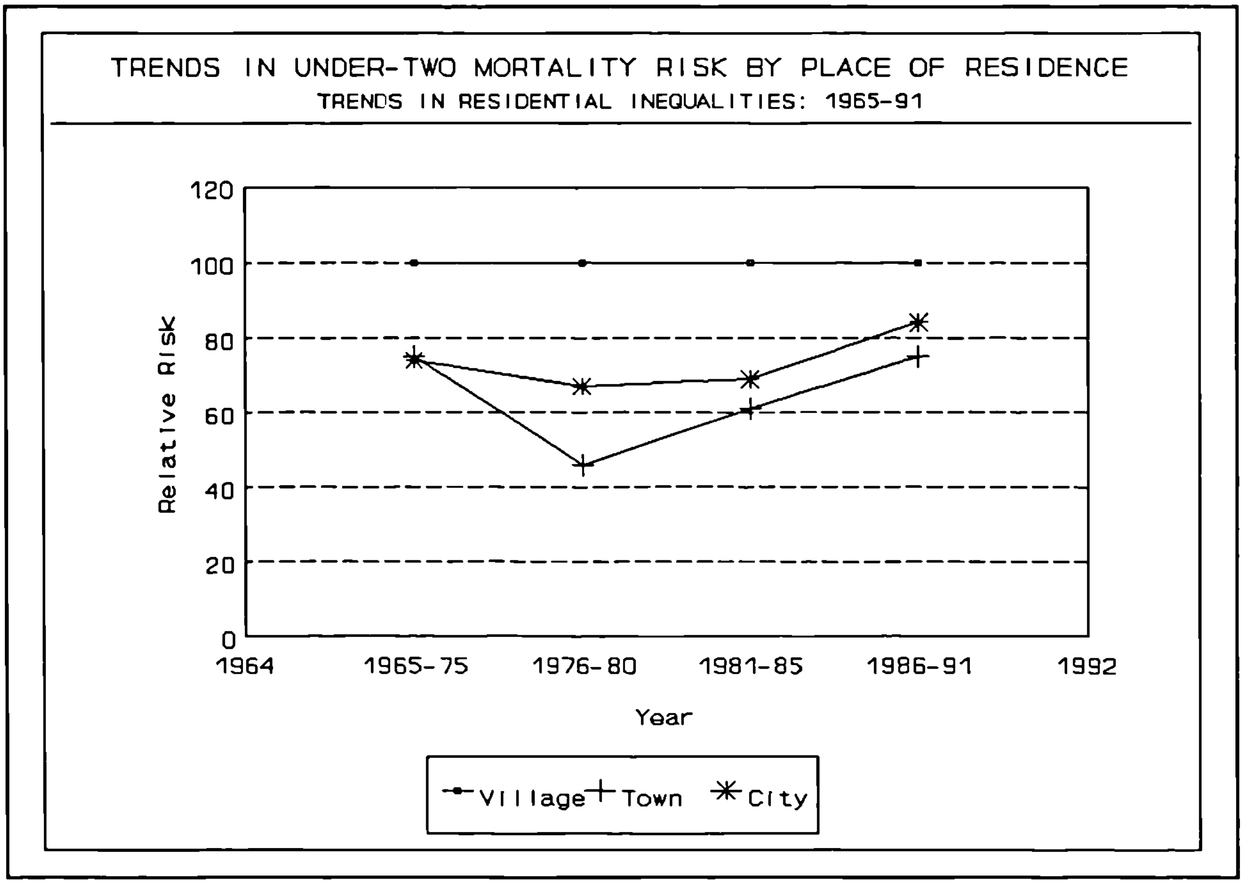


FIGURE 4.8

Using village as a reference category, for example, Figure 4.8 demonstrates how the 1986-91 childhood mortality estimates in towns have reverted back to the risk of the 1965-75 period in about two decades. Similarly and using mothers with at least secondary education to represent a group of middle class income as opposed to mothers with no education, Figure 4.9 supports further the claim by the World Bank (1994) that the gaps between these two social groups have narrowed over time in Zambia.

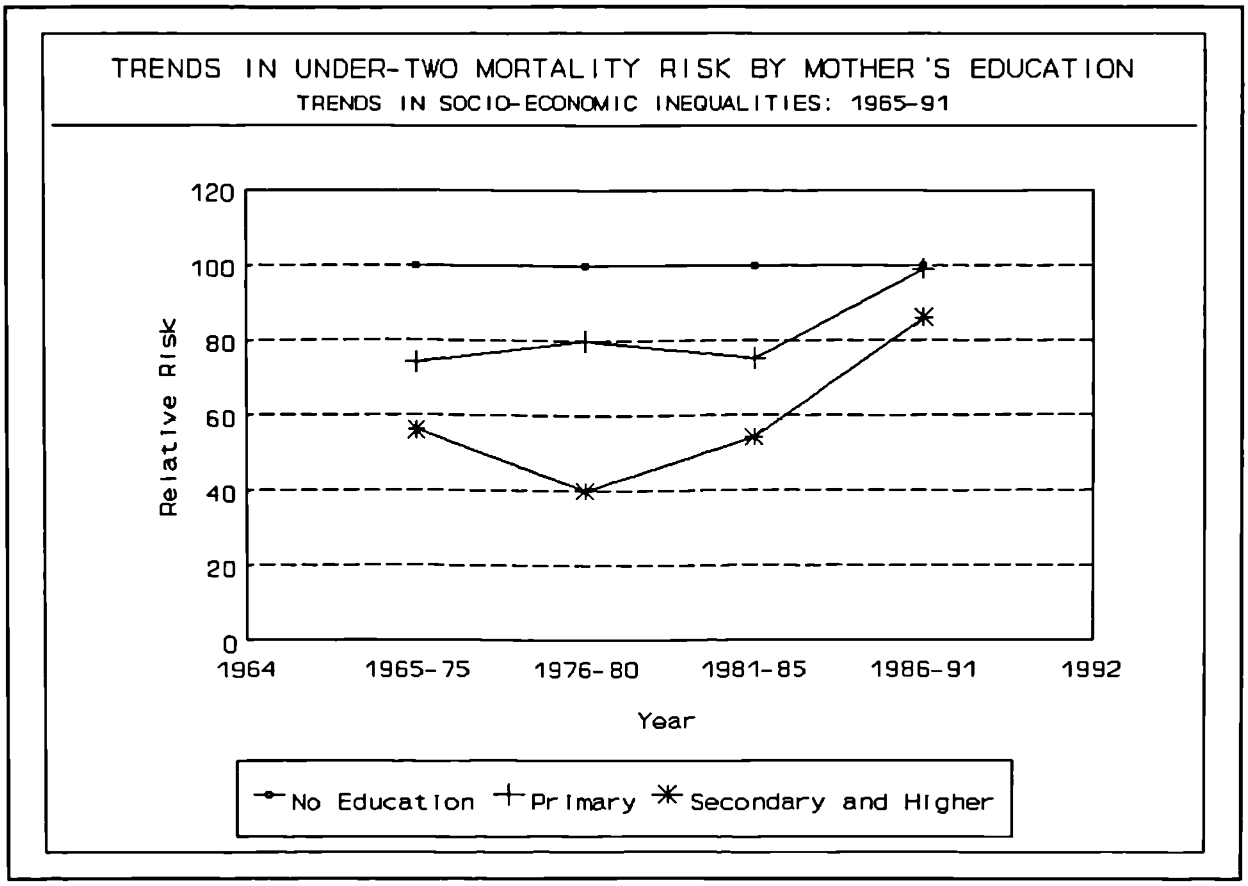


FIGURE 4.9

While the mortality risk gap between the two groups is estimated at almost 50 percent in the 1965-75 period, it narrows down to less than 15 percent in the 1986-91 period. Moreover, the narrowing of these mortality disparities is explained by a higher deterioration in childhood mortality especially amongst social groups that are otherwise considered to be advantaged.

4.4.2 **Evidence from Census Data**

Table 4.4 presents under-two mortality and related mortality risk ratios between mothers educational categories for the period 1978-1988 using both the 1980 and 1990 census data. Relative risk and percentage changes for national, urban and rural areas are also presented to illustrate changes in mortality between these individual categories by mothers education.

TABLE 4.4 TRENDS IN UNDER-TWO MORTALITY RISK BY REGION OF RESIDENCE AND MOTHER'S EDUCATION (Estimates from 1980 and 1990 Censuses)

MOTHER'S EDUCATION	NATIONAL UNDER-TWO MORTALITY 1978 (1980 CENSUS)		1988 (1990 CENSUS)		PERCENT CHANGE
	(2q0)	R.Risk	(2q0)	R.Risk	
No Education	151	100	184	100	21.9
Primary	125	83	166	90	32.8
Secondary +	80	53	118	64	47.5
	URBAN UNDER-TWO MORTALITY				
No Education	141	100	160	100	13.5
Primary	116	82	155	97	33.6
Secondary +	78	55	110	69	41.0
	RURAL UNDER-TWO MORTALITY				
No Education	155	100	189	100	21.9
Primary	133	86	174	92	30.8
Secondary +	69	45	140	74	102.9

Like estimates based on survey data, census estimates support earlier findings of narrowing mortality differentials between educational categories of mothers during the 1970s and the 1980s. Although under-two mortality levels are highest among children of mothers with no education, major deterioration in the survival chances of children is most striking amongst those from mothers with at least primary education and even worse for those children from mothers with at least secondary education.

In the rural areas, for example, under-two mortality for children from mothers with no education increased by 22 percent in about ten years while that for children of mothers with at least

secondary education increased by 103 percent.
This analysis, therefore, reinforces the World Bank's claim that the increase in poverty in Zambia originating from poor economic performance has been accompanied by deteriorating social and economic indicators such as early childhood mortality.

4.5 CONCLUSION

Using both survey and census data, Chapter Four has demonstrated the overall increase in early childhood mortality in Zambia since the 1980s. While this increase is largely influenced by the upsurge in infant and especially post-neonatal mortality, the study shows that rural childhood mortality had started to rise as early as the mid-1970s well before the increase in urban mortality. The delay in urban mortality increase might possibly be attributed to the government policy that subsidised urban rather than rural living conditions. The study also shows that those provinces that were once leaders in low childhood mortality levels, such as Copperbelt and Lusaka, in the 1960s have lost this lead to relatively poorer regions such as the North-Western, apparently one of the poorest rural provinces. The increase in overall early childhood mortality has been accompanied by the narrowing of mortality disparities between regions and social groups mostly resulting from deterioration in survival chances of children from otherwise advantaged households. Moreover, it is speculated that the increase in mortality parallels the poor performance of Zambia's political economy since the early 1970s and was possibly worsened by the AIDS epidemic during the 1980s.

CHAPTER FIVE

SOCIO-ECONOMIC CORRELATES OF CHILDHOOD MORTALITY

5.1 INTRODUCTION

The principal objective of Chapter Five is to identify the most discriminating of community-, household-, and individual-level socio-economic factors which should combine with selected cultural factors to be discussed in Chapter Six to form the socio-economic and cultural determinants block as illustrated earlier in Figure 1.2. These factors are then examined for evidence of strong co-variation with childhood mortality.
To achieve such an objective, study variables are firstly defined and selected for analysis based on univariate mortality risk differentials. Secondly, multivariate analysis using both logistic and Cox hazards regression models are undertaken to ascertain the key community-level, household-level and individual-level socio-economic factors influencing childhood mortality in Zambia during the 1987-91 period; i.e five years before the ZDHS.

5.2 GENERAL ANALYTICAL APPROACH

In line with the above objective, three analytical procedures are adopted. The first procedure involves the selection of socio-economic variables on the basis of univariate differential sizes as indicated by their implied relative risks, and their probable public health significance as reflected by the population attributable risk (PAR). Population attributable risk is defined here as an epidemiologic concept combining relative risk and risk factor prevalence so as to reflect the fraction of all cases associated with the risk factor (Kahn and Sempos, 1989). To estimate the population attributable risk, the formula below has been adopted.:

$$PAR = \frac{p(RR - 1)}{1 + p(RR - 1)}$$

where:

PAR	=	Population Attributable Risk,
RR	=	Relative Risk (i.e RR > 1),
p	=	Proportion of the population exposed to the risk factor.

Equally necessary in the selection is conformity of these factors to theoretical expectation and their explanatory significance on child survival in the light of the Mosley-Chen framework. For univariate analytical purposes, the first five years of life has been categorised into the following age intervals: neonatal (first month of life), post-neonatal (1-11 months), and child (12-59 months). This is aimed at assessing mortality risk variations between wider categories of post-neonatal and childhood periods of life as shown by other related investigations (Obungu, Kizito and Bicego, 1994).

The second procedure involves the assessment of gross (or uncontrolled) socio-economic effects on mortality risk. Estimates for neonatal, post-neonatal and childhood periods are produced by including only single variables in the logistic and hazards regression models. While hazards regression models have been adopted to allow use of censored observations during both post-neonatal and child periods, logistic regression has been used for neonatal risk analysis where there are no censored cases since all exposures are included. However, caution must be taken in interpreting parameter estimates from the hazard models due to extensive censoring of both the post-neonatal and child observations. During both periods, over 90 percent of the observations are censored. Both the logistic regression and hazards models assume that the observations are independent. Although the importance of controlling for correlation of outcomes between siblings in child survival studies is known, alternative statistical models that incorporated familial correlation found little change in parameter estimates from using both logistic and hazards models when such family effects are controlled (Curtis, Diamond, McDonald, 1993; Guo, 1993). For this analysis controlling for the survival status of preceding siblings is done where possible.

The choice of proportional hazards models is based on the preliminary examination of the data. A constant hazard has been assumed within the post-neonatal and child periods. The proportionality assumption has been examined by fitting interactions between each covariate and respective age group, and also by plotting the log-minus-log (LML) survival function to ensure that the baseline hazard functions are proportional (Norusis/SPSS, 1993). Moreover, the interactions between each covariate and age groups are insignificant, hence reassuring the proportionality assumption.

One-variable models are used here to identify those selected study variables whose implied relative and attributable risks are statistically significant.

Lastly, main effects models containing a reduced number of variables are fitted, in line with the argument that both household and individual socio-economic variables operate within the local community-level socio-economic environment, supported by community-level infrastructural characteristics as implied in the analytical framework. Whereas community-level variables are entered as a block in the model, household and individual variables are added in the form of single-order interactions to the main effects model. The outcome of this stage is the identification of key ultimate socio-economic correlates of neonatal, post-neonatal and child mortality in Zambia.

5.3 VARIABLE DEFINITION AND CONSTRUCTION

Guided by the Mosley-Chen analytical framework (1984), data availability and previous research findings, 20 socio-economic variables have been defined and grouped as follows:

Community-level variables: Rural-urban residence, mother's place of residence, province of residence, access to electricity (as infrastructural development index), access to water source, access to health services, easy/difficult to get to health services, person mother works for (as a community occupational index) and mother's current type of employment (as another community occupational index).

Household-level variables: Household economic status (derived from household assets as discussed later), presence of household radio, presence of household bicycle, whether mother earns cash, household size (number of household members) and household children size (i.e. number of children aged less than five in a household).

Individual-level variables: Mother's education, mother's occupation, mother's place of work, father's education, and father's occupation.

5.3.1 Community-level Socio-economic Variables

The definition and construction of community-level variables in this study reflect some important community features as identified in the Mosley-Chen framework for the study of child survival. Among these features are ecological setting, political economy and health system variables. According to Mosley and Chen (1984), the ecological setting should include climate, soil, rainfall, temperature, altitude, and seasonality. Political economy variables should reflect issues concerned with physical infrastructure such as roads, electricity, etc; political institutions and societal organisations at local community level. They further argue that such variables should reflect organisation of production which determine the distribution of resources and their availability within a community. Lastly, they argue that health system variables should reflect the extent to which western health system fits into the whole concept of health improvement of local communities (Mosley and Chen, 1984).

Although Casterline (1987) argues that community data collected in the WFS neither provide a basis for testing global hypotheses about demographic determinants nor do they offer a complete portrait of community settings, the DHS has recently collected community data on small geographical locations normally defined on an administrative basis; data that Casterline recommends to be incorporated into community surveys.

Despite the fact that such community data collected by the DHS might not reflect exact community level settings, they work as proxies for ecological settings, political economy and health systems as advanced by the Mosley-Chen framework and as seen in the Zambian context. However, Casterline has pointed out that since the local community is the context for most social and economic activity, especially in traditional rural societies and that it is reasonable to assume that spatial proximity would ordinarily be important determinant of the utilisation of social services, community data can contribute to the general understanding of the determinants of demographic behaviour.

There is strong argument for supposing that the effect of community factors is conditioned by household and individual characteristics. According to Casterline (1987), the essential process of studying community factor effect can only be captured through a multilateral approach in which the interactions among individual, household and community factors are explicitly modelled. This study therefore defines and constructs socio-economic variables on the basis of community, household and individual factors as supported by data availability from the Zambia Demographic and Health Survey, and within the Mosley-Chen framework for the study of child survival.

a) **Rural-urban Residence**

Rural-urban residence of the mother at the time of the survey has often been used as a proxy for living conditions (Hobcraft, McDonald and Rutstein, 1984). In this study, however, rural-urban residence of the mother is taken to reflect community characteristics which include provision of public and medical health services. In Zambia, for example, where over 40 percent of the population is classified urban, rural-urban residence also reflects the political economy of the country, highly dependent on copper mining.

The standard DHS categorisation of urban and rural similar to that used by the Central Statistical Office (CSO) in Zambia has been adopted here. As expected from the distribution of rural-urban population in Zambia presented in Table 5.1, about 43 percent of births during the five years before the survey (1987-91) are categorised as urban.

b) **Place of Residence**

Mother's place of residence at time of the survey has been found to be a key variable in child survival investigations (Tabutin and Akoto, 1992).

To explore the urban composition further, place of residence has been categorised into Village, Town, City and Capital City as defined by the ZDHS (Gaisie, et al., 1993).

As shown from Table 5.1, Town, City and Capital City make up the urban component since rural and village categories have same birth distribution at 57 percent and somehow conforms to the CSO's classification of rural.

c) **Province of Residence**

Incorporating large geographical units into community data analysis has been found more appropriate when the concern is measurement of economic opportunities or cultural contexts (Casterline, 1987).

TABLE 5.1 DISTRIBUTION OF BIRTHS ACCORDING TO COMMUNITY-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91.

CHARACTERISTICS	NUMBER	PERCENTAGE
RURAL/URBAN RESIDENCE		
Rural	3736	57.1
Urban	2803	42.9
PLACE OF RESIDENCE		
Village	3736	57.1
Town	1349	20.6
City	686	10.5
Capital City	768	11.7
PROVINCE OF RESIDENCE		
Central	574	8.8
Copperbelt	1371	21.0
Eastern	633	9.7
Luapula	607	9.3
Lusaka	915	14.0
Northern	608	9.3
North-Western	390	6.0
Southern	937	14.4
Western	491	7.5
ACCESS TO ELECTRICITY		
No	5256	80.6
Yes	1268	19.4
TRAVEL TIME TO WATER SOURCE		
0-14 Minutes	2413	54.0
15+ Minutes	2057	46.0

TRAVEL TIME TO HEALTH SERVICE		
0-29 Minutes	1410	21.6
30-89 Minutes	1897	29.1
90+ Minutes	1905	29.2
Mobile Source	380	5.8
Don't Know Source	783	12.0
Don't Know Time	142	2.2
EASY OR DIFFICULT TO GET TO HEALTH SERVICE		
Easy	3767	70.6
Difficult	1569	29.4
PERSON MOTHER WORKS FOR		
Self-Employed	2671	75.3
Family Member	444	12.5
Someone Else	433	12.2
MOTHER'S CURRENT TYPE OF EMPLOYMENT		
Did not work	2981	45.9
Self-employed	2669	41.1
Unpaid worker	101	1.6
Paid employee	748	11.5

A study using DHS data by Barbieri (1991) found significant correlation between childhood mortality differentials and all variables representing socio-cultural features of sub-regions within respective countries. At national level, a multivariate analysis for Kenya and Senegal brought out the importance of region (province) as an explanatory variable of infant mortality (Tabutin and Akoto, 1992).

Since the study aims at exploring socio-cultural associations and influence on childhood mortality (as in Chapter Six), province has been adopted as an explanatory variable. All nine provinces of Zambia namely, Central, Copperbelt, Eastern, Luapula, Lusaka, Northern, North-Western, Southern and Western are included.

For purposes of identifying structural patterns within the Zambian community, the adoption of province is particularly ideal in obtaining as much socio-economic and cultural homogeneity as possible. Moreover, the ethno-linguistic distribution by province may be important in explaining certain child survival structural patterns. Among the major ethno-linguistic groups in Zambia include the Bemba, Kaonde, Lozi, Lunda, Luvale, Mambwe, Nyanja, and Tonga. The Bemba speaking group live primarily in Northern and Luapula Provinces and extend their linguistic influence to Copperbelt, Central and Lusaka; the three most industrialised regions and possible ethno-linguistic "melting pots". Tonga speakers inhabit much of Southern Province while Lozi speaking groups inhabit Western Province. Furthermore, while Nyanja speaking groups primarily live in Eastern Province, the Luvale, Lunda and Kaonde are mostly found in North-Western Province (Gaisie, Cross and Nsemukila, 1993).

d) **Access to Electricity**

Local community-area electrification has been adopted in a number of studies as a measure of physical infrastructural development (Casterline, 1987; Mosley and Chen, 1984). In Zambia where only 39.2 and 3.1 percent of urban and rural households, have access to electricity, respectively, consideration of such a variable is essential in the provision of social and medical services. Access to electricity is, therefore, taken here as a dichotomous explanatory variable showing presence or absence of electricity.

e) Access to Water Source

Information on water source is vital in determining household hygiene and exposure to water-borne infections. Moreover, household access to water source might be used as a measure of community infrastructural development especially when information on distance to or travel time to water sources is considered.
As a community infrastructural development index, access to water source is defined here in terms of travel time.
During the survey, respondents were asked how long it took them to go to water source, get water and come back. This is based on water source used by the household for hand washing and dish-washing. Although there was no question on travel time to drinking water source, over 90 percent of households in the sample use the same source for both washing and drinking water.
In this analysis, therefore, travel time access to water source is categorised into: less than 15 minutes and 15 minutes and over.

f) Access to Health Services

Like access to water source, proximity to health services is a proxy for community infrastructural development. In the ZDHS survey, respondents were not asked on distance or travel time to health services. However, respondents were asked on how long it took them to travel from their home to a source of a family planning method. Since over 80 percent of these sources are both public and private medical health centres, the variable is assumed to measure proximity to health services.

Access to health service has been classified into six categories of 0-29 minutes, 30-89 minutes, mobile source, don't know source and don't know time. This classification is restricted only to univariate analysis. For multivariate purposes, the last three categories of mobile source, don't know source, and don't know time have been collapsed into one category called "other".

g) **Easy/difficult to get to Health Service**

In the absence of information on the form of transport used to travel to health services, a variable is constructed to reflect the respondents' perception of whether it is easy or difficult to get to the family planning source (taken here as health service). While over 70 percent of births during the five years before the survey fall under easy proximity, almost one-third of the births fell within the difficult category as earlier reflected in Table 5.1.

h) **Person Mother Works for**

On the suggestion of improving community survey designed data collection, Casterline (1987) recommends the recording of community level data on the composition of the community according to economic activity or occupation, among other demographic characteristics. The person the mother works for and her current type of employment at time of survey somehow reflect the political economy of that community. Particularly important is organisation of production which shows whether the mode of production and distribution of benefits are communal or based on individual entrepreneurship, and which later influences resource distribution and availability (Mosley and Chen, 1984).

During the survey, respondents were asked for person(s) they worked for. Based on this question, a community occupational index is constructed to measure mother's current economic activity and the impact it is likely to have on child survival. On the basis of person mother works for the variable is categorised into: self-employed, family member and someone else. As earlier shown from Table 5.1, over three-quarters of births in the sample belong to mothers categorised as self-employed while the remaining births are almost divided equally amongst mothers working for a family member and those working for someone else.

i) **Mother's Current Type of Employment**

Like person mother works for, current type of employment is a community occupational index adopted here to measure the political economy of communities in which the mothers are residing. Mother's current type of employment has been found to have significant influence on child survival and mortality in Sub-Saharan Africa (Tabutin and Akoto, 1992). For the purposes of this study, four categories on mother's current type of employment are adopted namely: not working, self-employed, unpaid worker, and paid employee.

5.3.2 Household-level Socio-economic Variables

Many of the household-level socio-economic variables adopted here are largely constructed from household goods and to a lesser extent services.

According to Mosley and Chen (1984), a variety of goods, services, and assets at the household level operate on child health and mortality through the proximate determinants.

TABLE 5.2: DISTRIBUTION OF BIRTHS ACCORDING TO HOUSEHOLD-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91.

CHARACTERISTICS	NUMBER	PERCENTAGE
HOUSEHOLD ECONOMIC STATUS		
Low	5808	88.8
High	736	11.2
HOUSEHOLD RADIO		
No	3735	57.3
Yes	2782	42.7
HOUSEHOLD BICYCLE		
No	5081	77.8
Yes	1447	22.2
MOTHER EARNS CASH		
NO	370	10.4
Yes	3180	89.6
GENERAL HOUSEHOLD SIZE		
10+	1567	23.9
5-9	3662	56.0
1-4	1315	20.1
HOUSEHOLD CHILDREN SIZE		
3+	1854	28.3
2	2576	39.4
1	1746	26.7
None	368	5.6

Since household income data were not collected in the ZDHS, household assets have been used to construct indices for measuring household wealth and economic status.

a) Household Economic Status

The explanatory variable to measure household economic status is constructed on the basis of presence or absence of the following household possessions: vehicle (either motorcycle or car), refrigerator and television. Determination of household economic status is based on the possession of any of the mentioned assets. Households lacking all of the above assets are considered poor or of low economic status compared to those in possession of any of the assets.

b) Mother Earns Cash

In the absence of information on household income and since durable goods do not always measure household disposable income, a cash explanatory variable is constructed from a question in the survey on whether the mother earned cash or not from her current economic activities for those who indicated that they were working. The household cash variable is dichotomised as "no"/"yes" based on whether the mother earned cash for her work or not.

c) **Household Radio**

Although only 8.3 percent of Zambian households are in possession of television sets and many rural areas lack television transmissions, possessing a radio is much more common with 23 and almost 60 percent of rural and urban households having radios, respectively (Gaisie, et al., 1993). Possession of a radio in areas lacking both newspaper distribution and television transmission, as the case may be for many remote rural villages, is essential for obtaining information on child health and other services. Since radios from remote areas lacking electricity require batteries, household radio as an explanatory variable might reflect both household economic status (in terms of disposable income) and access to media information, especially for village households.

d) **Household Bicycle**

The use of household bicycle in the construction of household wealth or economic status variable has been deliberately avoided for two main reasons. Firstly, it provides some form of transport particularly in remote rural villages. Secondly, bicycles are the only household possession much more common to rural (21.7 percent) than urban (15.8 percent) households. This is despite 78 percent of survey births being distributed among households without bicycles. Like earlier household explanatory variables, household bicycle has been dichotomously categorised.

e) **General Household Size**

Although some studies in Sub-Saharan Africa have taken household size as an environmental risk factor (Contoh, David and Bauni, 1990), household size (i.e. number of household members) is here adopted as a socio-economic variable measuring certain modes of living in different areas of Zambia. Since the late 1960s, mean household size has continued to increase in Zambia with urban household size being consistently higher than that in rural areas. Although this issue is also discussed on issues of household crowding within the cultural context of kinship survival strategies in Chapter Six and Seven, there is evidence to show some increase in average household size most especially among higher income households within the urban areas of Zambia (Ohadike, 1971; CSO, 1985; CSO, 1991; Gaisie, et al., 1993; Nsemukila, 1994).

In this study, household size, as an explanatory variable, is categorised into: 1-4, 5-9, and 10+.

f) **Household Children Size**

Closely linked to household size is the number of children living within these households. One important issue that is associated with the number of children in households is fostering: the issue pursued later in Chapter Six. As a control for household size per se, the variable is constructed from the number of children aged less than five. This is intended to investigate some significant association between age composition, within the household size variable, and child survival. Household children size is categorised into: none (where there is currently no surviving child),1,2, and 3+.

5.3.3 Individual-level Socio-economic Variables

The importance of examining the relationships between individual, household and community characteristics has been emphasised in some of the literature on child survival (Freedman, 1974 in Casterline, 1987; Mosley and Chen, 1984). Although the following socio-economic characteristics considered below are grouped within the individual level effects, in real life situations, they have been found to operate at household-level and to a lesser extent at community-level.

a) Parental Education

There is some evidence in the literature to suggest that parental education attainment is inversely associated with child survival. Particularly emphasized is mother's education, though recent evidence in Sub-Saharan Africa suggest some increasing influence of father's education (Caldwell, 1979; Hobcraft et al., 1984; Barbieri, 1991; Bicego and Boerma, 1991; Ahonsi, 1992). During the survey, mothers were asked about the highest levels of school they had attended, that is, primary, secondary, or higher. Similarly, they were asked about the highest level of schooling attained by their current husbands or partners. From these two questions, two explanatory variables of mother's education and father's education are constructed each with three categories of no education, primary education, and at least secondary education, respectively.

TABLE 5.3: DISTRIBUTION OF BIRTHS ACCORDING TO INDIVIDUAL-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91.

CHARACTERISTICS	NUMBER	PERCENTAGE
MOTHER'S EDUCATION		
No education	1168	17.9
Primary	4135	63.2
Secondary and higher	1239	18.9
MOTHER'S OCCUPATION		
Not working	2981	45.7
Agricultural (Self-employed)	1239	19.0
Blue collar	612	9.4
White collar	1697	26.0
MOTHER'S WORKING PLACE		
Home	1109	31.2
Away	2442	68.8
FATHER'S EDUCATION		
No education	571	9.3
Primary	3009	48.8
Secondary and higher	2585	41.9
FATHER'S OCCUPATION		
Never worked	137	2.2
Agricultural (Self-employed)	2647	43.0
Blue collar	1897	30.8
White collar	1477	24.0

b) **Parental Occupation**

Like mother's and father's education, parental occupation has been shown to exert influence on child survival (Hobcraft et al., 1984; Tabutin and Akoto, 1992). Although education and occupation of the mother have often been treated as proxies for socio-economic status, father's education and occupation have been used to measure household income and wealth in earlier investigations lacking family income data (Hobcraft et al., 1984; Tabutin and Akoto, 1992).

During the survey, mothers were asked about their own occupations and that of their spouses. These occupations were categorised into: "not working" (and "never worked" for spouse); "professional", "technical", "managerial"; "clerical"; "sales"; "agricultural-self employed"; "services"; "skilled manual", and "unskilled manual".

In this study, however, and considering the Zambian context where a line can not be drawn easily between occupations such as "professional", "technical", "managerial", "clerical", "sales" and "services" especially from interviewing spouses, these categories have been collapsed into "white collar". While "agricultural-self employed" has been retained, "skilled manual" and "unskilled manual" have been collapsed into "blue collar". This means that, parental occupation has now four categories namely "not working" (and "never worked"), "agricultural-self employed", "blue collar", and "white collar".

The distribution of births according to these individual socio-economic variables is presented in Table 5.3.

c) Mother's Working Place

The importance of mother's working place is becoming increasingly important in studies linking socio-economic factors and child survival. It is argued that the need to work, especially outside the home, may affect survival chances directly by simply preventing the mother from adequately caring for the child (Hobcraft et al., 1984). According to the new evidence emerging from Sub-Saharan Africa, children are often left in the care of other family members such as the child's brothers, sisters and grand parents (Ware, 1984; Tabutin and Akoto, 1992). To capture issues relating to child care, the mother's working place variable has been constructed with two categories of whether mother works from home or away from home. This variable includes only those women classified as working.

5.4 UNIVARIATE ANALYSIS

5.4.1 Univariate Analytical Approach

As earlier indicated in the general analytical approach, the univariate procedure aims at selecting socio-economic variables based on the size of mortality risk differentials as reflected in the relative risk (RR) and especially the population attributable risk (PAR). Also presented are the respective standard errors of mortality rates. On the basis of the three age intervals of <1 month (neonatal), 1-11 months (post-neonatal), and 12-59 months (child), life table mortality rates are computed using SPSS SURVIVAL program (Norusis/SPSS Inc, 1993). From the computed mortality rates, relative and attributable risks are estimated using theoretically low-risk categories as reference baseline groups.

To identify study variables with policy significance and to be adopted later in the multivariate analysis, the variables are selected on the basis of their probable public health importance using the population attributable risk (PAR) of at least 10 percent. Furthermore, those variable categories showing reduced mortality risk of 0.80 and less are also selected.

5.4.2 **Neonatal Mortality**

5.4.2.1 Community-level Variables

Table 5.4 presents neonatal mortality rates according to Community-level Socio-economic characteristics.

TABLE 5.4: NEONATAL MORTALITY BY COMMUNITY-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS.
RURAL/URBAN RESIDENCE					
Rural	51.1	3.7	1.50	22.2	3736
Urban	34.1	3.5	1.00	-	2803
PLACE OF RESIDENCE					
Village	51.1	3.7	1.33	21.5	3736
Town	38.5	5.4	1.00	0.0	1349
City	20.6	5.5	0.54	NA	686
Capital City	38.5	7.1	1.00	-	768
PROVINCE					
Central	40.9	8.5	1.23	8.1	574
Copperbelt	24.4	4.2	0.73	NA	1371
Eastern	70.3	10.7	2.11	31.2	633
Luapula	48.9	9.1	1.47	15.8	607
Northern	50.6	9.2	1.52	17.2	608
North-Western	55.3	12.1	1.66	16.5	390
Southern	39.2	6.5	1.18	8.3	937
Western	73.9	12.5	2.22	29.9	491
Lusaka	33.3	6.1	1.00	-	915

ELECTRICITY					
No	48.1	3.1	1.82	39.8	5256
Yes	26.4	4.6	1.00	-	1268
TRAVEL TIME TO WATER SOURCE					
15+ Minutes	43.2	4.6	0.79	NA	2057
0-14 Minutes	54.9	4.8	1.00	-	2413
TRAVEL TIME TO HEALTH SERVICE					
Don't know time	(28.6)	14.3	0.81	NA	142
Don't know source	57.8	8.7	1.63	18.4	783
Mobile source	37.5	10.0	1.06	1.2	380
90+ Minutes	49.5	5.2	1.40	18.7	1905
30-89 Minutes	38.7	4.6	1.09	4.9	1897
0-29 Minutes	35.4	5.1	1.00	-	1410
EASY/DIFFICULT TO GET TO HEALTH SERVICE					
Difficult	42.3	5.2	1.04	1.2	1569
Easy	40.6	3.3	1.00	-	3767
PERSON MOTHER WORKS FOR					
Self-employed	49.1	4.3	1.47	28.8	2671
Family member	(32.0)	8.6	0.97	NA	444
Someone else	(32.9)	8.8	1.00	-	433
MOTHER'S CURRENT TYPE OF EMPLOYMENT					
Did not work	42.5	3.8	1.30	19.3	2981
Self-employed	49.1	4.3	1.51	28.5	2669
Unpaid worker	(40.4)	20.2	1.24	2.8	101
Paid employee	32.6	6.7	1.00	-	748

Notes: **()**: less than 500 exposures; **S.E**: Standard Error; **RR**: Relative Risk; **PAR.**: Population Attributable Risk; **EXPOS**: Exposures; **NA**: Not Applicable.

On the basis of the Population Attributable Risk (PAR) of at least 10 percent for variable categories showing increased risk and for risk ratios of less than 0.80 for those showing reduced risk, access to electricity has the most significant proportion of births exposed to an increased risk of dying at almost 40 percent while easy/difficult access to health services has the least exposure. The observed reduced risk in terms of access to health services further supports the notion that distribution of health services in Zambia is relatively reasonable especially when compared to the rest of Sub-Saharan Africa as earlier shown in Chapter Two. On the other hand for Travel Time to Water Source, children far away from the water source have favourable survival chances than children within 15 minutes travel time to the source. This is possibly the case in areas where closer proximity to water source might increase exposure to malaria by way of living nearer to mosquito breeding grounds.

Based on the PAR, therefore, the following Community-level Socio-economic variables are listed in order of importance for childhood mortality in the first month of life:

a) Access to Electricity,

b) Province of Residence,

c) Person Mother Works For,

d) Mother's Current Type of Employment,

e) Rural-Urban Residence,

f) Place of Residence, and

g) Travel Time to Health Service.

During the neonatal period, and as shown from Table 5.4, children from homes without electricity are 82 percent at increased risk of dying than their counterparts from homes with electricity.

As for Province of Residence, during the same period, there are remarkable mortality differences between Lusaka Province the reference region and other provinces in Zambia. While neonatal mortality is lowest in the Copperbelt Province at 27 percent reduced risk when compared to Lusaka Province (probably because many children in the Copperbelt have access to better health services provided by the mining companies), children in Western and Eastern Provinces are more than twice at higher risk of dying. The lower risk associated with the Copperbelt Province reflects the provision of both maternal and child health services largely provided by the copper mining companies in the region. The third most significant variable reflecting socio-economic status of the mother in terms of her working environment is measured by the kind of person she works for. While children from mothers working for family members have reduced risk of dying, those from self-employed mothers are 47 percent at higher risk of dying compared to those from mothers working for someone else. Linked to persons mothers work for is the current type of employment the mother is involved in. There is further suggestion from this variable that children of self-employed mothers are at elevated risk of dying than children from paid employees. On the other hand, children from unpaid workers and from non-working mothers are 24 and 30 percent at higher risk of dying compared to children of mothers working as paid employees. The fact that children of self-employed mothers are at most increased risk of dying than children from non-working mothers may reflect certain patterns of child care practices, and the general household socio-economic status since non-working mothers may provide more time to take care of their children. Moreover, paid employees are more likely to have maternity leave during the first one month of child birth than self-employed mothers; many working as petty traders in the informal sector.

Two other community-level variables showing some significant influence are Region and Place of Residence. As expected, children from rural areas have higher mortality levels than children from urban areas. During the first month of life, children from rural areas are 50 percent at higher risk of dying than their counterparts in urban areas. Moreover, children from rural villages are about one-third at increased risk of dying compared to children from Lusaka city. Neonatal mortality is, however, lowest in other cities where children have 46 percent higher chances of survival.

Lastly, is the neonatal mortality risk by Travel Time to Health Service. Although neonatal mortality is highest amongst children of mothers who had no knowledge of family planning source (taken here as proxy for health service source), children from homes with at least 90 minutes of travel time are 40 percent at higher risk of dying than children from homes that are within 30 minutes of travel time to health service source. Caution must be taken, however, for estimates from mothers with no knowledge of time since they are based on exposures of less than 500 births.

5.4.2.2 Household-level Variables

Table 5.5 presents neonatal mortality rates according to household-level socio-economic characteristics.

From the six variables considered in Table 5.5 only three variables namely Household Economic Status, Household Children Size and possession of a radio present significant mortality risk to children in the first month of life.

TABLE 5.5: NEONATAL MORTALITY BY HOUSEHOLD-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91 PERIOD.

CHARACTER-RISTICS	RATE PER 1000	S.E.	RR	PAR	EXPOS
HOUSEHOLD ECONOMIC STATUS					
Low	46.2	2.9	1.86	43.3	5808
High	24.8	5.8	1.00	-	736
HOUSEHOLD RADIO					
No	47.7	3.6	1.23	11.6	3735
Yes	38.8	3.8	1.00	-	2782
HOUSEHOLD BICYCLE					
No	41.4	2.9	0.79	NA	5081
Yes	52.5	6.1	1.00	-	1447
MOTHER EARNS CASH					
No	58.4	12.7	1.35	3.5	370
Yes	43.4	3.7	1.00	-	3180
GENERAL HOUSEHOLD SIZE					
10+	31.8	4.5	0.47	NA	1567
5-9	40.4	3.4	0.60	NA	3662
1-4	67.6	7.3	1.00	-	1315
HOUSEHOLD CHILDREN SIZE					
3+	19.1	3.2	0.26	NA	1854
2	23.6	3.0	0.33	NA	2576
1	72.4	6.6	1.00	-	1746
None	(187.2)	23.5	2.59	21.7	368

The issue of the whether mother earns cash or not has the least significance in terms of child survival policy options on the basis of the population attributable risk.

The Table shows that children from low economic status households are 86 percent at increased risk of dying during the first month of life compared to their counterparts from high economic status households. On the other hand, number of children in the household is inversely associated with neonatal mortality. While mortality is lowest in households with at least three under-fives, it is highest in households without any under-five child.

Children from such households are almost 160 percent at increased risk of dying compared to households with one child. Although the higher risk in households with no under-five may largely reflect unobserved endogeneity for children most unlikely to survive the first five years of life, caution must be taken in interpreting the mortality estimates that are based on small number of births. Nevertheless, such households may also be reflecting a proportion of households having problems with medical situations such as sickle cell anaemia and other medical complications.

Furthermore, the increased risk of dying associated with absence of a radio may reflect issues surrounding general household economic status. Children from households with no radios are 23 percent at elevated risk of dying than their counterparts from homes with radios. One other interesting observation concerns the relationship between having a bicycle and neonatal mortality. Children from households without bicycles have over 20 percent higher chance of survival than their counterparts with bicycles. This mortality pattern might be explained by the rural-urban residential differences since rural households have overall more bicycles than urban households. The risk difference might as well be explained by regional differentials in mortality.

Like Household Children Size, the mean family size is inversely associated with childhood mortality in the first month of life. Children from households of at least 10 members have 53 percent more chance of surviving than children from households with average family size between 1-4. The inverse relationship between household size may either reflect higher survival chances in affluent households or demonstrate kinship survival strategies resulting from affluent members of the kinship network accepting responsible to accommodate poorer kin members. This discussion is followed up in Chapter Six.

5.4.2.3 Individual-level Variables

Table 5.6 presents neonatal mortality according to individual-level socio-economic characteristics.

TABLE 5.6: NEONATAL MORTALITY BY INDIVIDUAL-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91 PERIOD.

CHARACTER-ISTICS	RATE PER 1000	S.E.	RR	PAR	EXPOS
MOTHER'S EDUCATION					
No Education	49.1	6.6	1.27	11.6	1168
Primary	43.7	3.3	1.13	9.1	4135
Secondary +	38.7	5.6	1.00	-	1239
MOTHER'S OCCUPATION					
Not working	42.5	3.8	1.16	9.3	2981
Agricultural self-empl.	51.3	6.5	1.40	14.4	1239
Blue collar	53.7	9.5	1.47	11.1	612
White collar	36.6	4.7	1.00	-	1697
MOTHER'S WORKING PLACE					
Home	43.3	6.3	0.95	NA	1109
Away	45.7	4.4	1.00	-	2442
FATHER'S EDUCATION					
No education	57.7	10.2	1.59	9.6	571
Primary	46.6	4.0	1.29	13.5	3009
Secondary +	36.2	3.8	1.00	-	2585
FATHER'S OCCUPATION					
Never worked	(52.4)	19.8	1.46	3.8	137
Agricultural self-empl.	52.7	4.5	1.47	22.9	2647
Blue collar	34.9	4.3	0.97	NA	1897
White collar	35.8	5.0	1.00	-	1477

On the basis of the population attributable risk, only four variables namely Father's Occupation, Mother's Occupation, Father's Education and Mother's Education have a significant association with childhood mortality in the first month of life. As for children of mothers working either home or away, there is little difference in their mortality risk ratios. However, mortality is highest amongst children of Never Worked and Agricultural Self-employed Fathers at 46 and 47 percent higher risk of dying, respectively, compared to children of White Collar employees. Moreover, the mortality differentials are minimal between children of Blue and White Collar employees. With Mother's Occupation, however, mortality is highest amongst children of mother's working as Blue Collar workers and those in agricultural self-employed sectors. Children from these categories are 47 and 40 percent at higher risk of dying, respectively, than children from mothers working as White Collar workers. On the other hand, neonatal mortality is inversely associated with both father's and mother's education. Children of fathers with no education and those with primary education are 59 and 29 percent at increased risk of dying, respectively, compared to children of fathers with at least secondary education. Similarly, children from mothers with no education and from those with only primary education are 27 and 13 percent at higher risk of dying than children of mothers with at least secondary education. Although the significance of mother's education on child survival has been widely discussed in bio-medical literature, this study supports suggestions that father's education has much more significant influence in Sub-Saharan

Africa than mother's education (Hobcraft et al., 1984; Barbieri, 1991; Tabutin and Akoto, 1992).

5.4.3 Post-neonatal Mortality

5.4.3.1 Community-level Variables

Table 5.7 presents post-neonatal mortality rates according to Community-level socio-economic characteristics.

TABLE 5.7: POST-NEONATAL MORTALITY BY COMMUNITY-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91 PERIOD.

CHARACTER-ISTICS	RATE PER 1000	S.E.	RR	PAR	EXPOS
RURAL-URBAN RESIDENCE					
Rural	74.2	3.7	1.42	19.2	3550
Urban	52.3	3.5	1.00	-	2709
PLACE OF RESIDENCE					
Village	74.2	4.7	1.30	19.9	3550
Town	46.5	6.1	0.81	NA	1298
City	58.2	9.4	1.02	2.0	672
Capital City	57.1	8.9	1.00	-	739
PROVINCE OF RESIDENCE					
Central	52.1	9.9	1.00	0.0	551
Copperbelt	51.4	6.3	0.98	NA	1338
Eastern	68.4	10.9	1.31	11.0	590
Luapula	128.9	15.4	2.47	36.7	578
Northern	90.4	12.8	1.73	22.4	578
North-Western	55.7	12.5	1.07	2.1	369
Southern	36.2	6.4	0.69	NA	901
Western	84.6	13.9	1.62	17.4	456
Lusaka	52.2	7.8	1.00	-	885
ACCESS TO ELECTRICITY					
No	70.3	3.8	1.63	33.6	5009
Yes	43.0	6.0	1.00	-	1235

TRAVEL TIME TO WATER SOURCE					
15+ Minutes	62.3	5.7	0.78	NA	1970
0-14 Minutes	80.1	6.0	1.00	-	2284
TRAVEL TIME TO HEALTH SERVICE					
Don't know time	(36.9)	16.5	0.62	NA	138
Don't know source	92.0	11.4	1.54	16.0	739
Mobile source	(47.6)	11.5	0.80	NA	366
90+ Minutes	62.6	6.0	1.05	2.8	1813
30-89 Minutes	65.6	6.1	1.10	5.4	1825
0-29 Minutes	59.8	6.7	1.00	-	1361
EASY/DIFFICULT TO GET TO HEALTH SERVICE					
Difficult	58.2	6.3	0.91	NA	1504
Easy	63.9	4.3	1.00	-	3617
PERSON MOTHER WORKS FOR					
Self-employed	67.5	5.2	1.20	14.7	2543
Family member	(57.4)	11.7	1.02	1.0	430
Someone else	(56.4)	11.7	1.00	-	419
MOTHER'S CURRENT TYPE OF EMPLOYMENT					
Did not work	64.7	4.8	1.06	4.6	2857
Self-employed	67.5	5.2	1.10	7.2	2541
Unpaid worker	(42.1)	21.0	0.69	NA	93
Paid employee	61.2	9.3	1.00	-	724

As with mortality in the first month of life, travel time to water source continues to have an inverse association with post-neonatal mortality. Children with at least 15 minutes travel time to water source have over 20 percent reduced risk of dying compared to children from homes with less than 15 minutes travel time to the water source. On the other hand, and unlike neonatal mortality, mother's current type of employment has little effect on post-neonatal mortality despite children of self-employed mothers still at highest risk of dying.

Province of Residence and Access to Electricity continue to exert significant influence on post-neonatal mortality. Although post-neonatal mortality is lowest amongst children residing in Southern Province, children from Luapula Province are almost two and half times at higher risk of dying than children from Lusaka Province. Other provinces with higher mortality risks include Northern, Western, and Eastern at 73, 62 and 31 percent, respectively. It is clear that, with exception of North-Western Province with estimated relative risk of 1.07, post-neonatal mortality is highest among rural provinces of Zambia.

Like the first month of life, children from homes without electricity are at increased risk of dying. Children from such homes, for example, are 63 percent at higher risk of dying than their counterparts from homes with electricity. Also at increased risk of dying are children residing in rural villages. Children from rural areas have a 42 percent increased risk of dying than children from urban towns and cities.

While children of self-employed mothers continue to have higher post-neonatal mortality risk estimated at 20 percent more than children from mothers working for someone else, children of parents with no knowledge of family planning source are 54 percent at increased risk of dying compared to children from homes with less than 30 minutes travel time to the family planning source (here presented as a proxy for health service source). On the other hand, the variable representing how easy or difficult it is to get to health service has little significance on overall post-neonatal mortality.

5.4.3.2 Household-level Socio-economic Variables

Table 5.8 presents post-neonatal mortality according to household-level socio-economic characteristics.

TABLE 5.8: POST-NEONATAL MORTALITY BY HOUSEHOLD-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91 PERIOD.

CHARACTER-ISTICS	RATE PER 1000	S.E.	RR	PAR	EXPOS
HOUSEHOLD ECONOMIC STATUS					
Low	67.1	3.5	1.43	27.6	5546
High	47.0	8.2	1.00	-	718
HOUSEHOLD RADIO					
No	73.4	4.6	1.37	17.4	3561
Yes	53.7	4.5	1.00	-	2676
HOUSEHOLD BICYCLE					
No	67.4	3.8	1.22	14.7	4875
Yes	55.4	6.4	1.00	-	1373
MOTHER EARNS CASH					
No	(74.3)	14.8	1.17	1.7	349
Yes	63.7	4.6	1.00	-	3045
GENERAL HOUSEHOLD SIZE					
10+	40.3	5.2	0.34	NA	1518
5-9	56.7	4.1	0.47	NA	3517
1-4	119.9	10.1	1.00	-	1229
HOUSEHOLD CHILDREN SIZE					
3+	25.0	3.7	0.25	NA	1819
2	38.9	4.0	0.39	NA	2516
1	100.2	8.0	1.00	-	1624
None	(378.2)	37.7	3.77	30.5	305

While general household size continues to have some inverse association with post-neonatal mortality, the question of whether mother earns cash or not has little influence on the survival status of their children. On the other hand, and unlike the neonatal period when children from homes with no bicycles have reduced mortality risk, the reverse is true for post-neonatal period during which children from households without a bicycle are 22 percent at increased risk of dying. Moreover, those from households without a radio are even at higher mortality risk estimated at 37 percent. These observations can also be noted from the overall measure of household economic status variable with children from lower economic status homes at 43 percent elevated risk of dying. Like earlier observations, household children size continues to have an inverse relationship with post-neonatal mortality. The lower survival chances in homes currently with no under-five children continue at higher levels with post-neonatal risk estimated at 277 percent.

5.4.3.3 Individual-level Variables

Table 5.9 presents post-neonatal mortality according to individual-level socio-economic characteristics.

On the basis of the PARs of at least 10 percent, only one variable namely Father's Occupation has significant effect on post-neonatal mortality. Children of agricultural self-employed fathers have highest mortality at 38 percent increased risk compared to children from fathers working as white collar employees. Although other individual-level variables show little influence on overall post-neonatal mortality risk, children from parents with no education have highest risk of dying.

TABLE 5.9: POST-NEONATAL MORTALITY BY INDIVIDUAL-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91 PERIOD.

CHARACTER-ISTICS	RATE PER 1000	S.E.	RR	PAR	EXPOS
MOTHER'S EDUCATION					
No Education	68.8	8.0	1.15	6.8	1112
Primary	65.2	4.1	1.09	6.5	3958
Secondary +	59.6	7.2	1.00	-	1192
MOTHER'S OCCUPATION					
Not working	64.7	4.8	1.09	5.4	2857
Agricultural self-empl.	73.1	8.0	1.23	9.6	1177
Blue collar	58.6	10.2	0.99	NA	580
White collar	59.2	6.1	1.00	-	1636
MOTHER'S WORKING PLACE					
Home	62.1	7.8	0.94	NA	1062
Away	66.0	5.4	1.00	-	2333
FATHER'S EDUCATION					
No education	81.1	12.5	1.39	6.5	539
Primary	68.4	5.0	1.18	8.8	2872
Secondary +	58.2	4.9	1.00	-	2493
FATHER'S OCCUPATION					
Never worked	(39.2)	17.5	0.71	NA	130
Agricultural self-empl	76.5	5.6	1.38	19.5	2511
Blue collar	59.6	5.8	1.07	3.8	1832
White collar	55.5	6.3	1.00	-	1425

This is also true for children of mothers working in the agricultural self-employed sector. This sector is largely made up of agricultural subsistence communities. Like neonatal mortality, mother's working place has little influence on the risk associated with post-neonatal mortality.

5.4.5 Child Mortality

5.4.5.1 Community-level Variables

Like earlier Tables for Neonatal and Post-neonatal mortality, Table 5.10 presents Child mortality according to Community-level Socio-economic characteristics.

TABLE 5.10: CHILD MORTALITY BY COMMUNITY-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91 PERIOD.

CHARACTER-ISTICS	RATE PER 1000	S.E.	RR	PAR	EXPOS
RURAL-URBAN RESIDENCE					
Rural	49.8	3.9	1.03	1.7	3296
Urban	48.2	4.4	1.00	-	2571
PLACE OF RESIDENCE					
Village	49.8	3.9	1.26	17.7	3296
Town	50.5	6.5	1.28	15.2	1239
City	53.4	9.3	1.36	14.6	634
Capital City	39.4	7.6	1.00	-	698
PROVINCE OF RESIDENCE					
Central	31.1	7.8	0.78	NA	523
Copperbelt	46.7	6.1	1.16	8.8	1271
Eastern	75.3	11.9	1.88	25.8	551
Luapula	48.4	9.9	1.21	7.3	508
Northern	68.6	11.6	1.71	21.5	528
North-Western	(38.0)	10.5	0.95	NA	349
Southern	43.5	7.2	1.08	3.9	869
Western	(61.5)	12.3	1.53	15.0	419
Lusaka	40.1	7.0	1.00	-	840
ACCESS TO ELECTRICITY					
No	53.7	3.4	1.69	35.5	4669
Yes	31.8	5.2	1.00	-	1183
TRAVEL TIME TO WATER SOURCE					
15+ Minutes	53.8	5.5	1.02	0.9	1851
0-14 Minutes	52.6	5.1	1.00	-	2108

TRAVEL TIME TO HEALTH SERVICE					
Don't know time	(54.1)	20.4	1.48	4.3	133
Don't know source	86.7	11.6	2.38	32.2	674
Mobile source	(35.0)	10.1	0.96	NA	349
90+ Minutes	43.2	5.1	1.18	10.3	1703
30-89 Minutes	52.2	5.6	1.43	19.7	1709
0-29 Minutes	36.5	5.4	1.00	-	1282
EASY/DIFFICULT TO GET TO HEALTH SERVICE					
Difficult	47.6	5.9	1.10	2.9	1419
Easy	43.4	3.6	1.00	-	3393
PERSON MOTHER WORKS FOR					
Self-employed	51.3	4.7	1.43	26.9	2377
Family member	(63.5)	12.7	1.76	27.8	406
Someone else	(36.0)	9.6	1.00	-	396
MOTHER'S CURRENT TYPE OF EMPLOYMENT					
Did not work	47.0	4.2	1.16	11.3	2678
Self-employed	51.4	4.7	1.27	17.3	2375
Unpaid worker	(125.7)	37.8	3.11	20.2	93
Paid employee	40.4	7.8	1.00	-	681

Similarly, the question of how easy or difficult it is to get to health service continues to have little effect on late childhood mortality. Also with little influence on child mortality is the travel time to the water source.On the other hand and unlike during the first year of life, rural-urban residence has an insignificant effect on late childhood mortality. Most significant, however, is access to electricity which has shown substantial effect on mortality during the first five years of life. Children from homes with no electricity are 69 percent at increased risk of dying during childhood than children from homes with electricity. Moreover, children from homes where mothers have no knowledge of the health service (in this case family planning source) have twice the risk of dying during childhood than children from homes within 30 minutes of travel time.

Although child mortality is lowest in Central and North-Western Province, Eastern and Northern Provinces have highest mortality with children from these regions at 88 and 71 percent increased risk of dying, respectively. Again, and with only the exception of North-Western Province, rural provinces of Zambia continue to have higher mortality levels despite children from the Copperbelt having an increased risk of 16 percent compared to children from Lusaka Province.

Unlike earlier infant mortality estimates, child mortality is highest in cities and towns with children from there at 36 and 28 percent increased risk of dying compared to children from the capital Lusaka. Moreover, and despite higher levels of mortality risk compared to Lusaka, children from rural villages have better chances of survival than their counterparts from both towns and cities.

In terms of mother's socio-economic status, children of mothers working as unpaid workers and mothers working for family members have highest mortality risk estimated at 211 and 76 percent, respectively. However, estimates of such mortality risk should be taken with caution as they are based on less than 500 exposures. On the other hand, children of mothers working as self-employed continue to have high mortality risk.

5.4.5.2 <u>Household-level Variables</u>

Table 5.11 presents child mortality according to household-level socio-economic characteristics.

TABLE 5.11: CHILD MORTALITY BY HOUSEHOLD-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91 PERIOD.

CHARACTER-ISTICS	RATE PER 1000	S.E.	RR	PAR	EXPOS
HOUSEHOLD ECONOMIC STATUS					
Low	51.6	3.2	1.74	39.5	5186
High	29.6	6.6	1.00	-	685
HOUSEHOLD RADIO					
No	55.6	4.2	1.37	17.3	3309
Yes	40.6	4.0	1.00	-	2536
HOUSEHOLD BICYCLE					
No	50.4	3.4	1.12	8.5	4557
Yes	44.9	5.9	1.00	-	1299
MOTHER EARNS CASH					
No	(67.0)	14.6	1.36	3.5	324
Yes	49.1	4.2	1.00	-	2857
GENERAL HOUSEHOLD SIZE					
10+	32.8	4.8	0.34	NA	1458
5-9	41.5	3.6	0.44	NA	3323
1-4	95.1	9.6	1.00	-	1090
HOUSEHOLD CHILDREN SIZE					
3+	14.8	2.9	0.17	NA	1774
2	26.0	3.3	0.30	NA	2420
1	87.4	7.9	1.00	-	1469
None	(404.6)	47.4	4.63	31.0	208

With the exception of general household size and its inverse relationship with child mortality, only three household-level variables have a significant effect on childhood mortality. These are household economic status, household children size and possessing a radio. Children from low economic households with no radio are at higher risk of dying during late childhood. For example, children classified as low status are 74 percent at increased risk of dying than children from high economic status. On the other hand and while household children size continues with an inverse effect on child mortality, children from mortality-prone households are more than four times at higher risk of dying than children from households with only one under-five. The risk in mortality-prone households increases with increasing age of the child. Again, caution must be taken with this estimate since it is derived from less than 500 births.

5.4.5.3 Individual-level Variables

Table 5.12 presents child mortality according to individual-level socio-economic characteristics. Despite the fact that only two variables namely mother's education and mother's occupation have significant effect on child mortality, the estimates between children of mothers with no education and those of mothers with primary education are remarkable.
Even though the observed relative risks are almost the same at around 50 percent increased risk and both compared to children from mothers with at least secondary education, the proportion of children whose elevated mortality risk can be attributed to difference in maternal education is highest amongst children of mothers with primary education and estimated at 41 percent as

opposed to 20 percent for children of mothers with no education.

TABLE 5.12: CHILD MORTALITY BY INDIVIDUAL-LEVEL SOCIO-ECONOMIC CHARACTERISTICS: 1987-91 PERIOD.

CHARACTER-ISTICS	RATE PER 1000	S.E.	RR	PAR	EXPOS
MOTHER'S EDUCATION					
No Education	52.4	7.2	1.52	20.0	1038
Primary	52.6	3.8	1.53	40.7	3708
Secondary +	34.4	5.6	1.00	-	1123
MOTHER'S OCCUPATION					
Not working	47.0	4.2	1.03	1.9	2678
Agricultural self-empl.	59.3	7.5	1.29	10.7	1094
Blue collar	48.7	9.5	1.06	1.5	547
White collar	45.8	5.5	1.00	-	1542
MOTHER'S WORKING PLACE					
Home	48.2	7.0	0.93	NA	998
Away	52.1	4.9	1.00	-	2184
FATHER'S EDUCATION					
No education	(51.6)	10.3	1.02	0.3	497
Primary	50.1	4.4	0.99	NA	2682
Secondary +	50.6	4.7	1.00	-	2352
FATHER'S OCCUPATION					
Never worked	(32.5)	16.3	0.68	NA	125
Agricultural self-empl.	53.9	4.9	1.13	7.6	2326
Blue collar	48.1	5.3	1.00	0.0	1726
White collar	47.9	6.0	1.00	-	1348

This is particularly important in formulating mortality reduction policy options.

Like earlier estimates, children from mothers working in subsistence agriculture are 29 percent at higher risk of dying than children from mothers working as white collar employees.

Perhaps remarkable is the increasing importance of individual-level socio-economic variables such as maternal education on childhood mortality with increasing age of the child.

5.5 MULTIVARIATE ANALYSIS

5.5.1 Basic Statistical Models

The individual child is taken here as a unit of analysis with a dichotomous dependent variable of whether or not the child survived through neonatal, post-neonatal and child age intervals. Although a number of child survival investigations have often treated age as an explanatory variables (Trussell and Hammerslough, 1983), this study treats the adopted age intervals separately in order to ascertain the extent to which socio-economic factors influencing child survival vary across the age categories. At the same time this approach enables comparison of child survival age patterns in relation to socio-economic characteristics as attempted in earlier studies on developing countries and Sub-Saharan Africa in particular (Hobcraft, et al., 1984; Bicego and Boerma, 1991; Ahonsi, 1992; Obungu et al., 1994).

Since neonatal risk analysis does not involve censoring as earlier noted, we have adopted the basic logistic regression model below:

$$ln[q_i/1-q_i] = B_0 + B_iX_i$$

where q_i is the probability of dying in the first month of life for the ith individual given the array of explanatory indicators, X_i; and where B_0 is the model baseline constant and B_i represents a series of unknown parameters (Hosmer and Lemeshow, 1989; Norusis/SPSS Inc., 1993; Obungu et al., 1994).

The parameters of the model are estimated using the maximum-likelihood method within SPSS Logistic program. Taking each explanatory variable's theoretically low-risk level as reference, exponentiated values of the parameter estimates are then interpreted as estimated relative risk (Kahn and Sempos, 1989; Norusis/SPSS Inc., 1993).

To allow for censored exposures in the analysis of post-neonatal and child risks, Cox's hazards Regression model of the form below is adopted:

$$ln[h(t)_i/h_0(t)] = B_iX_i,$$

where $h(t)_i$ is the mortality (or predicted hazard) risk at age t (in months) for an individual with an array of covariates, X_i; where $h_0(t)$ is the baseline and arbitrary hazard at age t, and B represents the parameter estimates (Obungu et al., 1994).

The regression coefficients are estimated on the basis of partial-likelihood function using the SPSS Cox Regression procedure. The estimated Cox regressions are proportional hazards models since the ratio of individual baseline hazards are assumed constant within respective age intervals and all study variables have been treated consistently as categorical covariates.

Gross and net effects of the socio-economic variables are estimated on the basis of a causal ordering of the variables as implied in the analytical framework with the following generalized model sequence.

Model 1 $logit\ q_1 = B_0 + B_1X_1$

Model k $logit\ q_{1,k} = B_0 + B_1X_1 + B_kX_k$.

where Model 1 includes only community-level variables (entered in the model as a block); and Model *k* adds explanatory variables from both household- and individual-level socio-economic variables.

Adding each household- and individual-level variable to the series of models enables the assessment of mediated effects by way of observing changes in the estimated effects of community-level variables and other subsequent variables on mortality risk. As an approximate measure of goodness of fit, the likelihood-ratio test for the null hypothesis that all parameters are zero is obtained by comparing changes in the values of -2 times the log likelihood (*-2LL*) in which all coefficients are zero (ie. the initial model) with the *-2LL* for a model that contains the coefficients of interest (Norusis/SPSS Inc., 1993).

If the null hypothesis is true and the sample size is sufficiently large, the log of the likelihood-ratio statistic has a chi-square distribution with *r* degrees of freedom, where *r* is the difference between the number of terms in the full model and the model with only constant term.

It should be noted in this study, however, that the sample is not a purely random one (Gaisie, et al., 1993). This implies that the statistical significance of the goodness of fit of models in this study need not be taken to be more than broadly indicative, although it is more likely that in testing for the statistical significance of the model extension, the assumption of the chi-square distribution of changes in log likelihood is less strongly violated.

Hence, the importance of individual elements of the model is assessed by a change in the model log-likelihood associated with the addition of that variable s):

$$-2\ LL_t - LL_t \sim X^2 \text{ No. degrees of freedom).}$$

For both Logistic and Cox regression models, the model chi-square is adopted as approximate measure of model goodness of fit since it is the difference between *-2LL* for the model with only a constant and *-2LL* for model with variables of interest (Norusis SPSS Inc., 1993).

5.5.2 Selecting Predictor Variables for Multivariate Analysis

The multivariate analysis starts by considering gross effects of socio-economic variables on child survival using categories of neonatal, post-neonatal and child, respectively. This also enables the reassessment of statistical significance of the gross effects necessary for final socio-economic variable selection.

Overall selection of variables for multivariate modelling is based on the p-values of chi-square statistics using likelihood ratio statistic in logistic regression for neonatal mortality and using the Score statistic (and sometimes known as Global or Overall chi-square) for post-neonatal and child mortality resulting from Cox hazards regression. The Score statistic is preferred here since it is often used for entering selected predictor variables into a model within the SPSS Cox Regression Procedure. Moreover, the value for the Score statistic is very similar to that of the likelihood ratio statistic (Norusis/SPSS Inc., 1993). The selection of the study variables is therefore guided by the Score X^2 p-value of 10 percent significance or less.

5.5.3.1 <u>Community-level Socio-economic Variables</u>

Table 5.13 presents the gross effect of community-level socio-economic variables on neonatal, post-neonatal, and child mortality. Also presented in the table are p-values of Model Chi-Square in the case of neonatal mortality, p-values of the Score statistic for both post-neonatal and child mortality, and also exponentiated parameters in the form of relative risk.

As earlier noted in the univariate analysis, interesting mortality patterns emerge when age groups are considered separately. Previous important child survival findings have been found using this approach Hobcraft et al., 1984; Bicego and Boerma, 1991; Obungu et al, 1994). The following five community-level variables have been selected for neonatal mortality analysis based on the p-values of the Model X^2 as mentioned earlier.

a) Rural-urban residence,

b) Place of residence,

c) Province of residence,

d) Access to electricity, and

e) Access to water source.

TABLE 5.13 GROSS EFFECT OF COMMUNITY-LEVEL SOCIO-ECONOMIC FACTORS ON CHILDHOOD MORTALITY: RELATIVE RISKS OF NEONATAL, POST-NEONATAL AND CHILDHOOD PERIODS.

SOCIO-ECONOMIC VARIABLES	NEONATAL	POST-NEONATAL	CHILD
Rural-Urban Residence	00	[0 01]	[0 77]
Rural	1.51***	1.22**	1 04
Urban	1 00	1 00	1 00
Mother's Place of Residence	00	07]	[0 63]
Village	1 34	1 27*	1 27
Town	1 00	1 00	1.28
ity	.53*	1 15	1.38
apital	1 00	1 00	1 00
Province of Residence	00	00]	[0 02]
Central	1 23	0 91	0 78
Copperbelt	73	1 06	1 15
Eastern	2 15***	1.52***	1 83**
Luapula	1 48	1 85***	1.21
Northern	1 53	1 67***	1 71**
North-Western	1 68	1 01	0 95
Southern	1 18	0 87	1 05
Western	2 26**	1.55**	1.53
Lusaka	1 00	1 00	1 00
Access to Electricity	00	[0 00]	[0 00]
No	1 84***	1 62***	1 68***
Yes	1 00	1 00	1 00
Access to Water Source	08]	[0 16]	[0 88]
15+ Minutes	78*	0 88	1 02
0-14 Minutes	1 00	1 00	1 00
Access to Health Services	14]	[0 02]	[0 00]
Other	1.39*	1 42***	1 88***
90+ Minutes	1 41*	1 09	1 16
30-89 Minutes	1 10	1.21*	1 42*
0-29 Minutes	1 00	1 00	1 00
Easy difficult Access to Health Services	[79]	[89]	[0 62]
Difficult	1 04	0 99	1 08
Easy	1 00	1 00	1 00
Person Mother Works for	12]	[0.38]	[0 23]
Self Employed	1 51	1 27	1 42
Family Member	0 97	1 29	1.77*
Someone else	1 00	1 00	1 00
Mother's Current Type of Employment	[25]	[0.34]	[0 03]
Not Working	1 31	1 09	1 17
Self Employed	1.52*	1 16	1 24
Unpaid Worker	1 24	1 60*	2 74***
Paid Employee	1 00	1 00	1 00

*** $p<0.01$; ** $p<0.05$; * $p<0.10$; [] p-values of X^2;

Two additional variables of access to health service and person mother works for have been included in the initial analysis though they do not qualify to the selection criteria. They have 14 and 12 percent p-values of the model X^2 respectively. The reason for their adoption at this stage is based on their significance in earlier studies of child survival, particularly on neonatal mortality.

There is strong evidence from Table 5.13 that the influence of rural-urban residence on general childhood mortality is reduced significantly with increasing age of the child. While there is over 50 percent risk difference between rural and urban in the first month of life, there is only 4 percent risk difference during childhood. Similarly, both influences of mother's place of residence and access to water source are weakened with increasing age of the child with city children having lowest neonatal mortality rate and also highest child mortality levels. The opposite is true, however, for access to health services. Access to health services has stronger influence on mortality with increasing age of the child. The risk of dying among children categorised as "other" increases by almost 50 percent with increasing age of the child from the first month of life to late childhood. Significant influences across age intervals are notable for Province of Residence, Access to Electricity and to a lesser extent Access to Health Services. Below are community-level socio-economic variables selected for both post-neonatal and child mortality analysis.

Among the post-neonatal mortality variables include:

a) Rural-Urban Residence,

b) Place of Residence,

c) Province of Residence,

d) Access to Electricity, and

e) Access to Health Services.

For child mortality they include:

a) Province of Residence,

b) Access to Electricity,

c) Mother's Current Type of Employment.

Based on the above selection of variables, it is noted that the number of community-level variables significantly influencing mortality is reduced from seven variables in the first month of life to only three variables during late childhood, implying reduced influence of community-level socio-economic variables with increasing age of the child.

5.5.3.2 **Household-level Variables**

At the household level, the following variables are statistically significant across all age categories:

a) Household Economic Status,

b) Household Radio,

c) Household Size, and

d) Household Children Size.

On the other hand, the influence of bicycle possession on child survival weakens with increasing age of the child despite some notable increases in the risk of dying with increasing age of child.

The following household-level variables have, therefore, been selected for further analysis on neonatal, post-neonatal and child mortality.

1. Neonatal mortality:
    a) Household Economic Status,
    b) Household Radio,
    c) Household Bicycle,
    d) Household Size, and
    e) Household Children Size;

TABLE 5.14: GROSS EFFECT OF HOUSEHOLD-LEVEL SOCIO-ECONOMIC FACTORS ON CHILDHOOD MORTALITY: RELATIVE RISKS OF NEONATAL, POST-NEONATAL AND CHILD MORTALITY.

VARIABLE	NEONATAL	POST-NEONATAL	CHILD
Household Economic Status	[0.01]	[0.00]	[0.02]
Low	1.88**	1.52***	1.74**
High	1.00	1.00	1.00
Household Radio	[0.09]	[0.00]	[0.01]
No	1.23*	1.34***	1.38***
Yes	1.00	1.00	1.00
Household Bicycle	[0.09]	[0.12]	[0.45]
No	0.78*	1.17	1.12
Yes	1.00	1.00	1.00
Mother Earns Cash	[0.22]	[0.18]	[0.24]
No	1.36	1.23	1.32
Yes	1.00	1.00	1.00
Household Size	[0.00]	[0.00]	[0.00]
10+	0.46***	0.36***	0.35***
5-9	0.59***	0.48***	0.44***
1-4	1.00	1.00	1.00
Household Children Size	[0.00]	[0.00]	[0.00]
3+	0.26***	0.23***	0.18***
2	0.32***	0.37***	0.30***
1	1.00	1.00	1.00
None	2.75***	3.20***	3.77***

*** $p<0.01$; ** $p<0.05$; * $p<0.10$; [] p-values of X^2;

2. Post-neonatal mortality:

   a) Household Economic Status,

   b) Household Radio,

   c) Household Size, and

   d) Household Children Size;

3. Child mortality:

   a) Household Economic Status,

   b) Household Radio,

   c) Household Size, and

   d) Household Children Size.

The variable whether the mother earns cash is not statistically significant across all age categories, while possession of a bicycle is not significant during both post-neonatal and childhood periods.

5.5.3.3 <u>Individual-level Socio-economic Variables</u>

Table 5.15 presents some interesting observations on parental characteristics across the three age intervals.

Particularly interesting are the opposing influence of mother's education and father's education with increasing age of the child.

While mother's education has a statistically significant influence on child survival with increasing age of the child, the opposite is true for both father's education and to a lesser extent father's occupation.

Both mother's occupation and working place are not statistically significant across the three age categories.

TABLE 5.15: GROSS EFFECT OF INDIVIDUAL-LEVEL SOCIO-ECONOMIC FACTORS ON CHILDHOOD MORTALITY: RELATIVE RISK OF NEONATAL, POST-NEONATAL AND CHILD MORTALITY

VARIABLES	NEONATAL	POST-NEONATAL	CHILD
Mother's Education	[0.48]	[0.11]	[0.05]
No Education	1.28	1.27*	1.52**
Primary Education	1.13	1.24**	1.53**
Secondary +	1.00	1.00	1.00
Mother's Occupation	[0.18]	[0.24]	[0.46]
Not Working	1.16	1.06	1.05
Agricultural self-employed	1.41*	1.25*	1.29
Blue Collar	1.48*	1.02	1.05
White Collar	1.00	1.00	1.00
Mother's Working Place	[0.76]	[0.57]	[0.67]
Home	0.95	0.94	0.93
Away	1.00	1.00	1.00
Father's Education	[0.04]	[0.34]	[0.99]
No Education	1.61**	1.21	0.99
Primary Education	1.29*	1.08	1.00
Secondary +	1.00	1.00	1.00
Father's Occupation	[0.02]	[0.04]	[0.67]
Never Worked	1.48	0.71	0.74
Agricultural Self employed	1.48**	1.24**	1.13
Blue Collar	0.97	1.04	1.00
White Collar	1.00	1.00	1.00

*** $p<0.01$; ** $p<0.05$; * $p<0.10$; [] p-values of X^2;

Although only father's education and occupation qualify for further investigation for child survival during the first month of life, mothers's education is also included on the basis of its previous remarkable influences in other childhood mortality studies (Caldwell, 1979).

While two variables were selected during the post-neonatal period namely father's occupation and mother's education, only mother's education qualifies for the child mortality analysis. Interpretation of observed univariate socio-economic differentials is often made difficult due to the presence of confounding between explanatory variables within a multivariate regression model. As presented by Tables 5.16 and 5.17, there are indications from the crosstabulation of selected variables that varying degrees of association exist. Most notable are the associations between rural-urban residence, place of residence and province of residence. When explanatory variables are highly correlated, resulting coefficients might be misleading. This means that variables might have wrong signs and the significance levels might not correctly reflect the strength of the association with the dependent variable. In such circumstances it is suggested that one includes only one of the set of highly correlated variables in the model (Norusis/SPSS Inc., 1993). Since rural-urban residence and place of residence are highly associated, rural-urban residence has been dropped from neonatal mortality analysis of community-level variables since it does not contribute any influence to the model after controlling for place of residence, despite it being statistically significant during univariate analysis. Moreover, place of residence substitutes the influence of rural-urban residence since it is a more detailed break down of the rural-urban residency. On the other hand, resulting coefficients for place of residence must be taken cautiously since the variable is highly associated with province of residence.

TABLE 5.16 CROSSTABULATION OF PROVINCE OF RESIDENCE BY PLACE OF RESIDENCE.

	PLACE OF RESIDENCE				
PROVINCE OF RESIDENCE	Village	Town	City	Capital/ Large city	**TOTAL**
Central	385	186	1	0	574
Copperbelt	108	575	683	5	1371
Eastern	568	65	0	0	633
Luapula	512	95	0	0	607
Lusaka	90	64	0	761	915
Northern	523	85	0	0	608
North-Western	350	40	0	0	390
Southern	732	205	0	0	937
Western	459	32	0	0	491
TOTAL	3727	1347	684	768	6526

Chi-Square	**Value**	**DF**	**Significance**
Likelihood Ratio	7525.5	24	0.0000

TABLE 5.17 CROSSTABULATION OF RURAL/URBAN RESIDENCE BY PLACE OF RESIDENCE

	PLACE OF RESIDENCE				
REGION	Village	Town	City	Capital/ large city	**TOTAL**
Rural	3675	30	7	31	3743
Urban	61	1319	679	737	2796
TOTAL	3736	1349	686	768	6539

Chi-Square	**Value**	**DF**	**Significance**
Likelihood Ratio	7678.8	3	0.0000

5.5.4 The Effect of Socio-economic Factors on Neonatal Mortality

To explore the main and net effects of community, household, and individual factors on child survival in the first month of life, Table 5.18 presents nine regression models.

TABLE 5.18: RESULTS OF LOGISTIC REGRESSION MODEL OF NEONATAL MORTALITY AND ASSOCIATED SOCIO-ECONOMIC FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8	MODEL 9
COMMUNITY-LEVEL VARIABLES									
Place of Residence									
Village	0.41	0.41	0.41	0.37	0.37	0.44	0.33	0.32	0.32
Town	0.48	0.49	0.49	0.45	0.44	0.49	0.45	0.45	0.45
City	0.22	0.22	0.22	0.22	0.24	0.28	0.24	0.24	0.24
Province of Residence									
Central	3.34	3.29	3.30	3.26	3.23	2.98	2.71	2.75	2.76
Copperbelt	2.57	2.58	2.62	2.53	2.45	2.49	2.74	2.78	2.86
Eastern	5.52**	5.49**	5.51**	5.48**	5.43**	4.97**	4.41*	4.36*	4.31*
Luapula	3.70*	3.64*	3.69*	3.84*	3.76	3.66	3.47	3.56	3.56
Northern	3.70*	3.64*	3.67*	3.65	3.53	3.64	3.29	3.34	3.29
North-Western	4.28*	4.19*	4.20*	4.06*	3.72	4.20*	3.97*	4.02*	4.00*
Southern	2.88	2.85	2.85	2.91	3.11	3.33	2.92	2.96	2.92
Western	4.62*	4.54*	4.56*	4.87**	4.86*	4.30*	4.15*	4.22*	4.18*
Access to Electricity									
No	1.53	1.41	1.41	1.39	1.35	1.33	1.11	1.11	1.12
Access to Water Source									
15+ minutes	0.75*	0.74**	0.75**	0.75*	0.76*	0.78*	0.81	0.80	0.79
HOUSEHOLD-LEVEL VARIABLES									
Household Economic Status									
Low		1.81	1.84	1.87	1.84	1.91	1.70	1.68	1.72
Household Radio									
No			0.96	1.07	1.03	0.97	0.97	0.96	0.95
Household Bicycle									
No				0.73*	0.68**	0.66**	0.59***	0.58***	0.58***
Household Size									
10+					0.57**	1.69**	1.44	1.45	1.46
5-9					0.60***	1.20	1.18	1.17	1.17
Household Children Size									
3+						0.21***	0.21***	0.21***	0.21***
2						0.29***	0.30***	0.29***	0.29***
None						2.84***	2.74***	2.76***	2.79***
INDIVIDUAL-LEVEL VARIABLES									
Father's Occupation									
Never Worked							1.03	1.01	1.02
Agricultural Self-Employed							1.64*	1.59*	1.61*
Blue Collar							1.24	1.22	1.22
Father's Education									
No Education								1.08	1.09
Primary								1.11	1.14
Mother's Education									
No Education									0.88
Primary									0.80
Model Chi-square (X^2)	27.31	28.48	28.47	31.97	43.05	165.43	157.88	159.19	159.98
Degrees of freedom (df)	13	14	15	16	18	21	24	26	28

*** p<0.01; ** p<0.05; * p<0.10

Model 1 presents the net effect of the four selected community-level socio-economic variables. Models 2 through 5 sequentially add the household-level variables as a way of assessing their influence on the relationship between community-level variables and neonatal mortality and as implied by the child-survival framework.

Model 6, therefore, presents the net effect of both community-level and household-level socio-economic variables on neonatal mortality. Models 7 and 8 attempt to control for the two individual-level variables of both father's occupation and education. Finally, model 9 presents the net influence of community, household and individual-level socio-economic variables on neonatal mortality.

It should be said here that the idea behind the sequential control for certain variables is to assess the extent to which such controls explain some of the effects of community-level variables.

From model 1, it is shown that Province of Residence has the most significant effect on neonatal mortality. Most remarkable are the effects in Eastern, Western, North-Western, Luapula and Northern Provinces; all being rural regions. Children from the Eastern Province, for example, are more than five times at higher risk of dying during the first month of life than children from Lusaka Province. What is surprising, however, is that even children from the Copperbelt Province are more than twice at higher risk of dying compared to children from Lusaka Province. These differentials in neonatal mortality might be explained by some of the inequalities in quality health service provision especially that of maternal and child health services for which neonatal mortality is most sensitive. Also noted is the increased mortality risk for children in the capital city compared to other cities, towns and even villages. It is suspected here that place of residence is confounding with province of residence and the estimates must be taken with caution. Although access to electricity is not statistically significant, children from homes without electricity are about 53 percent at higher risk of dying than their counterparts from homes with electricity. On the other hand and as earlier noted from the univariate analysis, children far away from water source by at least 15 minutes have better survival chances than children close to the water source.

Model 6 presents community-level variables while controlling for household-level socio-economic variables. While there is little change in mortality risk estimates for place of residence and access to both electricity and water, some of the effects associated with province of residence are explained by controlling for household-level variables. Most notable is that only provinces such as Eastern, North-Western and Western continue to have significant effect on neonatal mortality. Controlling for household level variables accounts for about 12, 9 and 2 percent of the mortality risk associated with Eastern, Western and North-Western provinces, respectively. Although the significance associated with Luapula and Northern Provinces are accounted for by controlling for household size and presence of a bicycle, respectively, mortality risk is still more than three times relative to that in Lusaka Province.

Model 9 presents the net effect of community, household, and individual-level socio-economic variables on neonatal mortality. While there is little change in the risk estimates by place of residence, controlling for individual-level variables accounts for about 64 percent of the risk associated with not having electricity despite the estimates not being statistically significant. On the other hand, controlling for individual-level variables accounts for the significance associated with access to water source although children far away from the source continue to have higher survival chances. As for the province of residence, controlling for individual-level variables does little to explain the neonatal mortality risks associated with Eastern, North-Western and Western Provinces.

When household-level variables are examined from model 6, three variables, namely possession of a bicycle, general household size and household children size, are identified as having some significant effect on neonatal mortality even when community variables are taken into account. What is remarkable, however, is that controlling for household children size changes the effect of general household size on neonatal mortality. From a position of reduced risk for children from households of at least 10 members, the status changes to that of increased risk by 69 percent relative to households with less than five members. Although the significant effect of household size is accounted for by controlling for individual-level variables, children from homes with at least 10 members are still 46 percent at increased risk of dying. As for possessing a bicycle, controlling for both other household-level variables and individual-level variables increases the significance associated with not having a bicycle.

Children from homes with no bicycle are over 40 percent at reduced risk of dying than children from households owning a bicycle. Like earlier discussions, this mortality pattern might be reflecting the rural-urban inequalities since rural households own more bicycles than urban households. On the other hand and even after controlling for other variables, children from the mortality-prone households are about 179 percent at increased risk of dying compared to households with one under-five child. Moreover, household number of children continues to have an inverse association with neonatal mortality although some confounding is suspected considering the mortality risk pattern change from the general household size once number of children is accounted for.

In the case of individual-level variables, only father's occupation continues to have some significant effect after community and household-level variables are controlled for. Children of fathers working for themselves in the agricultural sector are at least 60 percent at increased risk of dying than children of white collar employees.

5.5.5 The Effect of Socio-economic Factors on Post-neonatal Mortality

To investigate the effects of community, household and individual-level variables on post-neonatal mortality, similar methodological procedures used on neonatal mortality are repeated here. Table 5.19 presents seven models with the first model including only the net effect of community-level variables. Model

2 through 4 sequentially introduce the household-level variables into respective models.

TABLE 5.19: RESULTS OF HAZARDS MODEL OF POST-NEONATAL MORTALITY AND ASSOCIATED SOCIO-ECONOMIC FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7
COMMUNITY-LEVEL VARIABLES							
Place of Residence							
Village	0.75	0.74	0.73	0.76	0.95	0.96	0.94
Town	0.78	0.78	0.78	0.81	0.92	0.98	0.98
City	0.90	0.91	0.91	0.96	1.04	1.12	1.13
Province of Residence							
Central	1.13	1.12	1.11	1.07	0.93	0.95	0.96
Copperbelt	1.30	1.27	1.25	1.28	1.23	1.18	1.17
Eastern	1.86**	1.85*	1.81*	1.72*	1.49	1.41	1.43
Luapula	2.24***	2.22**	2.14**	1.98**	1.74*	1.69	1.72*
Northern	2.01**	1.99**	1.94**	1.78*	1.62	1.63	1.68
North-Western	1.22	1.21	1.18	1.02	1.05	1.08	1.11
Southern	1.10	1.09	1.07	1.15	1.11	1.12	1.15
Western	1.91**	1.89**	1.84*	1.72*	1.40	1.47	1.50
Access to Electricity							
No	1.42**	1.34**	1.32*	1.23	1.23	1.26	1.25
Access to Health Services							
Others	1.17	1.17	1.14	1.10	0.97	0.94	0.92
90+ Minutes	0.90	0.90	0.88	0.91	0.90	0.88	0.87
30-89 Minutes	1.12	1.12	1.11	1.12	1.03	1.03	1.03
HOUSEHOLD-LEVEL VARIABLES							
Household Economic Status							
Low		1.16	1.12	1.07	1.05	1.06	0.99
Household Radio							
No			1.14	1.06	1.02	1.03	1.03
Household Size							
10+				0.42***	1.08	1.15	1.16
5-9				0.50***	0.94	0.96	0.96
Household Children Size							
3+					0.24***	0.22***	0.21***
2					0.38***	0.35***	0.35***
None					3.12***	3.11***	3.12***
INDIVIDUAL-LEVEL VARIABLES							
Father's Occupation							
Never Worked						0.44**	0.44**
Agricultural Self-Employed						1.04	1.03
Blue Collar						0.99	0.98
Mother's Education							
No Education							1.17
Primary Education							1.25*
Model Chi-square (X^2)	67.82	68.50	70.09	155.87	763.79	746.24	748.98
Degrees of freedom (df)	15	16	17	19	22	25	27

*** p<0.01; ** p<0.05; * p<0.10

Model 5, therefore, presents the net effects of community-level variables while controlling for all selected household-level variables. On the other hand, model 7 includes all the necessary controls involving all selected community, household and individual-level socio-economic variables.

From model 1, only province of residence and access to electricity have statistically significant effect on post-neonatal mortality. Children from homes with no electricity, for example, are 42 percent at increased risk of dying than children from homes with electricity.

Compared to the influence access to electricity has during the first month of life, model 1 shows this infrastructural index to have more significant influence during post-neonatal period. Like mortality during the first month of life, post-neonatal mortality risk is highest amongst the four rural provinces of Luapula, Northern, Western and Eastern. The mortality risk is highest in Luapula Province where children are more than twice at increased risk of dying than children from Lusaka Province.

Although mortality risk is relatively high for North-Western Province during the neonatal period, the risk of dying during post-neonatal is only 22 percent higher than the risk in Lusaka Province. While not statistically significant, mortality risk continues to be highest in the capital city of Lusaka and lowest in rural villages.

Model 5 presents the net influence from community-level socio-economic factors while controlling for household-level factors. Although post-neonatal mortality continues to be highest in Luapula Province relative to Lusaka Province, the significant effects from Northern, Western and Eastern Provinces are accounted for by the control for household-level variables. Most remarkable in explaining for these risks is the control for household children size. Overall, controlling for household-level variables accounts for 56, 43, 40 and 39 percent of the mortality risk associated with Western, Eastern, Luapula and Northern Provinces, respectively. Although not statistically significant, controlling for household number of children also accounts for many of the mortality inequalities between the capital city, towns and villages. For example, controlling for household number of children explains for about one-quarter of the survival chances for children from rural villages.

Even when access to electricity is considered, controlling for household-level variables accounts for about 45 percent of the mortality risk associated with having no electricity. This implies that this infrastructural index is largely influenced by household socio-economic status. Model 5 further shows household number of children to have a statistically significant effect on post-neonatal mortality even when both community-level and household-level socio-economic variables are accounted for. However, children from mortality-prone households are more than three times at elevated risk of dying than children from households with only one under-five.

Model 7, on the other hand, presents the estimates for all selected community, household and individual-level variables. Like in Model 5, Luapula Province continues to have the highest post-neonatal risk even after controlling for individual-level variables. In fact, the control for the individual-level variables such as father's occupation and mother's education have little influence on the mortality risk associated with children from Luapula Province. Children in Luapula remain at over 70 percent increased risk of dying compared to children from Lusaka Province.

Amongst household-level variables, only the number of children within households continue to have influence on mortality. It also shows that when other household variables are controlled for, children from homes with larger family size are at higher risk of dying than earlier noted from the gross effect estimates.

As for individual-level socio-economic variables, both father's occupation and mother's education have significant influence on post-neonatal mortality, although the lower risk associated with children from "never worked" fathers should be taken with caution since the category has very few births. While there is little mortality difference between children of agricultural self-employed, blue collar and white collar employed fathers, mother's education has emerged during post-neonatal as having significant influence with children of primary educated mothers at 25 percent higher risk of dying than children of mothers with at least secondary education.

Overall, however, and even when individual-level variables are controlled for, as demonstrated by Model 7, there is little explanation for the mortality pattern associated with household number of children.

5.5.6 The Effect of Socio-economic Factors on Child Mortality

To discuss the major effects of socio-economic factors on child mortality, Table 5.20 presents six hazards regression models.

TABLE 5.20: RESULT OF HAZARDS MODEL OF CHILD MORTALITY AND ASSOCIATED SOCIO-ECONOMIC FACTORS.

VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
COMMUNITY VARIABLES						
Province of Residence						
Central	0.73	0.71	0.69	0.69	0.71	0.71
Copperbelt	1.25	1.22	1.19	1.29	1.39	1.43
Eastern	1.62**	1.58*	1.50*	1.48	1.54*	1.50*
Luapula	1.09	1.06	0.96	0.92	1.07	1.05
Northern	1.40	1.36	1.28	1.20	1.40	1.40
North-Western	0.83	0.81	0.77	0.67	0.82	0.82
Southern	0.99	0.96	0.92	1.02	1.17	1.18
Western	1.31	1.27	1.19	1.12	1.10	1.09
Access to Electricity						
No	1.59**	1.44*	1.39	1.27	1.20	1.18
Mother's Current Type of Employment						
Not Working	1.10	1.09	1.06	1.06	1.19	1.07
Unpaid Worker	2.04*	2.02*	1.99*	1.97*	2.20**	2.00*
Self-Employed	1.13	1.12	1.11	1.15	1.31	1.17
HOUSEHOLD VARIABLES						
Household Economic Status						
Low		1.33	1.27	1.24	1.24	1.08
Household Radio						
No			1.19	1.10	1.10	1.08
Household Size						
10+				0.39***	1.08	1.08
5-9				0.45***	0.88	0.87
Household Children Size						
3+					0.18***	0.18***
2					0.31***	0.30***
None					3.77***	3.79***
INDIVIDUAL VARIABLES						
Mother's Education						
No Education						1.39
Primary Education						1.54**
Model Chi-square (X^2)	29.66	30.55	32.47	78.80	461.80	466.64
Degrees of freedom (df)	12	13	14	16	19	21

*** p<0.01; ** p<0.05; * p<0.10

Like in earlier Tables, model 1 presents community-level variables namely province of residence, access to electricity and mother's current type of employment; all of them showing some significant influence on child mortality.

Children from Eastern Province have the highest mortality risk at 62 percent elevated risk compared to children from Lusaka Province. Controlling for household-level variables explains the significance associated with Eastern Province. This is especially the case when general household size is added to the model. Although controlling for household number of children appears to explain for much of the significance associated with general household size, it worsens the mortality risk of children from Eastern Province.

Model 1 also shows that children from homes with no electricity are about 59 percent at higher risk of dying than children from homes with electricity.

However, controlling for both household and individual-level variables accounts for almost 70 percent of the mortality risk associated with having no electricity in the home. While the control for both household and individual-level variables has little influence on the relationship between mother's current type of employment and child mortality, children of unpaid workers are twice at increased risk of dying than children from paid employees. This means that not only are such children denied maternal care, but they are also denied any compensating income from their working mothers. Like the first year of life, children from mortality-prone households continue to have higher mortality risk even in late childhood. Controlling for mother's education has little effect on the relationship between household number of children and child mortality. On the other hand, children of mothers with primary education are 54 percent at higher risk of dying even when both community and household-level variables are taken into account. Moreover, children of primary educated mothers have worse survival chances than children from mothers with no education.

Overall and while controls of both household and individual-level variables, such as household economic status and mother's education, account for much of the community infrastructural effect (as is the case with electricity), they nonetheless worsen children's survival chances in the Copperbelt Province by about 72 percent. This further supports evidence of worsening mortality risk amongst children from socio-economic groups that are otherwise considered as more affluent as is the case between children of mothers with primary education as opposed to those with no education. Furthermore, two thirds of the mortality risk associated with household economic status is explained by controlling for mother's education.

5.6 OVERVIEW

The preceding analysis indicates that during the first month of life province of residence, owning a bicycle, household number of children and father's occupation are the key socio-economic factors determining childhood mortality. Although children from homes without a bicycle are at a reduced risk of dying, it is suspected that the variable is confounding with rural-urban residence, possibly reflecting rural economic status since there are more bicycles in rural than urban areas of Zambia. On the other hand, the analysis shows an inverse association between household number of children and neonatal mortality. Moreover, the study further highlights certain households to be more prone to overall childhood mortality. This pattern worsens with increasing age of the child, suggesting increased influence of socio-economic factors on familial effects.

During the post-neonatal period, province of residence, household number of children, father's occupation and mother's education are found to exert considerable influence on childhood mortality. Particularly notable is the continued influence from father's occupation and the emergence of mother's education as one of the strongest determinants of childhood mortality.

As for the age between 12 and 60 months, province of residence, mother's current type of employment, household number of children and mother's education emerge as the key socio-economic determinants of late childhood mortality.

Overall, there is an observed pattern of declining influence of community-level factors with increasing age of the child being replaced by increasing influence of both household and individual-level socio-economic factors. Moreover, the mortality effect of community-level factors is largely explained by controlling for household and individual-level socio-economic factors. This is especially the case for presence of electricity as a proxy for community-level infrastructural development index. Also to have emerged from this chapter is the increasing role of mother's education with increasing age of the child, further pointing to the significance of socio-economic forces surrounding the child's household environment.

CHAPTER SIX

SOCIO-ECONOMIC AND CULTURAL CORRELATES OF CHILDHOOD MORTALITY

6.1 INTRODUCTION

There are two major objectives for Chapter Six. The first is to define and construct variables within the socio-cultural context of the conceptual framework. It is also an attempt to identify predictor cultural explanatory variables influencing child survival and mortality in Zambia.

The second objective is a continuation of that in Chapter Five of identifying the most discriminating socio-economic variables. Within this objective, socio-economic variables identified in Chapter Five are combined with selected cultural variables to form the socio-economic and cultural determinants as conceptualized in the modified child survival framework.

6.2 DEFINITION AND CONSTRUCTION OF CULTURAL VARIABLES

Guided by both socio-cultural literature on child survival and data availability, the following five cultural correlates have been identified for analysis: ethnicity, mother's childhood place of residence, religion, type of marital union and mother's age at first marriage.

6.2.1 Ethnicity

According to Behm (1991), cultural patterns and ethnic groups can be quite varied and different groups may be at different stages of the transition in the process of cultural change. Particularly important in this differentiation process are cultural beliefs about procreation, child care and the causes of childhood diseases and their treatment.

A number of studies in the developing countries have demonstrated the influence of ethnicity on child survival. A study by Mensch, Lentzner and Preston (1985) shows that ethnicity in a plural society is the only social variable that can compete with parental education as a determinant of child survival.

As for Sub-Saharan Africa, Cantrelle and Locoh (1990) show that in both Cameroon and Zaire ethnicity determines even more than maternal education the survival of children. A study in Kenya by Venkatacharya (1991) also shows that ethnic background can largely influence the probability of dying of children. Most significant in the study is that ethnicity exhibits largest mortality differentials even when the effects of the factors such as region are controlled for. Similarly, among the variables used in the analysis on cultural differentials in Kenya and Cameroon, ethnicity was among the variables that turned out to be most important (Tabutin and Akoto, 1992).

In a study on social factors, nutrition and child mortality in rural Zambia, Wenlock (1979) found cultural rather than geographical factors to have generated more significant effect on child deaths. Particularly significant is the effect of parental ethnic background.

To explore both cultural and geographical influences on child survival in Zambia using the DHS data, ethnicity and mother's childhood place of residence are adopted here to complement geographically related socioeconomic correlates already discussed in Chapter Five.

Although there are many ethnic groupings in Zambia, and as earlier discussed in Chapter Two, they can be classified into a reduced number of groups on the basis of similarities in cultural practices and language (Venkatacharya, 1991; Gaisie, Cross and Nsemukila, 1993).

During the ZDHS survey, mothers were asked the ethnic group they belonged to. But the problem one encounters with this variable is its close link to inter-tribal marriages.

In the sample of rural Zambia, Wenlock (1979) found 30 percent of mothers had inter-tribal marriages. However, on the basis of both tribe and language, ethnicity has been categorized into the following six groupings as illustrated in Table 6.1: Bemba speaking, Tonga speaking, North-Western (i.e. including many ethnic groups mostly found in North-Western Province such as the Lunda, Luvale, Kaonde, etc.), Barotse (i.e. including many Lozi speaking ethnic groups), Nyanja speaking (i.e. including ethnic groupings such as Ngoni, Chewa, Nsenga, etc.) and Others. Within the "Others" category, Mambwe and Tumbuka ethnic groupings comprise over 80 percent. Since the "Others" category comprises many other ethnic groups that are not included in the first five categories, it is used here as reference baseline category in both univariate and multivariate analyses.

TABLE 6.1: DISTRIBUTION OF BIRTHS ACCORDING TO CULTURAL FACTORS FOR 1987-91 PERIOD

CULTURAL FACTORS	NUMBER	PERCENTAGE
CHILDHOOD PLACE OF RESIDENCE		
Village	3931	60.1
Town	1634	25.0
City	977	14.9
RELIGION		
Other	210	3.2
Protestant	4563	69.8
Catholic	1767	27.0
ETHNICITY		
Bemba speaking	2287	35.0
Tonga speaking	1173	17.9
North-Western	808	12.4
Barotse	450	6.9
Nyanja speaking	1045	16.0
Others	772	11.8
TYPE OF MARITAL UNION		
Never Married	353	5.4
Formerly Married	646	9.9
Polygamous	913	14.0
Monogamous	4617	70.7
AGE AT FIRST MARRIAGE		
Less than 15	961	15.5
15 - 19	4204	67.9
20+	1026	16.6

6.2.2 Mother's Childhood Place of Residence

Connected to ethnic differential factors within the child survival context are linkages to natural resources and ecological conditions in regions where the various ethnic groups live.

There is evidence from Wenlock's study (1979) of rural Zambia to show the influence of parents' residential status in respective tribal areas on childhood death rates.

In order to explore this tribal residential background of the mother, this chapter adopts the respondent's childhood place of residence. During the ZDHS survey mothers were asked as to where they lived most of the time until they were 12 years of age. From this question, mother's childhood place of residence is constructed with the following categories: Village, Town and City. It also becomes clear from Table 6.1 that many children in the sample come from mothers who spent the first 12 years of their childhood in rural villages of Zambia.

6.2.3 **Religion**

Among the two most often used indicators of cultural influences on child survival in the literature include ethnicity and religion (UN, 1991; Caldwell, 1991; Barbieri, 1991; Tabutin and Akoto, 1992). Similarly, the question on religious affiliation is used here as a proxy for cultural factors.

Since religion carries with it a number of values and norms which govern the behavioral, physiological and psychic levels of believers and may reflect on openness to western influences and /or adherence to customs, some studies stress the importance of including religion in studies of childhood mortality differentials (Tabutin and Akoto, 1992). Despite children from Christian mothers making up almost 97 percent of the sample, the Zambian population can be divided into four religious groups of

Protestants, Catholics, Muslims and Others. For purposes of stabilizing mortality estimates, Muslims and the "Others" religious affiliation are collapsed into one category classified here as "Others" since both groups together contribute only 3.0 percent to the sample of births. The category Catholic is used as reference.

6.2.4 Type of Marital Union

Among the most important cultural determinants of child health and survival are power relationships within the household (Mosley and Chen, 1984). In his study of the relationship between maternal education and childhood mortality in Nigeria, Caldwell (1979) postulates that one key change in traditional societies produced by mother's education is a shift of intra-household power relationship toward the mother to the benefit of her offspring. One of the factors particularly important in Caldwell's theory of linkage between increased maternal education and reduced child mortality is change in the traditional balance of family relationship including that between husband and wife. Other studies have added to the debate the importance of marital union relationships and how they relate to child care per se (Bledsoe, 1990). Particularly significant in this regard are polygynous marriages where the assistance given to each wife depends on her seniority, education, family origin, business success and also personal charm (Ware, 1984; Caldwell, 1991). There are also indications to show that the least child care given to children occurs when their parents are not married

(Caldwell, 1991). From various questions on marriage asked during the survey, this study constructs an explanatory variable to indicate the type of marital union within the cultural context of the adopted conceptual framework. Four categories representing existing marital unions are "never married", "formerly married", "polygynous", and "monogamous", where both polygynous and monogamous unions represent currently married women. It should be noted, however, that among the currently married women is a small proportion (2.8 percent) of mothers who indicated some form of cohabiting union. Included within the formerly married mothers are those women not living together with spouses (22.8 percent of births), divorced (57.1 percent) and those widowed (20.0 percent). However, over two-thirds of births according to type of marital union belong to mothers in monogamous relationships, used here as the reference category.

6.2.5 Age at First Marriage

A woman's age at entry into marital union or marriage is often linked to issues of general child care. While in most traditional societies such as Sub-Saharan Africa, and particularly Zambia, a mother has full responsibility for child care, she may have little control over influences of the kinship system over resource allocation or over critical cultural child care practices. Often decisions in these areas are reserved for the elders, particularly the mother-in-law or the husband, and the former may sometimes rigidly adhere to "harmful" traditional practices (Mosley and Chen, 1984). Most important in this case is mother's age since young mothers are more likely to be intimidated especially by mothers-in-law, and most often during their first births. There is a general view that in any traditional society there is a life cycle component to a woman's status within the family. The older the woman, the greater her power relative to her husband and perhaps mothers-in-law, although survival of children by parity does not support that contention (Ware, 1984). Meekers (1992) has, nevertheless, raised some difficulties associated with determining the onset of marital union. Despite that, the onset of marital union is generally used as a proxy for exposure to the risk of pregnancy and taken by others (such as Kalipeni, 1993) as a demographic variable, age at first marriage may reflect associations with exposure to the risk of pregnancy and ultimately to postpartum effects and general child care in the first few days of an infant's life. This is particularly true if the onset of marital union is influenced by the cultural environment surrounding mothers (such as early marriages) and which is often the case in traditional Zambia. On the basis of births by the age of the mother at first marriage, three categories of less than 15, 15-19 and 20+ are constructed, with the last group used as baseline reference.

6.3 UNIVARIATE ANALYSIS

6.3.1 Introduction

Using the same analytical procedures adopted in Chapter Five, this section aims at selecting cultural variables on the basis of size of mortality risk differentials as reflected in the relative risk and the probable public health importance indicated by the population attributable risk (PAR). Unlike previous sections, relative and attributable risks are NOT estimated using theoretically low-risk categories as reference baseline groups due to the nature of cultural factors. This means that in the absence of Zambian studies on mortality differentials by cultural factors, it is difficult to determine the category that is low risk.

6.3.2 Neonatal Mortality

Table 6.2 presents mortality rates in the first month of life according to cultural factors.

On the basis of at least 10 percent population attributable risk (PAR), only childhood place of residence and ethnicity have strong association with neonatal mortality. However, on the basis of at least 20 percent reduced risk relative to the reference category, religion has some remarkable association with neonatal mortality.

From Table 6.2, it is clear that childhood mortality during the first month of birth is highest amongst children whose mothers spent their 12 year childhood period in villages. Children from such mothers have an increased risk of 56 percent of dying than children whose mothers spent their childhood years in cities.

TABLE 6.2: NEONATAL MORTALITY BY CULTURAL CHARACTERISTICS: 1987-91 PERIOD.

CULTURAL FACTORS	RATE PER 1000	S.E.	RR	PAR	EXPOS
CHILDHOOD PLACE OF RESIDENCE					
Village	50.3	3.6	1.56	31.0	3931
Town	34.9	4.7	1.08	4.8	1634
City	32.2	5.8	1.00	-	977
RELIGION					
Other	(63.9)	17.7	1.19	2.0	210
Protestant	39.1	3.0	0.73	NA	4563
Catholic	53.5	5.6	1.00	-	1767
ETHNICITY					
Bemba speaking	37.0	4.1	0.71	NA	2287
Tonga speaking	38.2	5.8	0.74	NA	1173
North-Western	43.0	7.4	0.83	NA	808
Barotse	71.3	12.8	1.38	12.3	450
Nyanja speaking	48.0	6.9	0.93	NA	1045
Others	51.8	8.3	1.00	-	772
TYPE OF MARITAL UNION					
Never Married	49.3	12.0	1.20	1.4	353
Formerly Married	62.3	10.0	1.51	5.9	646
Polygamous	36.8	6.4	0.86	NA	913
Monogamous	42.2	3.1	1.00	-	4617
AGE AT FIRST MARRIAGE					
Less than 15	45.8	7.0	1.05	2.4	961
15 - 19	42.8	3.2	0.98	NA	4204
20+	43.8	6.6	1.00	-	1026

On the other hand, there is little mortality difference between children whose parents spent their childhood years in towns and cities, respectively.

As for ethnicity, mortality is lowest amongst Bemba and Tonga speaking ethnic groups and highest amongst the Lozi speaking category. Children from the Lozi (Barotse) speaking ethnic group are 38 percent at higher risk of dying than children from the reference category of other ethnic groups.

In the case of religion, neonatal mortality is highest amongst "other" religious groups, although estimates on this category should be taken cautiously as they are based on a small number of exposures. However, there is evidence of lower mortality risk amongst children of Protestant mothers with almost 30 percent reduced risk of dying compared to children of Catholic mothers. Similar findings have been reported in the Kenyan study by Venkatacharya (1991) where mortality risks were higher for children of Catholic mothers than Protestants. Perhaps, one of the reasons for increased risk of dying amongst children of Catholic mothers is the association between child spacing and the use of contraception. Not only is contraceptive use associated with improved child spacing patterns, but it also works as proxy for health service utilisation especially in rural areas where contraception is largely supplied by public health institutions. The policy of the Catholic Church on the use of contraception and its role on child spacing may indirectly influence utilisation of maternal and child health services and hence neonatal mortality.

Although mother's type of marital union and age at first marriage have little association with neonatal mortality, children of formerly married women and those who have never married are 51 and 20 percent at higher risk of dying than children from married monogamous unions. On the other hand, children from polygynous unions are 14 percent at reduced risk of dying than children of monogamous married mothers. The lower mortality risk associated with polygynous unions supports previous findings on the relationship between polygyny, child care and overall child survival (Schweitzer (1941) in Ware, 1984). Children from polygynous unions, and especially during the first month of delivery, are most likely to receive support from their co-wives and other members of the kin. Moreover, polygyny was sometimes and traditionally used as a child spacing strategy and has also been associated with longer periods of breastfeeding and child spacing in traditional Sub-Saharan Africa (Gray, 1981; Nsemukila, 1991).

Finally, there is some evidence to show large mortality risks associated with age at first marriage even though children from mothers aged less than 15 years are 5 percent at higher risk of dying in the first month of life than children from mothers aged at least 20 years.

6.3.3 **Post-neonatal Mortality**

Tables 6.3 presents post-neonatal mortality according to cultural characteristics. On the basis of selecting strongly associated variables using the population attributable risk, none of the cultural variables show significant influence on post-neonatal mortality. However, children of mothers who were brought up in towns and villages are 14 and 5 percent at higher risk of dying, respectively, than children of mothers brought up in the cities.

TABLE 6.3: POST-NEONATAL MORTALITY BY CULTURAL CHARACTERISTICS: 1987-91 PERIOD.

CULTURAL FACTORS	RATE PER 1000	S.E.	RR	PAR	EXPOS
CHILDHOOD PLACE OF RESIDENCE					
Village	63.8	4.2	1.05	3.8	3738
Town	69.5	6.7	1.14	8.0	1578
City	61.0	8.1	1.00	NA	946
RELIGION					
Other	(79.2)	20.4	1.20	2.1	197
Protestant	63.7	3.9	0.97	NA	4388
Catholic	66.0	6.4	1.00	-	1675
ETHNICITY					
Bemba speaking	77.3	6.0	1.09	6.3	2204
Tonga speaking	42.5	6.2	0.60	NA	1129
North-Western	61.3	9.0	0.87	NA	774
Barotse	64.0	12.6	0.91	NA	419
Nyanja speaking	56.8	7.7	0.80	NA	996
Others	70.6	10.0	1.00	-	733
TYPE OF MARITAL UNION					
Never Married	(58.2)	13.3	0.96	NA	336
Formerly Married	85.9	12.1	1.42	4.8	607
Polygamous	74.2	9.3	1.23	3.7	880
Monogamous	60.5	3.8	1.00	-	4426
AGE AT FIRST MARRIAGE					
Less than 15	57.1	8.0	0.88	NA	918
15 - 19	67.0	4.1	1.03	2.7	4028
20+	65.2	8.3	1.00	-	982

Furthermore, children of Bemba speaking mothers have highest mortality risk than children from other ethnic categories. Post-neonatal mortality is lowest amongst children of Tonga speaking mothers.

Although little mortality differentials are noted for children of Protestant and Catholic mothers during post-neonatal, children whose mothers are neither Catholic nor Protestant are 20 percent at elevated risk of dying than children from Catholic mothers. Unlike the first month of life, children from polygynous unions are 23 percent at higher risk of dying than children from monogamous unions. On the other hand, post-neonatal mortality is highest amongst children from formerly married mothers and possibly reflects the risk associated with marital disruption. Children of formerly married mothers are 42 percent at higher risk of dying than children from monogamous unions. Linked to mother's type of marital union is her age at first marriage. While there is little mortality difference between age categories 15-19 and 20+, children of mothers aged less than 15 years have lower post-neonatal mortality risk. Such a pattern can be explained by situations, for example, where children of younger mothers are often cared for by their older grand parents whose socio-economic status is rather more stable than that of their actual mothers.

6.3.4 Child Mortality

Table 6.4 presents child mortality according to cultural characteristics. On the basis of estimates from the population attributable risk (PAR), only mother's childhood place of residence has strong association with child mortality. Most remarkable is that children whose mothers were brought up in towns are 25 percent at increased risk of dying compared to children whose mothers were brought up in cities. Also important is that childhood mortality continues to be highest amongst children from Lozi speaking mothers, although levels are equally high for children from Bemba speaking mothers later in life.

TABLE 6.4 CHILD MORTALITY BY CULTURAL CHARACTERISTICS: 1987-91 PERIOD.

CULTURAL FACTORS	RATE PER 1000	S.E.	RR	PAR	EXPOS
CHILDHOOD PLACE OF RESIDENCE					
Village	47.3	3.7	1.06	4.6	3507
Town	55.9	6.2	1.25	13.5	1472
City	44.8	7.2	1.00	-	890
RELIGION					
Other	(56.5)	17.9	1.09	0.9	182
Protestant	47.7	3.2	0.92	NA	4117
Catholic	51.7	5.8	1.00	-	1568
ETHNICITY					
Bemba speaking	51.3	5.1	1.04	2.9	2040
Tonga speaking	40.5	6.2	0.82	NA	1082
North-Western	47.8	8.2	0.97	NA	728
Barotse	(63.0)	12.9	1.27	NA	393
Nyanja speaking	49.0	7.3	0.99	NA	941
Others	49.5	8.6	1.00	-	683
TYPE OF MARITAL UNION					
Never Married	(25.6)	9.0	0.56	NA	317
Formerly Married	61.1	10.6	1.35	4.0	557
Polygamous	67.0	9.2	1.48	7.3	817
Monogamous	45.4	3.3	1.00	-	4166
AGE AT FIRST MARRIAGE					
Less than 15	46.0	7.4	0.94	NA	867
15 - 19	51.7	3.8	1.06	4.6	3767
20+	49.0	7.4	1.00	-	920

For example, children from Lozi mothers are 27 percent at higher risk of dying than children from other ethnic backgrounds. On the other hand, the lower risk associated with children of Tonga speaking mothers throughout the first five years of life further supports the existing low mortality levels in Southern Province where many Tonga speaking mothers are resident.

Although children of Protestant mothers continue to enjoy lower mortality risk compared to their counterparts from Catholic mothers, mortality differentials are narrower with increasing age of the child. Moreover, mortality remains highest amongst children from other religious backgrounds.

As for the type of marital union mothers are involved in, children from formerly married mothers and those from polygynous unions continue to have highest childhood mortality with children from polygynous unions at 48 percent increased risk of dying compared to children from monogamous unions. Surprisingly, children of never married mothers are 44 percent at reduced risk of dying than children from monogamous unions. While such estimates should be taken cautiously, children of never married mothers might represent children from high socio-economic status single mothers. On the other hand, there are fewer mortality differentials by mother's age at first marriage.

6.4 SUMMARY OF UNIVARIATE ANALYSIS

One-variable models from both logistic and Cox hazards regression have been used to estimate the overall gross effect of cultural factors on neonatal, post-neonatal and child mortality.

Table 6.5 presents the relative risk of mortality in association with the selected cultural backgrounds. Only one variable namely mother's type of marital union is consistently statistically significant throughout the five-year period.

TABLE 6.5 GROSS EFFECT OF CULTURAL FACTORS ON CHILDHOOD MORTALITY: RELATIVE RISKS OF NEONATAL, POST-NEONATAL AND CHILDHOOD MORTALITY.

CULTURAL FACTORS	NEONATAL	POSTNEONATAL	CHILD
CHILDHOOD PLACE OF RESIDENCE	[0.01]	[0.33]	[0.43]
Village	1.58**	1.05	1.03
Town	1.08	1.17	1.21
City	1.00	1.00	1.00
RELIGION	[0.02]	[0.59]	[0.75]
Other	1.20	1.14	1.06
Protestant	0.73**	0.95	0.92
Catholic	1.00	1.00	1.00
ETHNICITY	[0.05]	[0.02]	[0.66]
Bemba speaking	0.71*	1.07	1.05
Tonga speaking	0.73	0.70**	0.82
North-Western	0.83	0.91	0.98
Barotse	1.39	1.06	1.26
Nyanja speaking	0.92	0.89	0.99
Others	1.00	1.00	1.00
TYPE OF MARITAL UNION	[0.12]	[0.00]	[0.06]
Never Married	1.17	0.80	0.64
Formerly Married	1.49**	1.36***	1.24
Polygamous	0.87	1.31***	1.40**
Monogamous	1.00	1.00	1.00
AGE AT FIRST MARRIAGE	[0.92]	[0.51]	[0.73]
Less than 15	1.05	0.91	0.90
15 - 19	0.98	1.04	1.04
20+	1.00	1.00	1.00

*** $p<0.01$; ** $p<0.05$; * $p<0.10$; [] p-values of X^2;

However, it is noted that while the risk associated with children of formerly married mothers is reduced with increasing age of the child, the opposite is true for children from polygamous unions. Although children from polygamous unions are 13 percent at reduced risk of dying during the first month of life, they have the worst survival chances during late childhood at 40 percent elevated risk compared to children from monogamous unions. This could mean that the advantages in terms of child survival during the first month of life are overtaken by the socio-economic inequalities amongst such children and possibly resulting from marital instability and the poverty that may be associated to such marital unions.

While mother's age at first marriage has little statistical significance throughout the five year period, the effect of religious background is strongest only during the first one month of life reflecting differences in certain practices between religious groups and especially utilisation of health services. On the other hand, the significance of mother's childhood place of residence is restricted to the first month of life with mortality highest amongst children of mothers brought up in the villages. While such effects are reduced as the child grows, the risks are elevated later in life for children whose mothers were brought up in towns.

As for the influence of ethnic background on childhood mortality, major differentials are also restricted to the first month of life which might reflect inequalities in the provision of maternal and child health services. Alternatively, many of the cultural practices that may elevate childhood mortality risks are common earlier than later in life. Moreover, similar socio-economic factors may be responsible for mortality risk later in life since there is little evidence of risk disparities by cultural factors, with exception only of children from polygamous unions.

6.5 MULTIVARIATE ANALYSIS

6.5.1 Introduction

Adopting analytical procedures similar to those used in Chapter Five, the multivariate analysis is divided into two main parts. The first part explores main and net effects of the most discriminating of cultural factors on neonatal, postneonatal and child mortality. The second part combines both selected socio-economic and cultural correlates in an effort to finally identify ultimate socio-economic and cultural factors to form the socio-economic and cultural block as illustrated in the conceptual framework and presented by Figure 1.2.
On the other hand Tables 6.6, 6.7 and 6.8 show the association between ethnicity, mother's childhood place of residence, and religion. Although all variables show some association, they have been included in the model for conceptual reasons and their coefficients should be interpreted with caution.

TABLE 6.6 CROSSTABULATION OF ETHNICITY BY MOTHER'S CHILDHOOD PLACE OF RESIDENCE

	CHILDHOOD PLACE OF RESIDENCE			
ETHNICITY	Village	Town	City	**TOTAL**
Bemba	1201	722	363	2286
Tonga	892	175	106	1173
North-Western	533	198	77	808
Barotse	329	95	26	450
Nyanja	566	204	275	1045
Others	403	238	130	771
TOTAL	3924	1632	977	6533

Chi-Square	**Value**	**DF**	**Significance**
Likelihood Ratio	378.1	10	0.0000

TABLE 6.7 CROSSTABULATION OF RELIGION BY MOTHER'S CHILDHOOD PLACE OF RESIDENCE

	CHILDHOOD PLACE OF RESIDENCE			
RELIGION	Village	Town	City	**TOTAL**
Other	166	18	25	209
Protestant	2794	1150	619	4563
Catholic	970	465	332	1767
TOTAL	3930	1633	976	6539

Chi-Square	**Value**	**DF**	**Significance**
Likelihood Ratio	75.8	4	0.0000

TABLE 6.8 CROSSTABULATION OF ETHNICITY BY MOTHER'S RELIGIOUS AFFILIATION

	RELIGION			
ETHNICITY	Other	Protestant	Catholic	**TOTAL**
Bemba	23	1361	902	2286
Tonga	36	999	137	1172
North-Western	35	700	73	808
Barotse	53	326	71	450
Nyanja	31	583	431	1045
Others	31	589	150	770
TOTAL	209	4558	1764	6531

Chi-Square	**Value**	**DF**	**Significance**
Likelihood Ratio	738.6	10	0.0000

6.5.2 Cultural Correlates of Childhood Mortality

6.5.2.1 The Effect of Cultural Factors on Neonatal Mortality

To explore the net effect of cultural factors on neonatal mortality in Zambia, and on the basis of findings from the univariate analysis, five models are constructed using logistic regression procedure.

TABLE 6.9: RESULTS OF A LOGISTIC REGRESSION ANALYSIS OF NEONATAL MORTALITY: RELATIVE RISK OF NEONATAL MORTALITY ASSOCIATED WITH CULTURAL FACTORS.

CULTURAL VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
CHILDHOOD PLACE OF RESIDENCE					
Village	1.58**	1.62**	1.61**	1.67**	1.54**
Town	1.08	1.11	1.11	1.12	1.05
RELIGION					
Other		1.10	0.91	0.95	0.88
Protestant		0.71***	0.68***	0.68***	0.66***
ETHNICITY					
Bemba speaking			0.65**	0.63**	0.61**
Tonga speaking			0.70	0.69*	0.63**
North-Western			0.82	0.80	0.66
Barotse			1.26	1.17	1.15
Nyanja speaking			0.85	0.82	0.78
TYPE OF MARITAL UNION					
Never married				1.26	na
Formerly married				1.48**	1.49**
Polygamous				0.79	0.80
AGE AT FIRST MARRIAGE					
Less than 15					1.09
15 - 19					0.99
Model Chi-square (X^2)	9.95	17.81	28.95	36.04	34.62
Degrees of freedom (df)	2	4	9	12	13

*** p<0.01; ** p<0.05; * p<0.10

Table 6.9 presents exponentiated regression coefficients in the form of relative risk of neonatal mortality associated with cultural factors. Whereas model 1 presents the main effects of childhood place of residence only, models 2,3,4 and 5 add religion, ethnicity, type of marital union and age at first marriage to model 1, and subsequent models, respectively. In all models, net effects and possible interactions are noted.

Model 5, therefore, reflects the combined net effects of all selected cultural variables. For exploration of cultural effects, all variables are included in the models; even those variables such as mother's age first marriage which fail to qualify by the selection criteria.

From model 1, the results support findings from the univariate analysis that children whose mothers spent their first 12 years of childhood in villages are at increased risk of dying than children whose mothers were brought up in the cities.

However, controlling for other cultural variables, as shown by model 5, does little to explain the more than 50 percent risk that is associated with mothers being brought up in villages. This is the case despite the fact that controlling for mother's religious background and her type of marital union tends to worsen the mortality risk for such children. While model 2 shows lowest mortality risk amongst children of Protestant mothers and highest risk for other religious backgrounds, controlling for other cultural variables such as ethnicity and mother's age at first marriage improves the survival chances of children from Protestant mothers. In fact, such children have more than one-third increased survival chances than children of Catholic mothers. Similarly, controlling for both mother's type of marital union and her age at first marriage also improves the survival chances of children from the major ethnic groups with Bemba and Tonga speaking children having higher survival chances.

Overall, however, only mother's age at first marriage has little effect on neonatal mortality while mother's religion, her childhood place of residence, her ethnicity and type of marital union have statistically significant influences on childhood mortality during the first month of life.

6.5.2.2 The Effect of Cultural Factors on Post-neonatal Mortality

Table 6.10 presents the results of a hazards regression analysis of post-neonatal mortality according to cultural factors.

TABLE 6.10: RESULTS OF A HAZARD MODEL ANALYSIS OF POST-NEONATAL MORTALITY: RELATIVE RISK OF POST-NEONATAL MORTALITY ASSOCIATED WITH CULTURAL FACTORS.

CULTURAL VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
TYPE OF MARITAL UNION					
Never married	0.80	0.83	0.82	na	na
Formerly married	1.36***	1.35**	1.34**	1.33**	1.34**
Polygamous	1.31***	1.41***	1.42***	1.42***	1.42***
ETHNICITY					
Bemba speaking		1.10	1.10	1.14	1.14
Tonga speaking		0.69**	0.69**	0.72**	0.72**
North-Western		0.92	0.92	0.95	0.95
Barotse		1.05	1.06	1.11	1.09
Nyanja speaking		0.93	0.94	0.96	0.95
CHILDHOOD PLACE OF RESIDENCE					
Village			1.01	0.98	0.98
Town			1.10	1.03	1.04
AGE AT FIRST MARRIAGE					
Less than 15				0.93	0.93
15 - 19				1.05	1.05
RELIGION					
Other					1.15
Protestant					0.99
Model Chi-square (X^2)	14.04	29.53	30.49	27.51	28.03
Degrees of freedom (df)	3	8	10	11	13

*** p<0.01; ** p<0.05; * p<0.10

Like Table 6.9, model 5 presents the net post-neonatal mortality risk while controlling for all selected cultural variables.

Unlike the first month of life, only mother's type of marital union and her ethnic background have strong association with post-neonatal mortality.

While controlling for other cultural variables explain some of the effects associated with children of formerly married mothers, the reverse is true of children from polygynous unions whose mortality risk worsens by 35 percent. This is especially the case when mother's ethnicity is controlled for. This further points to certain ethnic practices that tend to worsen the survival chances of children in polygynous unions. Moreover, controlling for mother's age at first marriage worsens some of the survival chances of children from many ethnic backgrounds. Mortality risk is highest amongst children whose mothers are Bemba speaking, while children of Tonga speaking mothers continue to have highest survival chances.

Overall, however, there is little effect on post-neonatal mortality from mother's childhood place of residence, religious background and her age at first marriage.

6.5.2.3 **The Effect of Cultural Factors on Child Mortality**

Table 6.11 presents child mortality risks that are associated with the selected cultural factors. From the five models presented in Table 6.11, only mother's type of marital union has a strong association with child mortality.

Particularly important is that children from polygamous unions have the highest risk of dying later in childhood than children from monogamous unions.

TABLE 6.11: **RESULTS OF A HAZARD MODEL ANALYSIS OF CHILD MORTALITY: RELATIVE RISK OF CHILD MORTALITY ASSOCIATED WITH CULTURAL FACTORS.**

CULTURAL VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
TYPE OF MARITAL UNION					
Never married	0.64	0.63	0.63	na	na
Formerly married	1.24	1.23	1.22	1.21	1.21
Polygamous	1.40**	1.44**	1.50**	1.50**	1.50**
CHILDHOOD PLACE OF RESIDENCE					
Village		0.95	0.97	0.96	0.97
Town		1.16	1.15	1.13	1.13
ETHNICITY					
Bemba speaking			1.09	1.13	1.11
Tonga speaking			0.82	0.85	0.86
North-Western			0.98	1.02	1.03
Barotse			1.30	1.44	1.45
Nyanja speaking			1.06	1.08	1.05
AGE AT FIRST MARRIAGE					
Less than 15				0.97	0.97
15 - 19				1.10	1.10
RELIGION					
Other					0.89
Protestant					0.91
Model Chi-square (X^2)	7.58	9.51	13.54	12.45	12.91
Degrees of freedom (df)	3	5	10	11	13

*** $p<0.01$; ** $p<0.05$; * $p<0.10$

Moreover, controlling for other cultural variables such as mother's childhood place of residence and her ethnic background elevates children's mortality risk by 25 percent. This means that children from polygamous unions are 50 percent at increased risk of dying even when other cultural factors are taken into account. On the other hand, little influence is noted from other cultural factors despite children of Lozi speaking mothers having highest mortality risk while Tonga speaking children continuously show better survival chances during the first five years of life. Overall, therefore, this cultural analysis shows that many cultural influences on childhood mortality are largely restricted to the first month of life and thereafter declines with increasing age of the child. Although children from polygamous unions have better survival chances during the first month of life, the reverse is true during late childhood. On the other hand, mortality inequalities resulting from other cultural factors such as mother's religious affiliation and her ethnic background are minimal as the child grows further suggesting the importance of cultural practices that may surround child birth in some communities. Alternatively, these results show that while different cultural factors may have varying effects on childhood mortality risk during the first month of life, that may not be the case as children grow when they are more likely to be affected by the socio-economic situation surrounding their households.

6.5.3 Socio-economic and Cultural Correlates of Mortality

6.4.3.1 Introduction

This section is an attempt to build the socio-economic and cultural determinants block as discussed in the conceptual framework.

To achieve this aim, logistic and Cox hazards regression models are applied on neonatal, postneonatal and child mortality using similar procedures discussed earlier in the analytical section. However, the socio-economic variables are entered as a block into the regression model while cultural variables are entered individually. This is an attempt to examine co-variations between cultural and socio-economic variables. The ultimate aim, therefore, is to select the most discriminating of both socio-economic and cultural factors to form the socio-economic and cultural determinants block, which in later chapters is examined with intermediate behavioral and proximate determinants, in an attempt to explore pathways through which socio-economic and cultural determinants influence child survival.

6.5.3.2 <u>The Effects of Socio-economic and Cultural Factors on Neonatal Mortality</u>

To investigate the effect of both socio-economic and cultural factors on neonatal mortality, five regression models have been constructed as illustrated by Table 6.12.

Model 1 shows the net effect of socio-economic factors in the absence of controls for cultural factors. On the other hand, model 5 presents a full model of combined socio-economic and cultural factors.

Comparing estimated coefficients between model 1 and model 5, it is shown that household number of children, household bicycle, province of residence and father's occupation continue to exert some significant influence on neonatal mortality. This is in spite of controlling for the effects of selected cultural variables. Although the control for cultural variables has little effect on the relationship between household number of children, household bicycle and childhood mortality during the first month of life, remarkable changes are noted between province of residence and neonatal mortality. With only exception of Southern, Northern and Luapula Provinces, controlling for *cultural variables worsens* the mortality risk of children in other provinces.

Table 6.12: RESULTS OF A LOGISTIC REGRESSION ANALYSIS OF NEONATAL MORTALITY: RELATIVE RISKS OF SOCIO-ECONOMIC AND CULTURAL CORRELATES OF MORTALITY.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
SOCIO-ECONOMIC VARIABLES					
Household Children Size					
3+	0.21***	0.21***	0.21***	0.21***	0.21***
2	0.30***	0.30***	0.30***	0.30***	0.30***
None	2.72***	2.69***	2.74***	2.76***	2.80***
Household Bicycle					
No	0.58***	0.58***	0.59***	0.59***	0.57***
Province of Residence					
Central	2.71	2.69	2.80	2.79	2.78
Copperbelt	2.75	2.69	3.20	3.23	3.17
Eastern	4.34*	4.11*	4.84*	4.50*	4.80*
Luapula	3.40	3.32	3.60	3.41	3.35
Northern	3.21	2.95	2.75	2.73	2.68
North-Western	3.93*	3.91*	5.93*	5.80*	6.50**
Southern	2.87	2.94	2.79	2.70	2.70
Western	4.11*	4.03*	4.22	4.08	4.24
Father's Occupation					
Never Worked	1.05	1.04	1.07	1.04	1.00
Agricultural Self-employed	1.67**	1.64*	1.63*	1.61*	1.73**
Blue Collar	1.25	1.23	1.26	1.27	1.25
Place of Residence					
Village	0.33	0.34	0.32	0.32	0.31
Town	0.45	0.46	0.40	0.42	0.42
City	0.24	0.24	0.20	0.21	0.20
Household Economic Status					
Low	1.76	1.74	1.66	1.66	1.57
Household Size					
10+	1.44	1.45	1.48	1.46	1.50
5-9	1.17	1.18	1.17	1.16	1.18
Access to Water					
15+ Minutes	0.80	0.80	0.81	0.81	0.80
Mother's Education					
No Education	0.91	0.90	0.93	0.85	0.87
Primary	0.84	0.84	0.84	0.78	0.79
CULTURAL VARIABLES					
Religion					
Other		1.00	0.92	0.91	0.98
Protestant		0.75*	0.71**	0.72*	0.72*
Ethnicity					
Bemba Speaking			0.69	0.70	0.67
Tonga Speaking			0.81	0.80	0.78
North-Western			0.47	0.47	0.40*
Barotse (Lozi speaking)			0.82	0.83	0.72
Nyanja speaking			0.53**	0.53**	0.49**
Childhood Place of Residence					
Village				1.13	1.13
Town				0.87	0.88
Type of Marital Union					
Never Married					na
Formerly Married					1.56**
Polygamous					0.75
Model Chi-square (X^2)	157.55	160.54	168.85	170.19	176.71
Degrees of freedom (df)	24	26	31	33	35

*** $p<0.01$; ** $p<0.05$; * $p<0.10$

Particularly significant is the increase in mortality risk for children in North-Western and to a lesser extent Copperbelt Provinces.

In North-Western Province, for example, controlling for mother's ethnicity elevates the mortality risk of children by 68 percent. Further control for mother's type of marital union worsens the mortality risk by six times for children from North-Western Province relative to children in the reference province of Lusaka. As for Copperbelt Province, controlling for cultural factors increases children's mortality risk by 24 percent. Neonatal mortality is also high in Eastern Province where children are almost five times more likely to die during the first month of life than children from Lusaka Province. Generally, however, mortality levels in all the provinces have more than twice the risk than to Lusaka.

For father's occupation, mortality risk is only elevated among children of agricultural self-employed fathers especially when mother's type of marital union is controlled for. The control for cultural variables also increases the mortality risk of children from agricultural self-employed fathers by 9 percent.

As for cultural variables, only mother's childhood place of residence shows no statistically significant effect on neonatal mortality when socio-economic variables are taken into account. Although mortality risk is still lowest among children of Protestant mothers and almost all major ethnic groups, children of formerly married mothers are 56 percent at higher risk of dying during the first month of life than children from monogamous unions.

Surprisingly, however, and after controlling for all selected variables, children from ethnic groups resident in the North-Western Province have the highest survival chances compared to other ethnic groups.

6.5.3.3 **The Effect of Socio-economic and Cultural Factors on Post-neonatal Mortality**

Table 6.13 presents four hazards regression models with model 1 showing the net effect of socio-economic variables while model 4 shows a full model including both socio-economic and cultural variables.

Comparing models 1 and 4, the table above shows that controlling for cultural variables has little impact on the relationship between socio-economic variables and post-neonatal mortality. However, controlling for mother's type of marital union accounts for the significance associated with province of residence, although children in Luapula Province continue to have about 69 percent higher mortality risk than children of Lusaka Province. Even when cultural variables are taken into account, household number of children, father's occupation and mother's education continue to exert some significant influence on post-neonatal mortality. Caution must be taken, however, with children of never worked fathers since the estimates are based on fewer than 500 births. On the other hand, controlling for cultural variables accounts for some of the risk associated with the mortality-prone households.

In the case of cultural variables, only mother's type of marital union remains statistically significant when socio-economic variables are accounted for.

Table 6.13: RESULTS OF A COX HAZARDS REGRESSION ANALYSIS OF POST-NEONATAL MORTALITY: RELATIVE RISK OF SOCIO-ECONOMIC AND CULTURAL CORRELATES OF MORTALITY.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4
SOCIO-ECONOMIC VARIABLES				
Household Children Size				
3+	0.22***	0.21***	0.21***	0.21***
2	0.35***	0.35***	0.35***	0.35**
None	3.15***	3.07***	3.03***	3.03***
Father's Occupation				
Never Worked	0.44**	0.44**	0.45**	0.45**
Agricultural Self-employed	1.00	0.99	0.99	0.99
Blue Collar	0.98	0.96	0.96	0.96
Province of Residence				
Central	0.97	0.96	0.96	0.96
Copperbelt	1.21	1.18	1.15	1.15
Eastern	1.41	1.36	1.52	1.53
Luapula	1.73*	1.67	1.69	1.69
Northern	1.67	1.57	1.62	1.63
North-Western	1.09	1.04	1.00	1.00
Southern	1.16	1.10	1.06	1.05
Western	1.45	1.39	1.32	1.33
Place of Residence				
Village	0.89	0.88	0.83	0.82
Town	0.97	0.97	0.93	0.93
City	1.10	1.13	1.13	1.12
Mother's Education				
No Education	1.15	1.14	1.15	1.15
Primary	1.24*	1.25*	1.26*	1.26*
Access to Electricity				
No	1.24	1.23	1.22	1.22
CULTURAL VARIABLES				
Type of Marital Union				
Never Married		na	na	na
Formerly Married		1.18	1.17	1.17
Polygamous		1.37***	1.37***	1.37***
Ethnicity				
Bemba Speaking			1.05	1.06
Tonga Speaking			1.12	1.12
North-Western			1.11	1.11
Barotse (Lozi Speaking)			1.13	1.14
Nyanja Speaking			0.93	0.94
Religion				
Other				1.01
Protestant				1.04
Model Chi-square (X^2)	755.00	756.35	733.96	733.50
Degrees of Freedom (df)	20	22	27	29

*** p<0.01; ** p<0.05; * p<0.10

Unlike the first month of life during which children from polygynous unions are at reduced mortality risk, children from such marital unions are 37 percent at increased post-neonatal risk of dying.

Overall, only household and individual-level socio-economic variables continue to exert influence on post-neonatal mortality. This is unlike the first month of life when community, household and individual-level variables have considerable influence on mortality. As for cultural variables, only mother's type of marital union continues to have any statistical significance on post-neonatal mortality.

6.5.3.3 **The Effect of Socio-economic and Cultural Factors on Child Mortality.**

Table 6.14 presents four hazards regression models of the association between socio-economic and cultural factors, and child mortality.

While model 1 presents the net effect of socio-economic variables on child mortality, model 4 presents the effect of both socio-economic and cultural variables.

Although the overall control for cultural variables accounts for some of the mortality risk associated with household number of children and nearly all Zambian provinces, it elevates the risk for children by mother's education, and those children whose mothers are currently working as unpaid workers. This is also true for children in Eastern Province. For example, controlling for cultural variables and especially mother's childhood place of residence increases the mortality risk of children from mothers with no education and those with only primary education by 24 and 16 percent, respectively.

As for children of mothers working as unpaid workers and despite being based on fewer births, controlling for cultural variables worsens the mortality risk of such children.

TABLE 6.14: RESULTS OF A COX HAZARDS REGRESSION ANALYSIS OF CHILD MORTALITY: RELATIVE RISK OF SOCIO-ECONOMIC AND CULTURAL CORRELATES OF MORTALITY.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4
SOCIO-ECONOMIC VARIABLES				
Household Children Size				
3+	0.18***	0.17***	0.17***	0.17***
2	0.30***	0.29***	0.29***	0.29***
None	3.86***	3.81***	3.81***	3.75***
Mother's Education				
No Education	1.41	1.33	1.36	1.51*
Primary	1.56**	1.53**	1.54**	1.65**
Mother's Current Type of Employment				
Not Working	1.09	1.07	1.06	1.07
Unpaid Worker	2.06*	2.17**	2.18**	2.19**
Self-employed	1.18	1.14	1.15	1.16
Province of Residence				
Central	0.73	0.72	0.65	0.66
Copperbelt	1.45*	1.44*	1.32	1.30
Eastern	1.51*	1.40	1.64*	1.74**
Luapula	1.09	1.03	0.92	1.01
Northern	1.43	1.30	1.21	1.25
North-Western	0.85	0.75	0.57	0.62
Southern	1.22	1.15	0.98	1.02
Western	1.11	1.07	0.76	0.81
Access to Electricity				
No	1.23	1.24	1.25	1.26
CULTURAL VARIABLES				
Type of Marital Union				
Never Married		0.57	0.57	0.55
Formerly Married		1.06	1.05	1.03
Polygamous		1.48**	1.47**	1.48**
Ethnicity				
Bemba Speaking			1.20	1.18
Tonga Speaking			1.21	1.25
North-Western			1.41	1.40
Barotse (Lozi Speaking)			1.60	1.58
Nyanja Speaking			0.87	0.86
Childhood Place of Residence				
Village				0.83
Town				1.10
Model Chi-square (X^2)	470.37	474.93	478.24	481.52
Degrees of Freedom (df)	17	20	25	27

*** p<0.01; ** p<0.05; * p<0.10

Particularly important here is the control for mother's type of marital union.

In the case of province of residence, controlling for both mother's ethnicity and childhood place of residence elevates the mortality risk of children in Eastern Province by 85 percent. Among the selected cultural variables, only mother's type of marital union remains significant even after both socio-economic and other cultural variables are controlled for. Children from polygamous unions remain at 48 percent increased risk of dying during late childhood compared to their counterparts from monogamous unions.

Overall, therefore, household and individual-level socio-economic variables such as household number of children and mother's education have emerged as major determinants of childhood mortality even when cultural variables are controlled for. Moreover, only one cultural variable namely mother's type of marital union continues to exert significant influence on late childhood mortality even after controlling for socio-economic variables.

6.6 OVERVIEW

Several conclusions arise from this analysis of the effect of socio-economic and cultural factors on overall childhood mortality in Zambia.

During the first month of life, there is a remarkable influence on mortality from three tiers of community, household and individual-level socio-economic factors which include province of residence, household number of children, household ownership of a bicycle and father's occupation. During this time there is also substantial influence on mortality from cultural factors such as religion, ethnicity and mother's type of marital union. As the child grows, however, there is evidence of the increasing role of household and individual-level socio-economic factors with mother's education emerging as one of the most key individual-level socio-economic determinants. This is accompanied by a declining role of cultural factors, except for mother's type of marital union where children in polygamous unions are at increased risk of dying with increasing age of the child.

Although province of residence is statistically significant for both neonatal and child periods, but not for post-neonatal, the regional effect is weakened dramatically with increasing age of the child.

Overall, however, this chapter shows that while both community-level socio-economic and associated cultural factors have major influence during the first month of life, their role during late childhood is reduced as children are exposed more to the socio-economic environment surrounding their households. This is especially reflected by the increasing contribution of both household and individual-level socio-economic factors such as mother's education. Moreover, the significant role of cultural factors is largely restricted to the first month of life, except for children in polygamous unions whose worsened mortality risk is possibly a reflection of the socio-economic inequalities within such unions as children are further exposed to factors influencing their household's economic status.

CHAPTER SEVEN

INTERMEDIATE BEHAVIOURAL DETERMINANTS OF CHILDHOOD MORTALITY

7.1 INTRODUCTION

In order to develop one of the major modifications to the Mosley-Chen child survival framework, Chapter Seven aims to identify the main intermediate behavioural variables whose effects, when combined with proximate determinants (discussed in Chapter Eight), would contribute to an explanation of the socio-economic and cultural mortality differentials amongst Zambian children. To achieve this objective, family, feeding, reproductive, and health care behavioural variables are constructed and operationally defined. Secondly, respective mortality differentials and patterns are assessed and significant variables are then selected on the basis of both their relative and population attributable risks.

To summarise the univariate analytical procedure, one-variable gross effect models are constructed for selecting those variables that are statistically significant and are later incorporated into the multivariate analysis.

7.2 DEFINITION AND CONSTRUCTION OF VARIABLES

The construction of intermediate behavioural variables on the basis of existing behavioural literature on child survival and data availability is divided into four main categories. These are family behavioural factors, feeding behavioural factors, reproductive behavioural factors and health care behavioural factors. Within these categories are the following variables:

Family Behavioural Variables: Household density, Kinship and Drinking/washing water source;

Feeding Behavioural Variables: Duration of breastfeeding, Age for plain water, Age for formula or other milk, Age for other liquids, and Age for solid or mushy food;

Reproductive Behavioural Variables: Duration of sexual abstinence, Sex while breastfeeding, Number of marital unions, Ever use of any family planning (FP) method, Current use by FP method, and Discussion of FP with partner;

Health Care Behavioral Variables: Tetanus toxoid vaccination, Prenatal care, Place of delivery and Assistance at delivery.

7.2.1 Family Behavioural Variables

7.2.1.1 <u>Household Density</u> (Persons per sleeping room)

Based on the significant effects of general household size and household number of children on childhood mortality (as seen in Chapters Five and Six), a proxy for household crowding has been constructed using the number of persons per sleeping room within a household. Not only does crowding reflect extended family living arrangements and social control as linked to the concepts of health and disease, but it also reflects the degree of contagion of respiratory infection (Da Vanzo, 1984; Aaby, 1992). According to Aaby, the more susceptible individuals living together are, the greater the risk that someone will be exposed intensively. This is especially true with issues of overcrowding, intensive exposure and measles mortality. While household density may reflect pressure on household resources, it may also reflect kinship economic survival strategies as shown in earlier studies in Zambia on aspects of domesticity and family relationship (Ohadike, 1971; UNECA/CSO, 1985). Culturally, crowding resulting from extended family co-residence may be a carry-over of the socio-economic strategy of fulfilling kinship obligation (Ohadike, 1971).

TABLE 7.1: DISTRIBUTION OF BIRTHS BY FAMILY BEHAVIORAL VARIABLES

VARIABLE	NUMBER	PERCENTAGE
HOUSEHOLD DENSITY		
0-2 persons per room	1237	19.0
3 persons per room	2231	34.3
4 persons per room	1610	24.8
5+ persons per room	1418	21.8
KINSHIP		
Relative	1413	21.7
Own child	5104	78.3
DRINKING/WASHING WATER SOURCE		
Same	6201	95.1
Different	319	4.9

The household density variable is therefore categorized into four groups of 0-2, 3, 4, and 5+ persons per sleeping room. The last category is used here as baseline reference.

7.2.1.2 Kinship

Due to design problems of retrospective birth history data, this study is unable to investigate the effect of fosterage, that is, arrangements in which children live in different households from their biological mothers. Instead, the variable "kinship" attempts to identify mortality differentials between biological children of heads of households and other children residing with biological mothers who in turn are related in many ways to the head of the household. Evidence from the Zambian sample shows a low proportion of children residing away from biological mothers before their fifth birthday. As illustrated by Table 7.1, almost 22 percent of births in the sample are children of relatives to household heads. Kinship is therefore divided into two categories of "relative" and "own child", using the latter as baseline reference category.

7.2.1.3 Drinking/Washing Water Source

Although drinking and washing water sources are discussed in Chapter Eight within a micro-environmental perspective, the question as to whether households use the same water source for drinking and washing is used here as a proxy for family behaviour on household exposure to water-borne infection.

It is clear, however, as shown by Table 7.1, that over 95 percent of births are from households using the same water source for drinking and washing. The variable has two categories and uses births from households using different water sources for drinking and washing as reference.

7.2.2 Feeding Behavioural Variables

7.2.2.1 Duration of Breastfeeding

The construction of this variable is aimed at investigating the association between breastfeeding duration and childhood mortality. Although the study excludes all those children who were never breastfed, the analysis is also restricted to children aged at least one month. Ideally, analysis would have been restricted to children aged at least one year since almost all children dying during the first year of life are more likely to be breastfed until death. Also important here is the problem of reverse causation that has not been controlled for in this study. While shorter duration of breastfeeding may elevate mortality risk, it might also result from an early child death. For comparative purposes, however, it is decided that breastfeeding duration for children aged 1-11 and 12-60 months are both analysed.

For the purposes of this study, the duration of breastfeeding is divided into three categories, namely 0-6, 7-18 and 19+ months using the last category as reference.

7.2.2.2 Supplementary Feeding

With the exception of breastfeeding, other forms of feeding and particularly supplementary feeding involves questions on age at which a child is introduced to **Plain Water, Formula or Other Milk, Other Liquids**, and **Solid or Mushy Food.**

TABLE 7.2: DISTRIBUTION OF BIRTHS BY FEEDING BEHAVIORAL VARIABLES

VARIABLE	NUMBER	PERCENTAGE
DURATION OF BREASTFEEDING		
0-6 months	1105	19.8
7-18 months	2901	52.0
19+ months	1575	28.2
AGE FOR PLAIN WATER		
Not given	261	4.5
0 months	4100	71.6
1+ months	1369	23.9
AGE FOR FORMULA OR OTHER MILK		
Not given	4247	74.9
0-3 months	810	14.3
4+ months	617	10.9
AGE FOR OTHER LIQUIDS		
Not given	1757	31.1
0-3 months	1280	22.7
4+ months	2614	46.3
AGE FOR SOLIDS OR MUSHY FOOD		
Not given	772	13.5
0-3 months	1860	32.6
4+ months	3074	53.9

Since over two-thirds of children are introduced to plain water within the first month of life, age for plain water as illustrated by Table 7.2 is categorised into three groups of "not given", "0 months" and "1+ months". On the other hand, other supplementary feeding variables are categorised into "not given", "0-3 months" and "4+ months". Although all supplementary feeding variables include "not given" amongst their categories, this group should be interpreted with caution as it is likely to include many children dying before they could be introduced to the respective feeding practices, or those that were sickly.

While most births in this sample are introduced to other liquids and solids or mushy food after the fourth months of life, almost 75 percent of children are not given infant formula or other milk supplements. Lack of introducing formula or other milk amongst the "not given" category may reflect influences of public health education associated with the infant formula campaign or the fact that many households in Zambia can not afford the cost of infant formula in particular.

Like duration of breastfeeding, analysis of supplementary feeding variables is restricted to children aged 1-11 and 12-60 months.

7.2.3 **Reproductive Behavioural Variables**

7.2.3.1 **Duration of Sexual Abstinence**

The importance of postpartum sexual abstinence as an element of Sub-Saharan African child spacing pattern is well known. The distribution of births according to the following categories of "0-2 months", "3-6 months" and 7+ months, as demonstrated in Table 7.3, shows a normally distributed pattern of postpartum sexual abstinence. Almost 50 percent of births come from the 3-6 months duration of sexual abstinence.

7.2.3.2 **Sex while Breastfeeding**

To complement information on duration of sexual abstinence, an attitude variable on sexual relations while breastfeeding is included. As shown by Table 7.3, over 85 percent of births belong to women who think it does not matter when a mother resumes sexual relations while breastfeeding.

TABLE 7.3: DISTRIBUTION OF BIRTHS BY REPRODUCTIVE BEHAVIORAL VARIABLES

VARIABLE	NUMBER	PERCENTAGE
DURATION OF SEXUAL ABSTINENCE		
0-2 months	1440	25.7
3-6 months	2725	48.6
7+ months	1446	25.8
SEX WHILE BREASTFEEDING		
Wait	936	14.3
Doesn't matter	5594	85.7
NUMBER OF MARITAL UNIONS		
More than once	1141	18.5
Once	5037	81.5
EVER USE OF ANY FP METHOD		
Never used	3075	47.0
Traditional	1609	24.6
Modern	1860	28.4
CURRENT USE BY FP METHOD		
No method	5450	83.3
Traditional	520	7.9
Modern	574	8.8
DISCUSSION OF FP WITH PARTNER		
Never	1928	35.3
Once or twice	1896	34.7
More often	1645	30.1

Births are therefore divided into two categories of mothers who think a mother should wait and those who think otherwise. Births belonging to the latter category are used as reference.

7.2.3.3 Number of Marital Unions

As a follow up to the cultural factors associated with mother's with type of marital union, as discussed earlier in Chapter Six, the number of marital unions the mother has been involved in is used as a proxy for behavioral issues associated with marital instability and the impact that might have on child survival. This is also likely to reflect certain issues linked to children who may not be biological children of the mother's current spouse. The variable is therefore divided into two categories of mothers: those who have married more than once and those who have married only once. The latter group which comprises almost 82 percent of births is used here as reference category.

7.2.3.4 Issues of Family Planning

The last three reproductive behavioral variables presented in Table 7.3 are associated with use and discussion of family planning methods amongst mothers and their spouses. Although births are almost equally distributed according to mothers discussing family planning with their spouses as categorised into "never", "once or twice", and "more often", 83 percent of births are to mothers currently not using any method of family planning. Almost equal proportions of births are to mothers who have used family planning at one time and those currently using either traditional or modern methods of family planning. It should be noted here that traditional methods include some folkloric practices too. While each variable includes three respective categories, those of mothers ever and currently using modern methods are used as reference. For the discussion of family planning with partners, births belonging to mothers often discussing family planning with spouses are taken here as reference.

7.2.4 Health Care Behavioural Variables

7.2.4.1 Tetanus Toxoid Vaccination

Tetanus vaccination is taken here not only as proxy for tetanus protection, but also as a reflection of mother's access to general health services and particularly prenatal care.

TABLE 7.4: DISTRIBUTION OF BIRTHS BY HEALTH CARE BEHAVIORAL VARIABLES.

VARIABLE	NUMBER	PERCENTAGE
TETANUS VACCINATIONS		
None	1096	19.2
One	2382	41.7
Two+	2232	39.1
PRENATAL CARE		
None	403	7.1
Some care	5264	92.9
PLACE OF DELIVERY		
Home	2904	50.7
Health centre	2828	49.3
ASSISTANCE AT DELIVERY		
None	396	6.9
Birth attendants	563	9.8
Relatives	1994	34.7
Medical personnel	2797	48.6

During the survey mothers were asked how many times they received tetanus injections during pregnancy of an index child. Based on respective responses, the births have been grouped into the following categories of "none", "one", and "at least two" as shown in Table 7.4.

Over 80 percent of births are amongst mothers given at least one injection of tetanus toxoid. The category of at least two vaccinations is used as reference.

7.2.4.2 **Prenatal Care**

This variable splits births into two groups according to whether mothers have prenatal care for the index child or not. However, Table 7.4 shows that only 7 percent of births have no prenatal care.

7.2.4.3 **Place of Delivery**

Despite almost 93 percent of births having received some prenatal care, less than half of all births are delivered at health centres. The variable, therefore, splits births into categories of those delivered at home and those delivered at health centres. Health centres here include both public and private hospitals and clinics.

7.2.4.4 **Assistance at Delivery**

Closely linked to place of delivery is the assistance received at birth of a child. The variable is divided into types of assistance received according to person(s) who assisted with the delivery. Births are therefore divided into four categories according to persons giving assistance at delivery. The categories are "none", "birth attendants", "relatives", and "medical personnel". While the category of birth attendants includes both trained and untrained attendants, medical personnel includes doctors, clinical officers, nurses and midwives.

As expected from the distribution of births according to place of delivery, almost 35 percent of all births are delivered by relatives and only about 10 percent by birth attendants. On the other hand, the no assistance category, comprising almost 7 percent of births, is likely to include mostly older mothers with previous experience of child birth.

7.3 UNIVARIATE ANALYSIS

7.3.1 Neonatal Mortality

7.3.1.1 Mortality Differentials According to Family Behavioral Factors

Table 7.5 presents neonatal mortality rates according to the three family behavioral factors of household density, kinship and drinking/washing water source.

On the basis of population attributable risk (PAR) of at least 10 percent, the most significant variables within the family behavioral contexts are household density and to a lesser kinship.

TABLE 7.5: NEONATAL MORTALITY BY FAMILY BEHAVIOURAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
HOUSEHOLD DENSITY					
0-2	79.9	8.2	2.23	54.2	1237
3	45.9	4.6	1.28	14.6	2231
4	22.0	3.7	0.61	na	1610
5+	35.9	5.1	1.00	-	1418
KINSHIP					
Relative	59.0	6.6	1.50	9.8	1413
Own child	39.4	2.8	1.00	-	5104
DRINKING/WASHING WATER SOURCE					
Same	44.0	2.7	1.06	5.4	6201
Different	41.6	11.5	1.00	-	319

The risk difference between children of households using same and those using different sources of water for both washing and drinking is small at only 5 percent. However, the effect of household density (measured by number of persons per sleeping room) on neonatal mortality exhibits a U-shaped pattern. With lowest risk at 4 persons per sleeping room, the risk of dying during the first month of life increases with declining number of persons per sleeping room. Only with at least five persons per sleeping room is there an increasing risk of dying. Children in households with density of less than 3 persons are over twice at risk of dying compared with households of at least 5 persons per sleeping room. It should be noted here that results from the crowding variable are possibly influenced by unobservable endogeneity and especially that included dead children no longer contribute to household crowding since they are dead. On the other hand, children in households of 4 persons per room are at

40 percent reduced risk of dying relative to the reference category. This result suggests that households perceived as crowded are otherwise healthier and might be influenced by other socio-economic factors. It also suggests that crowding in those households is in itself a result of higher survival chances among residing children.

Mortality differentials by kinship are remarkable when children of heads of households and those of their dependent relatives are compared. During the first month of life, children of relatives are at 50 percent increased risk of dying compared to biological children of household heads. This is despite those children's dependent mothers living together within the same households. One possible reason is in the way different mothers within the same household utilise health care services. Moreover, some mothers are also more likely to care for their new born during the first month of life. In most cases, however, dependent mothers tend to have lower levels of education than household heads.

7.3.1.2 Mortality Differentials by Reproductive Behavioral Factors

On the basis of the selection criteria for probable public health significance using the population attributable risk (PAR) of at least 10 percent, Table 7.6 shows that almost all considered reproductive behavioral variables have remarkable influence on mortality during the first month of life, with exception of two variables namely sex while breastfeeding and number of marital unions. Although both sex while breastfeeding and the number of marital unions have little probable public health significance on the basis of the proportion of births exposed to risk, children of mothers who think it is preferable not to have sexual relations while breastfeeding are at 37 percent higher risk of dying than children whose mothers thought it did not matter.

TABLE 7.6: NEONATAL MORTALITY BY REPRODUCTIVE BEHAVIORAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
DURATION OF SEXUAL ABSTINENCE					
0-2 months	83.2	7.8	3.30	53.4	1440
3-6 months	34.0	3.6	1.35	18.6	2725
7+ months	25.2	4.2	1.00	-	1446
SEX WHILE BREASTFEEDING					
Wait	57.1	7.9	1.37	5.0	936
Doesn't matter	41.6	2.8	1.00	-	5594
NUMBER OF MARITAL UNIONS					
More than once	47.6	6.5	1.12	2.2	1141
Once	42.6	2.9	1.00	-	5037
EVER USE OF ANY FP METHOD					
Never used	49.0	4.0	1.40	20.0	3075
Traditional	43.8	5.3	1.25	10.4	1609
Modern	35.0	4.4	1.00	-	1860
CURRENT USE BY FP METHOD					
No method	45.8	2.9	1.29	20.8	5450
Traditional	31.3	7.8	0.88	na	520
Modern	35.5	7.9	1.00	-	574
DISCUSSION OF FP WITH PARTNER					
Never	54.3	5.4	1.37	16.6	1928
Once or twice	30.5	4.0	0.77	na	1896
More often	39.7	5.0	1.00	-	1645

This mortality difference is possibly explained by socio-economic inequalities since mothers in the former category are most likely to belong to lower economic status. Many such women tend to be more traditional than mothers in the former category, and are more unlikely to use any family planning method. Expectedly, children of mothers married more than once have higher mortality risks than children whose mothers are in one stable relationship. However, mortality differentials are greatest by duration of postpartum sexual abstinence and smallest by number of marital unions. Index children whose mothers abstained from sexual relations for up to 2 months are over 3 times at risk of dying compared to those whose mothers abstained for at least 7 months. There is clear evidence, however, to show that neonatal mortality is inversely associated with duration of sexual abstinence. On the other hand caution should be taken in considering the 0-2 months category where shortened sexual abstinence could have resulted from a child death thus elevating relative risks between the groups considered here.

Children of mothers who have never used any method of family planning are at 40 percent increased risk of dying while children of those who used traditional methods at one time are at 25 percent higher risk of dying; both cases compared to children of mothers who used modern methods at some time. Even though neonatal mortality is highest amongst children of mothers currently not using any family planning method, mortality is lowest amongst children of mothers currently using traditional methods of family planning. Children from mothers currently using traditional methods are at more than 10 percent reduced risk of dying compared to children of modern method users.

The observed child survival pattern by usage of family planning method is supported by the effect the discussion of family planning amongst spouses has on mortality. While children of spouses who have never discussed family planning are at 37 percent higher risk of dying compared to children from parents discussing family planning more often, neonatal mortality is lowest amongst children of spouses who have either discussed it once or twice by over 20 percent compared to the reference category.

Overall, the elevated mortality risk among children of mothers who never discuss family planning with their spouses and have never used any family planning method may be explained by their socio-economic status since non-use of family planning might reflect low levels of education and less exposure to "westernisation".

7.3.1.3 Mortality Differentials by Health Care Behavioural Factors

Table 7.7 presents neonatal mortality according to health care behavioural factors. Although only tetanus vaccination has probable public health significance on neonatal mortality, there are remarkable influences on mortality from other health care variables. Expectedly, children whose mothers received no tetanus toxoid injection are at more than twice risk of dying compared to children whose mothers received at least two injections. Mortality differences are also remarkable for children whose mothers had only one injection with 30 percent elevated risk of dying relative to the reference category of at least two injections.

TABLE 7.7: NEONATAL MORTALITY BY HEALTH CARE BEHAVIORAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
TETANUS VACCINATION					
None	70.9	8.2	2.10	35.1	1096
One	43.8	4.3	1.30	13.4	2382
Two+	33.7	3.9	1.00	-	2232
PRENATAL CARE					
None	96.2	15.8	2.24	8.1	403
Some care	41.9	2.8	1.00	-	5264
PLACE OF DELIVERY					
Home	46.5	4.0	1.08	3.9	2904
Health centre	43.0	3.9	1.00	-	2828
ASSISTANCE AT DELIVERY					
None	51.8	11.6	1.20	2.4	396
Birth attendants	36.2	8.1	0.84	na	563
Relatives	49.9	5.1	1.16	6.2	1994
Medical personnel	43.1	4.0	1.00	-	2797

The influence of prenatal care on neonatal mortality is also demonstrated. Index children from mothers without any prenatal care are more than twice as likely to be at risk of dying compared to those from mothers with care, despite births from mothers with medical care only comprising 7 per cent of the sample.

While neonatal mortality is lowest for those births assisted by birth attendants, the risks of dying are highest among births without any assistance and those assisted by relatives at 20 and 16 percent respectively; both compared to births assisted by medical personnel. Observed higher risks of dying amongst births assisted by medical personnel in comparison to those assisted by birth attendants may be attributed to those high risk births likely to have been referred to health institutions possibly by birth attendants themselves.

7.3.2 **Post-neonatal Mortality**

7.3.2.1 Mortality Differentials by Family Behavioral Factors

Table 7.8 presents post-neonatal mortality according to family behavioral factors. While drinking/washing water source and kinship have little influence on post-neonatal mortality differentials, only household density continues to have some significant effect.

TABLE 7.8: POST-NEONATAL MORTALITY BY FAMILY BEHAVIORAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
HOUSEHOLD DENSITY					
0-2	121.7	10.6	2.46	39.9	1142
3	56.5	5.2	1.14	7.9	2131
4	49.4	5.7	1.00	0.0	1575
5+	49.4	6.1	1.00	-	1368
KINSHIP					
Relative	78.8	7.8	1.30	6.0	1332
Own child	60.7	3.6	1.00	-	4907
DRINKING/WASHING WATER SOURCE					
Same	64.9	3.4	1.01	0.9	5934
Different	64.1	14.7	1.00	-	306

Children from households of less than 3 persons per sleeping room are almost 2.5 times at risk of dying relative to those from households of at least 5 persons per sleeping room. Unlike almost 40 percent risk difference during the first month of life, there is no observed difference between 4 and at least 5 persons per sleeping room during the post-neonatal period. On the other hand, children from households of 3 persons per sleeping room are only 14 percent at risk compared to the reference; a 50 percent reduced risk when compared to mortality during the first month of life.

Although children of dependent relatives to heads of households continue having higher risks of dying of around 30 percent during the post-neonatal period, the differences are narrower than those observed earlier for neonatal mortality.

7.3.2.2 Mortality Differentials by Feeding Behavioral Factors

Table 7.9 presents post-neonatal mortality according to five feeding behaviour factors of duration of breastfeeding, age for introduction of plain water, formula or other milk, other liquids and solids or mushy food. The aim here is to identify mortality differentials by varying feeding patterns particularly age at which children are introduced to supplementary feeding.

Although post-neonatal mortality shows inverse association with duration of breastfeeding, the relative risk of 55, for instance, for children breastfed for less than 7 months, as compared to those breastfed for at least 19 months, must be treated with caution since it might include many children whose breastfeeding duration was terminated by their own death. This is possibly true also for the 7-18 months category.

Since over two-thirds of children are given plain water within the first one month of life and that only 5 percent of births are not given water, the category "not given" may relate to many of the children dying before they are given any plain water.

TABLE 7.9: POST-NEONATAL MORTALITY BY FEEDING BEHAVIOURAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
DURATION OF BREASTFEEDING					
0-6 months	247.4	11.1	55.00	95.4	972
7-18 months	41.6	3.8	9.24	84.2	2896
19+ months	4.5	1.7	1.00	-	1573
AGE FOR PLAIN WATER					
Not given	391.8	62.3	9.89	41.0	116
0 months	64.8	4.1	1.64	32.3	3999
1+ months	39.6	5.4	1.00	-	1365
AGE FOR FORMULA OR OTHER MILK					
Not given	67.3	4.2	1.35	23.3	4011
0-3 months	66.2	9.3	1.33	15.7	796
4+ months	49.9	9.1	1.00	-	616
AGE FOR OTHER LIQUIDS					
Not given	131.3	9.6	4.17	53.8	1518
0-3 months	58.9	6.9	1.87	22.2	1275
4+ months	31.5	3.5	1.00	-	2611
AGE FOR SOLID OR MUSHY FOOD					
Not given	309.7	25.5	9.86	56.9	537
0-3 months	57.1	5.6	1.82	23.6	1854
4+ months	31.4	3.2	1.00	-	3069

This is likely to be the case since it is common practice in Zambia, and Sub-Saharan Africa in general, for children to be given plain water within the first few weeks of life (UNECA/CSO, 1985; Cosminsky, Mhloyi and Ewbank, 1993). Nevertheless, children given plain water in the first month of life are at 64 percent higher risk of dying compared to those given after one month. The pattern is similar for age when children are introduced to solid or mushy food. Children not given any solid or mushy food, which again may reflect some earlier deaths, are almost 10 times at risk of dying compared to those children given similar food from the age of 4 months. However, children given solid or mushy food during the first 3 months of life are at 82 per cent higher risk of dying relative to those children given solids during and after the fourth month of life. Although there are similarities in mortality patterns during the post-neonatal period according to age when children are given formula and other liquids and when introduced to plain water and solids or mushy food, almost 75 and over 30 percent of children are not given formula and other liquids, respectively. This is probably because fewer households can afford the cost of formula and other liquids. This means that the "not given" category for formula and other liquids may actually reflect a possible existing mortality situation and might include a proportion of early deaths.

For children not given formula or other milk, mortality risk is elevated by 35 percent while those introduced during the first 3 months of life are 33 percent at higher risk; both cases compared to the reference category of at least 4 months. While children not given other liquids are four times more at risk of dying during the post-neonatal period, a similar pattern of inverse association exists with children introduced during the first 3 months of life having 87 percent elevated risk of dying compared to those introduced after the fourth month.

Overall, all considered feeding behavioral variables contribute significantly to the post-neonatal mortality differentials and demonstrate the mortality risks associated with early supplementary feeds.

7.3.2.3 Mortality Differentials by Reproductive Behavioural Factors

Table 7.10 presents post-neonatal mortality according to reproductive behavioural factors.

TABLE 7.10: POST-NEONATAL MORTALITY BY REPRODUCTIVE BEHAVIORAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
DURATION OF SEXUAL ABSTINENCE					
0-2 months	79.0	7.9	1.65	23.9	1325
3-6 months	63.1	5.0	1.32	17.2	2634
7+ months	47.9	5.9	1.00	-	1410
SEX WHILE BREASTFEEDING					
Wait	75.1	9.4	1.20	2.8	884
Doesn't matter	62.7	3.5	1.00	-	5366
NUMBER OF MARITAL UNIONS					
More than once	84.3	9.0	1.39	6.7	1088
Once	60.6	3.6	1.00	-	4827
EVER USE OF ANY FP METHOD					
Never used	76.6	5.2	1.51	24.0	2928
Traditional	58.8	6.3	1.16	6.9	1540
Modern	50.8	5.4	1.00	-	1796
CURRENT USE BY FP METHOD					
No method	69.0	3.7	1.98	47.0	5206
Traditional	55.0	10.6	1.58	21.7	504
Modern	34.9	8.0	1.00	-	554
DISCUSSION OF FP WITH PARTNER					
Never	68.0	6.2	1.20	9.7	1826
Once or twice	64.0	6.0	1.13	6.5	1839
More often	56.6	6.1	1.00	-	1581

Like in the first month of life, both sex while breastfeeding and the number of marital unions have little effect even on post-neonatal mortality despite that children of mothers married more than once are at increased risk of dying. Although the impact of sexual abstinence duration is less pronounced during the post-neonatal period than during the first month of life, the inverse association between duration of abstinence and mortality continues. Children associated with abstinence of less than 3 months are 65 percent at increased risk of dying compared to children associated with at least 7 months of abstinence. Similarly, children categorised under mothers who objected to having sex while breastfeeding are over 20 percent at higher risk of dying relative to children whose mothers did not mind. Again, this may be reflecting the traditional views especially amongst women from lower socio-economic status whose children are generally at higher risk of dying than children from higher socio-economic groups.

As for the impact of number of marital unions on mortality, the effect increases during the post-neonatal period when births from mothers married more than once are at 39 percent higher risk of dying compared to children from mothers married only once.

With the exception of mother's discussion of family planning with partner, mortality differentials seem to have widened during post-neonatal mortality for both ever-use and current-use of family planning methods. For current-use by family planning method, for example, children from mothers not using any method are almost twice at risk of dying compared to those from mothers using modern methods. The widening mortality differentials can be explained by the increased influence of socio-economic factors with increasing age of the child.

The mortality patterns are also similar for children according to whether mothers have ever used any family planning method. Overall, post-neonatal mortality patterns according to reproductive behavioral factors behave as initially expected, while the issues associated with family planning are perhaps a reflection of socio-economic inequalities between families.

7.3.2.4 **Mortality Differentials by Health Care Behavioural Factors**

Table 7.11 presents post-neonatal mortality differentials according to the health care behavioral factors. As noted from the table and like in the first month of life, only tetanus vaccination has any probable public health significance during the post-neonatal period.

TABLE 7.11: POST-NEONATAL MORTALITY BY HEALTH CARE BEHAVIOURAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
TETANUS VACCINATION					
None	85.8	9.4	1.58	15.7	1021
One	65.7	5.5	1.21	9.7	2280
Two+	54.3	5.1	1.00	-	2158
PRENATAL CARE					
None	100.4	17.0	1.62	4.0	366
Some care	62.1	3.6	1.00	-	5048
PLACE OF DELIVERY					
Home	68.7	5.1	1.14	6.6	2772
Health centre	60.5	4.8	1.00	-	2709
ASSISTANCE AT DELIVERY					
None	63.1	13.2	1.03	0.4	376
Birth attendants	70.5	11.2	1.15	2.5	543
Relatives	69.3	6.1	1.13	5.1	1897
Medical personnel	61.2	4.8	1.00	-	2679

Although mortality differentials seem narrowed compared to those observed during the first month of life for many variables, the differences have widened for place of delivery where births delivered at home are 14 percent at elevated risk of dying.

The effect of place of delivery on mortality is slightly more significant for post-neonatal mortality than for neonatal mortality. Moreover, many variables show expected mortality patterns. Children whose mothers had no tetanus toxoid injection are 58 percent at higher risk of dying compared to children whose mothers had at least two injections. As for children whose mothers had only one injection, they are 21 percent at higher risk of dying relative to the reference category.

Observations are not different from the expected pattern for those children whose mothers had no prenatal care. Such children have increased risks of dying of 62 percent compared to children whose mothers sought prenatal medical care. Although mortality patterns according to assistance at delivery show expected differential patterns with lowest mortality amongst births assisted by medical personnel, births without any assistance have reduced risk of dying compared to those assisted by both birth attendants and relatives. While births assisted by birth attendants have lowest mortality risks during the first one month of life, they have highest risks of dying during the post-neonatal period.

7.3.3 **Child Mortality**

7.3.3.1 **Mortality Differentials by Family Behavioural Factors**

Table 7.12 presents child mortality differentials according to family behavioural factors.

TABLE 7.12: CHILD MORTALITY BY FAMILY BEHAVIOURAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
HOUSEHOLD DENSITY					
0-2	88.8	9.6	3.08	47.6	1011
3	55.6	5.3	1.93	36.1	2014
4	30.5	4.5	1.06	3.1	1499
5+	28.8	4.7	1.00	-	1302
KINSHIP					
Relative	50.0	6.4	1.02	0.4	1231
Own child	48.8	3.3	1.00	-	4618
DRINKING/WASHING WATER SOURCE					
Same	49.2	3.0	0.98	na	5561
Different	50.0	13.4	1.00	-	287

Unlike earlier observations made during the first year of life, only household density has a significant effect on mortality differentials during late childhood. There are virtually no notable differences in child mortality by both kinship and drinking/washing water source. One interesting observation is that mortality differentials by household density are much more pronounced during late childhood than during infancy further pointing to increased influence of socio-economic factors as a child grows older. Even though mortality continues having an inverse association with household density, children from households of less than 3 persons per sleeping room are over 3 times at risk of dying compared to children from households of at least 5 persons per sleeping room. This is equally true for those children from households of 3 persons per sleeping room where children are almost twice at risk of dying. Overall,little mortality differences are noticed for households of both 4 and at least 5 persons per sleeping room.

7.3.3.2 Mortality Differentials by Feeding Behavioral Factors

Table 7.13 presents child mortality differentials according to feeding behavioral factors.

In contrast to earlier observations made the during the post-neonatal period, mortality levels are lowest amongst children breastfed for less than 7 months. This observation might be explained by socio-economic characteristics of parents and particularly well to do working mothers. Moreover, many of the children breastfed for shorter durations could have died, anyway, during earlier periods, leaving only healthy children from higher status socio-economic households. However, children breastfed for 7-11 months are 57 percent at higher risk of dying compared to those breastfed for at least 19 months.

Although the relative risk of 4.07 for children not given plain water is suspect as reflected by small exposures and standard error, children given water within the first month of life are 27 percent at higher risk of dying compared to those given water after one month further strengthening the argument of higher mortality risk associated with unnecessary early introduction of feeds to children.

TABLE 7.13: CHILD MORTALITY BY FEEDING BEHAVIOURAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
DURATION OF BREASTFEEDING					
0-6 months	5.3	2.6	0.14	na	758
7-18 months	60.4	4.7	1.57	26.7	2778
19+ months	38.4	5.0	1.00	-	1566
AGE FOR PLAIN WATER					
Not given	151.7	45.6	4.07	14.7	78
0 months	45.9	3.5	1.23	14.6	3748
1+ months	37.3	5.4	1.00	-	1312
AGE FOR FORMULA OR OTHER MILK					
Not given	45.3	3.5	1.13	10.1	3750
0-3 months	50.9	8.4	1.27	13.1	745
4+ months	40.0	8.3	1.00	-	586
AGE FOR OTHER LIQUIDS					
Not given	47.7	6.1	1.08	2.7	1331
0-3 months	47.7	6.4	1.08	2.5	1202
4+ months	44.0	4.2	1.00	-	2530
AGE FOR SOLID OR MUSHY FOOD					
Not given	49.5	11.4	1.12	1.4	393
0-3 months	46.2	5.2	1.04	1.5	1751
4+ months	44.3	3.9	1.00	-	2974

On the other hand, age at which children are introduced to both other liquids and solid feeds has little significant effect on mortality differentials later in childhood. This is possibly because many of the children at this stage are already introduced to many of these feeding practices.

7.3.3.3 Mortality Differentials by Reproductive Behavioural Factors

Table 7.14 presents child mortality differentials according to reproductive behavioural factors.

Unlike earlier observations made on mortality differentials by duration of sexual abstinence during the first year of life, no clear mortality pattern emerges during late childhood when mortality is lowest for less than 3 months abstinence and highest for the 3-6 months category. Moreover, there is little difference in mortality between the three categories.

Furthermore, and in contrast to infant mortality differentials, child mortality is lowest among children whose mothers prefer not having sex while breastfeeding.

Most interesting, however, is the increased risk associated with issues of family planning during late childhood as compared to the first year of life.

While children from mother married more than once are 52 percent at higher risk of dying compared to children of those mothers married only once, children from mothers currently not using any method of family planning are over twice at risk of dying relative to those from mothers using modern methods of family planning. The increase in influence on child mortality differentials is equally noted for children categorised by mother's discussion of family planning with partner.

Children whose mothers never discussed family planning with spouses are 67 percent at higher risk of dying compared to those whose parents discussed family planning more often.

TABLE 7.14: CHILD MORTALITY BY REPRODUCTIVE BEHAVIOURAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
DURATION OF SEXUAL ABSTINENCE					
0-2 months	40.9	5.8	0.93	na	1224
3-6 months	45.9	4.4	1.04	2.5	2473
7+ months	44.1	5.8	1.00	-	1344
SEX WHILE BREASTFEEDING					
Wait	43.6	7.4	0.88	na	820
Doesn't matter	49.8	3.2	1.00	-	5040
NUMBER OF MARITAL UNIONS					
More than once	70.4	8.5	1.52	8.6	1000
Once	46.2	3.2	1.00	-	4543
EVER USE OF ANY FP METHOD					
Never used	53.0	4.5	1.25	13.3	2712
Traditional	49.4	5.9	1.16	6.9	1452
Modern	42.5	5.0	1.00	-	1707
CURRENT USE BY FP METHOD					
No method	53.2	3.4	2.16	51.1	4859
Traditional	34.1	8.5	1.39	15.5	477
Modern	24.6	6.8	1.00	-	535
DISCUSSION OF FP WITH PARTNER					
Never	64.8	6.3	1.67	26.3	1706
Once or twice	42.6	5.0	1.10	5.1	1725
More often	38.9	5.2	1.00	-	1494

Again, the increased influence from family planning variables is a reflection of the practices that are associated with "modernity" and higher socio-economic status whose influence on childhood mortality increases with age of the child.

7.3.3.4 Mortality Differentials by Health Care Behavioural Factors

Table 7.15 presents child mortality according to health care behavioural factors.

TABLE 7.15: CHILD MORTALITY BY HEALTH CARE BEHAVIOURAL FACTORS: 1987-91 PERIOD.

VARIABLE	RATE PER 1000	S.E.	RR	PAR	EXPOS
TETANUS VACCINATION					
None	58.2	8.0	1.41	11.4	937
One	45.0	4.6	1.09	4.4	2135
Two+	41.4	4.5	1.00	-	2044
PRENATAL CARE					
None	68.8	14.6	1.55	3.5	331
Medical	44.4	3.1	1.00	-	4744
PLACE OF DELIVERY					
Home	45.8	4.3	0.99	na	2588
Health centre	46.1	4.3	1.00	-	2550
ASSISTANCE AT DELIVERY					
None	55.3	12.7	1.18	2.2	353
Birth attendants	50.7	10.1	1.09	1.5	506
Relatives	41.5	4.9	0.89	na	1770
Medical personnel	46.7	4.4	1.00	-	2520

The table illustrates a general narrowing of mortality differentials for all variables considered for late childhood mortality relative to earlier observations during the first year of life. Nevertheless, only tetanus vaccination continues to have considerable influence on child mortality. Children whose mothers received no tetanus toxoid injection continue being at over 40 percent higher risk of dying compared to children whose mothers had at least 2 injections. This observation is equally supported by prenatal care where children from mothers without any care have 55 percent elevated risk of dying. Although there is little difference in child mortality levels between births delivered from home and those delivered from health centres, risk differences are notable on the basis of delivery assistance received at birth.

Mortality is lowest amongst births assisted by relatives and highest for those without assistance. Even though mortality is relatively higher for births assisted by medical personnel compared to those assisted by relatives, the latter are almost at 30 percent reduced risk of dying compared to those without any assistance. Like earlier results, the observed increased risk of dying for births assisted by medical personnel may be explained by high-risk births likely to have been reported to health centres on the basis of previous birth experiences amongst some mothers.

7.3.4 Summary and Test for Statistical Significance

To complement the identification criteria (using PAR) of significant variables to be included in the main effects regression models, one-variable models are fitted for each variable to identify those with statistically significant gross effects on neonatal, post-neonatal and child mortality. The exercise also enables comparison of variable gross effects on mortality with increasing age of the child. Statistical significance is determined using p-values of model X^2 for neonatal mortality and the global score for post-neonatal and child mortality.

Table 7.16 presents the gross effects of family behavioural factors on neonatal, post-neonatal and child mortality.

TABLE 7.16: GROSS EFFECTS OF FAMILY BEHAVIOURAL FACTORS ON CHILDHOOD MORTALITY: TESTING FOR STATISTICAL SIGNIFICANCE.

VARIABLE	NEONATAL	POST-NEONATAL	CHILD
HOUSEHOLD DENSITY	[0.00]	[0.00]	[0.00]
0-2	2.28***	2.52***	2.91***
3	1.28	1.41***	1.90***
4	0.61**	1.02	1.05
5+	1.00	1.00	1.00
KINSHIP	[0.00]	[0.09]	[0.56]
Relative	1.51***	1.17*	1.09
Own child	1.00	1.00	1.00
DRINKING/WASHING WATER SOURCE	[0.84]	[0.99]	[0.95]
Same	1.06	1.00	0.98
Different	1.00	1.00	1.00

*** P<0.01; ** P<0.05; * P<0.10; [] P-values of X^2.

Even though both household density and kinship are statistically significant during the first month of life, kinship only becomes significant during the post-neonatal period at 10 percent level. As for the late childhood period, only household density continues to be statistically significant. It is observed, however, that while being statistically significant during all childhood periods, the gross effects of household density on mortality increases with increasing age of the child, again suggesting that large household densities are associated with higher survival chances of children in larger family households. This result, therefore, does not support the notion that crowded households are associated with higher childhood mortality. Probably household density as measured here in terms of persons per sleeping room may not sufficiently reflect risks associated with crowding, especially in the absence of additional information, such as, room-space, ventilation, etc.

The opposite is true for kinship where the gross effect on mortality is reduced with increasing age of the child. Children of dependent relatives are at more than 50 percent higher risk of dying during the first month of life compared to only 9 percent during late childhood. The small mortality difference associated with kinship during later childhood can possibly be explained by non-discriminating child care practices especially that carers are most likely to be dependent relatives themselves.

Table 7.17 presents gross effects of feeding behavioral factors on post-neonatal and child mortality. Analysis of feeding practices on neonatal mortality is avoided here since most children are not introduced to many of these practices. With exception of age for formula or other milk, all considered variables have remarkable statistically significant effects on mortality differentials. Apart from age for plain water and for solid or mushy food where relative risks for those "not given" increases with age of child, there is general narrowing of mortality differentials for all variables with increasing age of the child. While children breastfed between 7-18 months are over twice at risk of dying during post-neonatal period, only 73 percent are at elevated risk during late childhood when compared to reference categories.

In contrast, and despite lack of statistically significant effect on mortality, the influence of age for formula increases with increasing age of the child in support of early studies citing contamination for children at later age groups.

TABLE 7.17: GROSS EFFECTS OF FEEDING FACTORS ON CHILDHOOD MORTALITY: TESTING FOR STATISTICAL SIGNIFICANCE.

VARIABLE	POST-NEONATAL	CHILD
DURATION OF BREASTFEEDING	[0.00]	[0.00]
0-6 months	5.35***	1.33
7-18 months	2.31***	1.73***
19+ months	1.00	1.00
AGE FOR PLAIN WATER	[0.00]	[0.00]
Not given	5.71***	8.01***
0 months	1.42***	1.31
1+ months	1.00	1.00
AGE FOR FORMULA OR OTHER MILK	[0.30]	[0.28]
Not given	1.24	1.32
0-3 months	1.28	1.52
4+ months	1.00	1.00
AGE FOR OTHER LIQUIDS	[0.00]	[0.00]
Not given	2.26***	1.72***
0-3 months	1.39***	1.21
4+ months	1.00	1.00
AGE FOR SOLID OR MUSHY FOOD	[0.00]	[0.00]
Not given	4.17***	7.22***
0-3 months	1.35***	1.18
4+ months	1.00	1.00

*** $p<0.01$; ** $p<0.05$; * $p<0.10$; [] p-values of X^2.

While children introduced to formula in the first 3 months of life are 28 percent at higher risk of dying during post-neonatal, the risk increases to 52 percent during late childhood when compared to children introduced after the third month.

Overall, relative risks for the "not given" category for age for plain water and solid or mushy food should be taken cautiously since most children are introduced to these feeding practices within the first year and those children not introduced may reflect highly selected cases likely to include many sick children.

TABLE 7.18: GROSS EFFECTS OF REPRODUCTIVE BEHAVIOURAL FACTORS ON CHILDHOOD MORTALITY: TESTING FOR STATISTICAL SIGNIFICANCE.

VARIABLE	NEONATAL	POST-NEONATAL	CHILD
DURATION OF SEXUAL ABSTINENCE	[0.00]	[0.11]	[0.39]
0-2 months	3.40***	1.29**	1.29
3-6 months	1.35	1.17	1.18
7+ months	1.00	1.00	1.00
SEX WHILE BREASTFEEDING	[0.05]	[0.64]	[0.73]
Wait	1.38***	1.05	0.94
Doesn't matter	1.00	1.00	1.00
NUMBER OF MARITAL UNIONS	[0.48]	[0.00]	[0.00]
More than once	1.12	1.42***	1.49***
Once	1.00	1.00	1.00
EVER USE OF ANY FP METHOD	[0.07]	[0.00]	[0.16]
Never used	1.41**	1.37***	1.32*
Traditional	1.26	1.15	1.19
Modern	1.00	1.00	1.00
CURRENT USE BY FP METHOD	[0.18]	[0.00]	[0.00]
No method	1.30	1.99***	2.36***
Traditional	0.88	1.48*	1.55
Modern	1.00	1.00	1.00
DISCUSSION OF FP WITH PARTNER	[0.00]	[0.00]	[0.00]
Never	1.38***	1.36***	1.65***
Once or twice	0.77	1.11	1.11
More often	1.00	1.00	1.00

*** p<0.01; ** p<0.05; * p<0.10; [] p-values of X^2.

Table 7.18 presents gross effects of reproductive behavioral factors on neonatal, post-neonatal and child mortality.

During the first month of life, four out of six variables are statistically significant of which only two variables of duration of sexual abstinence and mother's discussion of FP with partner are statistically significant at less than 1 percent level. Interestingly, only four variables are statistically significant at less than 1 percent level during post-neonatal.

By late childhood, however, only three variables of number of marital unions, current use by FP method and mother's discussion of FP with partner continue being statistically significant.

Although mother's discussion of FP with partner has consistently shown significant effects on mortality differentials throughout the three age periods, different mortality patterns emerge with increasing age of child when one looks at other variables.

While the significant effects of number of marital unions and current use by FP method increase remarkably with increasing age of the child, the opposite is true for both sex while breastfeeding and ever use of FP method. This is particularly true for current use by FP method where the risk of dying for children from mothers not using any method increases from 30 to 136 percent. In contrast, for the duration of sexual abstinence, the risk of dying for children associated with less than 3 months of abstinence declines from 240 percent during first month of life to 29 percent by late childhood. Both cases compared to respective reference categories of at least 7 months.

Lastly, Table 7.19 presents gross affects of health care behavioral factors on child mortality. During the three age categories considered in the study, only two variables, namely tetanus vaccination and prenatal care, have statistically significant effects on mortality. In both cases, however, the gross effect of these variables are reduced remarkably with increasing age of the child, thus supporting earlier studies on the relative importance of health care services during the first few months of life. Children whose mothers received no tetanus toxoid injection are over 100 percent at increased risk of dying compared to children whose mothers received at least two injections during neonatal period. This is compared to only 48 percent higher risk of dying during late childhood.

TABLE 7.19: GROSS EFFECTS OF HEALTH CARE BEHAVIORAL FACTORS ON CHILDHOOD MORTALITY: TESTING FOR STATISTICAL SIGNIFICANCE.

VARIABLE	NEONATAL	POST-NEONATAL	CHILD
TETANUS VACCINATION	[0.00]	[0.00]	[0.08]
None	2.14***	1.47***	1.48**
One	1.30*	1.15	1.13
Two+	1.00	1.00	1.00
TYPE OF PRENATAL CARE	[0.00]	[0.00]	[0.02]
None	2.36***	1.54***	1.66**
Some care	1.00	1.00	1.00
PLACE OF DELIVERY	[0.53]	[0.42]	[0.95]
Home	1.08	1.07	1.01
Health centre	1.00	1.00	1.00
ASSISTANCE AT DELIVERY	[0.46]	[0.85]	[0.70]
None	1.21	1.09	1.20
Birth attendants	0.84	1.12	1.08
Relatives	1.16	1.03	0.91
Medical personnel	1.00	1.00	1.00

*** $p<0.01$; ** $p<0.05$; * $p<0.10$; [] p-value of X^2.

Similarly, the risk of dying for children whose mothers received no prenatal care is reduced by almost 30 percent from neonatal to late childhood periods; both cases compared to children whose mothers received prenatal care.

7.4 MULTIVARIATE ANALYSIS

7.4.1 Introduction

Like previous multivariate analytical sections, this is an attempt to estimate the independent effects of each selected variable while controlling for the influences of other variables on childhood mortality.
In order to examine both resulting mortality patterns and assess the independent influence of the selected variables, main effects models are constructed by sequentially fitting these variables within a logistic regression for neonatal and Cox hazards regression for both post-neonatal and late childhood periods.

7.4.2 Neonatal Mortality

7.4.2.1 Main Effects of Family Behavioural Factors on Neonatal Mortality

To explore the main effects of family behavioral factors on neonatal mortality, Table 7.20 presents three logistic regression models sequentially fitted variables.

TABLE 7.20: RESULTS OF A LOGISTIC REGRESSION OF NEONATAL MORTALITY AND FAMILY BEHAVIOURAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3
HOUSEHOLD DENSITY			
0-2	2.28***	2.38***	2.39***
3	1.28	1.37*	1.37*
4	0.61**	0.63**	0.63**
KINSHIP			
Relative		1.50***	1.50***
DRINKING/WASHING WATER SOURCE			
Same			1.10
Model X^2	51.9	62.5	62.9
df	3	4	5

*** P<0.01; ** P<0.05; * P<0.10.

While Model 1 shows the gross effect of household density on neonatal mortality, controlling for kinship as demonstrated by Model 2, elevates the risks of dying by 4 and 32 per cent for categories 0-2 and 3 persons per sleeping room, respectively. Adding drinking/washing water source to the model as illustrated by Model 3 contributes little to the model with both household density and kinship sustaining their statistical significance. The table, therefore, demonstrates that even after controlling for other family behavioural factors, children of dependent mothers still have higher mortality risks. Also noted is that children in households considered less crowded are in fact at higher mortality risk suggesting certain influence from others socio-economic factors, such as, mean household size since most educated households have higher mean household sizes.

7.4.2.2 **Main Effects of Reproductive Behavioural Factors on Neonatal Mortality**

Table 7.21 presents six logistic regression models based on the reproductive behavioural factors.

TABLE 7.21: RESULTS OF A LOGISTIC REGRESSION OF NEONATAL MORTALITY AND REPRODUCTIVE BEHAVIORAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
DURATION OF SEXUAL ABSTINENCE						
0-2 months	3.40***	3.74***	3.58***	3.63***	3.62***	3.92***
3-6 months	1.35	1.47*	1.43*	1.46*	1.47*	1.69**
SEX WHILE BREASTFEEDING						
Wait		1.63***	1.75***	1.75***	1.75***	1.73***
NUMBER OF MARITAL UNIONS						
More than once			1.14	1.10	1.09	1.17
EVER USE OF ANY FP METHOD						
Never used				1.39*	1.32	1.17
Traditional				1.35	1.36	1.30
CURRENT USE BY FP METHOD						
No method					1.13	1.29
Traditional					0.90	0.89
DISCUSSION OF FP WITH PARTNER						
Never						1.25
Once or twice						0 76
Model X^2	58.4	65.9	61.5	65.5	66.3	66.3
df	2	3	4	6	8	10

*** p<0.01; ** p<0.05; * p<0.10.

There is clear evidence from Table 7.21 to show that even after controlling for other reproductive behavioural variables, duration of sexual abstinence and sex while breastfeeding have strong association with neonatal mortality. Most remarkable, however, is that controlling for other behavioural variables and especially issues of family planning elevate the risk of dying for children associated with shorter durations of abstinence. Surprising, however, is that longer durations of sexual abstinence are linked to mothers most unlikely to use or/and discuss any family planning method. In other words, mothers most familiar with family planning have shorter duration of sexual abstinence that are further associated with higher mortality risk. This observation supports the notion that the sexual abstinence taboo erodes with increasing levels of modernisation and may elevate the risk associated with childhood mortality through changes in already existing child spacing patterns (Hobcraft, 1991). Controlling for other reproductive behaviours, for example, worsens the mortality risk for children belonging to the 0-2 and 3-6 months durations of sexual abstinence by 22 and 97 percent, respectively.

7.4.2.3 Main Effects of Health Care Behavioural Factors on Neonatal Mortality

Table 7.22 presents four logistic regression models constructed from the selected health care behaviour variables of tetanus vaccination, prenatal care, place of delivery and assistance at delivery.

Even after controlling for place of delivery and assistance at delivery, tetanus vaccination and prenatal care continue having some statistically significant effects on mortality during the first month of life.

Even though both place of delivery and assistance at delivery explain little of the effects of tetanus vaccination, controlling for prenatal care, as demonstrated by Model 2, accounts for about 27 per cent of the vaccination's effect on neonatal mortality risks.

TABLE 7.22: RESULTS OF A LOGISTIC REGRESSION OF NEONATAL MORTALITY AND HEALTH CARE BEHAVIOURAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4
TETANUS VACCINATION				
None	2.14***	1.80***	1.83***	1.83***
One	1.30*	1.33*	1.32*	1.32*
PRENATAL CARE				
None		1.57*	1.66**	1.65**
PLACE OF DELIVERY				
Home			0.91	0.89
ASSISTANCE AT DELIVERY				
None				1.04
Birth attendants				0.83
Relatives				1.06
Model X^2	20.3	24.0	25.1	26.1
df	2	3	4	7

*** p<0.01; ** p<0.05; * p<0.10.

Moreover, tetanus vaccination, as a proxy for health service utilisation, shows more association with neonatal mortality than prenatal care. Children without any vaccination are at 83 per cent higher risk of dying compared to children with no prenatal care at 65 per cent higher risk of dying; both groups compared to their respective reference categories.

7.4.3 Post-neonatal Mortality

7.4.3.1 Main Effects of Family Behavioural Factors on Post-neonatal Mortality

Table 7.23 presents the results of Cox hazards regression models constructed on the basis of three family behavioural variables and their influence on post-neonatal mortality.

TABLE 7.23: RESULTS OF A COX HAZARDS REGRESSION OF POST-NEONATAL MORTALITY AND FAMILY BEHAVIORAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3
HOUSEHOLD DENSITY			
0-2	2.52***	2.55***	2.56***
3	1.41***	1.43***	1.44***
4	1.02	1.04	1.04
KINSHIP			
Relative		1.15	1.15
DRINKING/WASHING WATER SOURCE			
Same			1.04
Model X^2	99.5	101.5	102.2
df	3	4	5

*** p<0.01; ** p<0.05; * p<0.10

Even though controlling for both kinship and drinking/washing water source slightly elevates mortality risks by household density as shown by Models 2 and 3, the two variables contribute little to the general hazards model. However, the contribution of household density to post-neonatal mortality differentials remains remarkable and statistically significant. Children from households perceived as crowded are in fact at reduced risk of dying than children from less crowded households.

7.4.3.2 Main Effects of Feeding Behavioural Factors on Post-neonatal Mortality

Table 7.24 presents five hazards regression models constructed on the basis of selected feeding variables. Although duration of breastfeeding has a much more significant gross effect on post-neonatal mortality, as demonstrated by Model 1 and earlier shown by Table 7.17, controlling for other feeding practices accounts for over one-third of the mortality risk associated with children breastfed for less than seven months.

TABLE 7.24: RESULTS OF COX HAZARDS REGRESSION OF POST-NEONATAL MORTALITY AND FEEDING BEHAVIORAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
DURATION OF BREASTFEEDING					
0-6 months	5 35***	4 73***	4.95***	4.49***	3.32***
7-18 months	2 31***	2 28***	2.36***	2.37***	2.33***
AGE FOR PLAIN WATER					
Not given		2 81***	2 80***	2.52***	1.95***
0 months		1 21*	1.20	1.18	1.12
AGE FOR FORMULA OR OTHER MILK					
Not given			0 95	0 86	0 82
0-3 months			0 98	0 94	0 94
AGE FOR OTHER LIQUIDS					
Not given				1.37***	1 25*
0-3 months				1 21	1 16
AGE FOR SOLID OR MUSHY FOOD					
Not given					1 94***
0-3 months					1 15
Model X^2	195 4	254 4	259 7	270.4	307 0
df	2	4	6	8	10

*** p<0.01; ** p<0.05; * p<0.10.

Most important is the control for age at which children are introduced to both plain water and solid or mushy feed.
After controlling for all feeding behavioural variables, the age at which children are introduced to formula or other milk has little effect on post-neonatal mortality for possibly two major reasons. First, because fewer mothers can afford the cost of formula and secondly that mothers are responding to public health education on the risk factors associated with the use of formula. However, estimates from age at which children are introduced to feeds should be taken cautiously since most of the statistical significance is associated with children not introduced to the feeds and could as well have died from factors that have little to do with feeding practices.

7.4.3.3 **Main Effects of Reproductive Behavioural Factors on Post-neonatal Mortality**

Table 7.25 presents results of six hazards regression models constructed from the selected reproductive behavioural variables. Unlike the influence other reproductive behavioural variables have on duration of sexual abstinence during the neonatal period as illustrated earlier in Table 7.21, there is little observed influence during the post-neonatal period.
Although duration of sexual abstinence continue to have some association with post-neonatal mortality, there is increased influence from children whose mothers have married more than once. Moreover, there is increased association between both current use and discussion of family planning. This pattern

suggests that issues of family planning are most associated with modernity and exposure to the western kind of life style.

TABLE 7.25: RESULTS OF COX HAZARDS REGRESSION OF POST-NEONATAL MORTALITY AND REPRODUCTIVE BEHAVIOURAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
DURATION OF SEXUAL ABSTINENCE						
0-2 months	1.29**	1.31**	1.31**	1.29**	1.30**	1.29*
3-6 months	1.17	1.19	1.17	1.18	1.20	1.23
SEX WHILE BREASTFEEDING						
Wait		1.10	1.14	1.14	1.13	1.06
NUMBER OF MARITAL UNIONS						
More than once			1.51***	1.46***	1.43***	1.52***
EVER USE OF ANY FP METHOD						
Never used				1.48***	1.29**	1.11
Traditional				1.19	1.11	1.05
CURRENT USE BY FP METHOD						
No method					1.63**	1.59*
Traditional					1.25	1.25
DISCUSSION OF FP WITH PARTNER						
Never						1.30**
Once or twice						1.18
Model X^2	4.4	5.1	21.8	35.3	40.3	38.6
df	2	3	4	6	8	10

*** $p<0.01$; ** $p<0.05$; * $p<0.10$.

Children of mothers not using any family planning method and never discussing family planning with spouses are at higher mortality risk. Perhaps close association with family planning reflects certain socio-economic characteristics of many family planning users such as higher education.

On the other hand, the issue of sex while breastfeeding has least impact during the post-neonatal period.

7.4.3.4 **Main Effects of Health Care Behavioural Factors on Post-neonatal Mortality.**

Table 7.26 presents four hazards regression models resulting from selected health care behavioural factors.
It is noted here that only tetanus vaccination has a statistically significant effect on post-neonatal mortality.

TABLE 7.26: RESULTS OF COX HAZARDS REGRESSION OF POST-NEONATAL MORTALITY AND HEALTH CARE BEHAVIOURAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4
TETANUS VACCINATION				
None	1.47***	1.34**	1.35**	1.35**
One	1.15	1.15	1.16	1.16
PRENATAL CARE				
None		1.29	1.30	1.30
PLACE OF DELIVERY				
Home			0.96	0.90
ASSISTANCE AT DELIVERY				
None				1.14
Birth attendants				1.19
Relatives				1.03
Model X^2	12.1	14.9	14.8	15.9
df	2	3	4	7

*** p<0.01; ** p<0.05; * p<0.10.

Controlling for prenatal care only explains for 28 percent of the risks associated with mother not having any vaccination, while other health care behavioral factors have little significant influence on post-neonatal mortality. On the other hand, the association between tetanus vaccination and mortality weakens during post-neonatal period than in the first month of life. This strengthens the view that health care services have stronger impact on child health and mortality during the first few weeks of life than later.

7.4.4 Child Mortality

7.4.4.1 Main Effects of Family Behavioural Factors on Child Mortality

Table 7.27 presents three hazards regression models constructed from sequential fitting of family behavioural factors.

TABLE 7.27: RESULTS OF COX HAZARDS REGRESSION OF CHILD MORTALITY AND FAMILY BEHAVIOURAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3
HOUSEHOLD DENSITY			
0-2	2.91***	2.90***	2.91***
3	1.90***	1.90***	1.90***
4	1.05	1.05	1.05
KINSHIP			
Relative		1.07	1.08
DRINKING/WASHING WATER SOURCE			
Same			1.01
Model X^2	49.4	48.8	49.1
df	3	4	5

*** p<0.01; ** p<0.05; * p<0.10

Like earlier observations from Table 7.16, controlling for both kinship and drinking/washing water source does little to change the significant influence of household density. Children from households of less than 3 persons per sleeping room are almost 3 times more at risk of dying compared to children from households of at least 5 persons per sleeping room. Moreover, the association between household density and childhood mortality strengthens the suggestion of a link to other socio-economic variables not included in the model. It also supports the argument that socio-economic factors have increased influence on mortality as the child grows. Children in households with a density of less than 3 persons per sleeping room are almost three times at higher mortality risk compared to about twice higher during the first month of life.

7.4.4.2 Main Effects of Feeding Behavioural Factors on Child Mortality

Table 7.28 presents results of five hazards regression models constructed from selected feeding behavioural variables. Model 1 presents the gross effect of duration of breastfeeding on child mortality. On the other hand, controlling for other feeding practices, as demonstrated by model 5, increases the survival chances of children with shorter durations of breastfeeding, while those children breastfed between 7-18 months are still at 65 per cent increased risk of dying compared to children breastfed for longer durations. The increased survival chances are especially explained by controlling for both age at which children are introduced to plain water and to solid feed.

TABLE 7.28: RESULTS OF COX HAZARDS REGRESSION OF CHILD MORTALITY AND FEEDING BEHAVIORAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
DURATION OF BREASTFEEDING					
0-6 months	1.33	0.83	0.85	0.80	0.34*
7-18 months	1.73***	1.70***	1.73***	1.75***	1.65***
AGE FOR PLAIN WATER					
Not given		8.58***	8.41***	6.52***	1.86
0 months		1.22	1.23	1.21	1.20
AGE FOR FORMULA OR OTHER MILK					
Not given			1.26	1.16	1.12
0-3 months			1.44	1.37	1.41
AGE FOR OTHER LIQUIDS					
Not given				1.57***	1.36*
0-3 months				1.15	1.12
AGE FOR SOLID OR MUSHY FOOD					
Not given					7.53***
0-3 months					1.10
Model X^2	13.3	61.4	64.0	70.8	134.2
df	2	4	6	8	10

*** $p<0.01$; ** $p<0.05$; * $p<0.10$.

Although this low risk can possibly be explained by children from higher socio-economic households practising shorter durations of breastfeeding, the category also includes only children who have survived the first year of life and does not include frail children who could have died earlier, any way.

It is also interesting, however, to note that the significant contribution of plain water supplementation to child mortality risks is explained largely by the introduction of solid or mushy foods suggesting some strong correlation between the two variables. It is also true that children introduced to solids are most likely to be given plain water even though water is generally introduced at an earlier age.

7.4.4.3 Main Effects of Reproductive Behavioural Factors on Child Mortality

Table 7.29 presents six models created from selected reproductive behaviour variables.

TABLE 7.29: RESULTS OF COX HAZARDS REGRESSION OF CHILD MORTALITY AND REPRODUCTIVE BEHAVIORAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
DURATION OF SEXUAL ABSTINENCE						
0-2 months	1.29	1.28	1.26	1.25	1.26	1.46
3-6 months	1.18	1.16	1.15	1.15	1.18	1.37
SEX WHILE BREASTFEEDING						
Wait		0.95	0.98	0.98	0.98	0.90
NUMBER OF MARITAL UNIONS						
More than once			1.64***	1.59***	1.55***	1.59***
EVER USE OF ANY FP METHOD						
Never used				1.30	1.09	0.87
Traditional				1.07	0.98	0.87
CURRENT USE BY FP METHOD						
No method					1.92*	2.10*
Traditional					1.28	1.38
DISCUSSION OF FP WITH PARTNER						
Never						1.65**
Once or twice						1.31
Model X^2	1.9	1.9	11.4	14.3	18.8	27.2
df	2	3	4	6	8	10

*** p<0.01; ** p<0.05; * p<0.10.

Unlike earlier observations in previous sections where relatively more reproductive behaviour variables have been shown to have significant effects during the first year of life, only three variables namely number of marital unions, current use of family planning and discussion of family planning with partner have statistically significant influence on child mortality.

Although controlling for the three variables associated with family planning have little influence on the effect of the number of marital unions on child mortality, the increased association between such variables and later childhood mortality is remarkable. For example, children of mothers currently not using any family planning method are more than twice at increased risk of dying. Again, this increased association with mortality may be linked to other socio-economic factors.

On the other hand, there is little significance between duration of sexual abstinence and child mortality possibly because fewer mothers continue to abstain for more than one year.

7.4.4.4 Main Effects of Health Care Behavioral Factors on Child Mortality

Table 7.30 presents results of four hazards regression models on the main effects of health care behavioral variables on child mortality.

Even though the gross effect of tetanus vaccination on child mortality is statistically significant, as shown by Model 1, controlling for prenatal care reduces that significant contribution. Additional control for place of delivery and assistance at delivery has little influence on the effects of tetanus vaccination despite the fact that none of the controlled variables sustains the statistical significance as illustrated by Model 4.

TABLE 7.30: RESULTS OF COX HAZARDS REGRESSION OF CHILD MORTALITY AND HEALTH CARE BEHAVIOURAL FACTORS.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4
TETANUS VACCINATION				
None	1.48**	1.31	1.31	1.33
One	1.13	1.14	1.13	1.14
TYPE OF PRENATAL CARE				
None		1.41	1.48	1.46
PLACE OF DELIVERY				
Home			0.90	1.66
ASSISTANCE AT DELIVERY				
None				0.68
Birth attendants				0.63
Relative				0.49
Model X^2	5.1	7.0	7.6	10.3
df	2	3	4	7

*** p<0.01; ** p<0.05; * p<0.10.

The fact that none of the health care behaviour variables shows any significance is evidence of how little influence health care issues can have on older children in the presence of other most influential socio-economic factors. Nevertheless, children whose mothers receive no tetanus vaccination, have no prenatal care and are delivered at home continue to experience higher mortality risks.

7.5 OVERVIEW

Table 7.31 presents an overview of the main effects of selected intermediate behavioral factors on general childhood mortality in Zambia.

TABLE 7.31: RELATIVE RISKS OF CHILDHOOD MORTALITY ASSOCIATED WITH MAIN EFFECTS OF SELECTED INTERMEDIATE BEHAVIOURAL VARIABLES: RESULTS OF LOGISTIC AND COX HAZARDS REGRESSION.

VARIABLE	NEONATAL MODEL 1	POST-NEONATAL MODEL 2	CHILD MODEL 3
HOUSEHOLD DENSITY			
0-2	2.04***	2.71***	2.74***
3	1.18	1.51***	1.90***
4	0.52**	1.09	1.08
5+	1.00	1.00	1.00
KINSHIP			
Relative	1.60**	ns	ns
Own child	1.00	ns	ns
DURATION OF BREASTFEEDING			
0-6 months	na	3.65***	0.37
7-18 months	na	2.31***	1.68***
19+ months	na	1.00	1.00
AGE FOR PLAIN WATER			
Not given	na	2.05***	ns
0 months	na	1.11	ns
1+ months	na	1.00	ns
AGE FOR OTHER LIQUIDS			
Not given	na	ns	1.63**
0-3 months	na	ns	1.34
4+ months	na	ns	1.00
AGE FOR OTHER SOLID OR MUSHY FOOD			
Not given	na	1.95***	8.43***
0-3 months	na	1.27**	1.22
4+ months	na	1.00	1.00
DURATION OF SEXUAL ABSTINENCE			
0-2 months	3.93***	0.70**	ns
3-6 months	1.78**	0.92	ns
7+ months	1.00	1.00	ns
SEX WHILE BREASTFEEDING			
Wait	1.64**	ns	ns
Doesn't matter	1.00	ns	ns
NUMBER OF MARITAL UNIONS			
More than once	ns	1.45***	1.49**
Once	ns	1.00	1.00
DISCUSS FP WITH PARTNER			
Never	1.20	1.45***	1.77***
Once or twice	0.75	1.25	1.28
More often	1.00	1.00	1.00
TETANUS VACCINATION			
None	1.95***	1.36**	ns
One	1.26	0.99	ns
At least two	1.00	1.00	ns
Model X^2	107.8	314.3	129.9
df	11	16	12

Note: na -not applicable; ns -not selected *** p<0.01; ** p<0.05.

To assess the main effects of the most discriminating of behavioral variables on neonatal, post-neonatal and child mortality, three regression models are constructed on the basis of a forward stepwise procedure within the SPSS program.
While Model 1 for neonatal mortality uses logistic regression, Models 2 and 3 for post-neonatal and child mortality, respectively, use the Cox hazards regression procedure. In all cases, the likelihood ratio statistic is used to select variables for removal from the model at a 10 percent significant level cut-off value.
Table 7.31 presents all those selected variables believed to contribute significantly to the model.
Among the family behavioural variables discussed earlier, only household density, used here as a proxy for crowding, has a statistically significant effect on general childhood mortality. Moreover, its increased effect on mortality with increasing age of the child means that other unexplained socio-economic factors are involved in the relationship. Furthermore, the analysis shows no evidence that higher household density constitutes any childhood mortality risk apart from acting as a survival enhancing strategy amongst the households in Zambia.On the other hand, the analysis of kinship shows that mortality differences within households between children of household heads and dependent mothers are only visible during the first month of life and thereafter disappear in later childhood. Intra-household inequalities in childhood mortality especially during the first year of life can perhaps be explained by health care service utilisation as opposed to socio-economic factors that tend to

influence mortality more later in life.

Amongst feeding behavioral variables, only duration of breastfeeding has significant effect on mortality for all periods after the first year of life, although the influence is reduced with increasing age of the child. In fact, children with shortest durations of breastfeeding have better survival chances, suggesting the influence of socio-economic factors, such as parental education and income.

As for the reproductive behaviour variables, only mother's discussion of family planning with partner is statistically significant throughout the five year interval. Moreover, its effect on mortality differentials increases with increasing age of the child. The opposite is true for duration of sexual abstinence with its effect reduced with increasing age of the child. This means that practices associated with duration of sexual abstinence and sex while breastfeeding have most influence during the first month of life while other socio-economic influences emerge later in life. Moreover, the increased influence of both the number of marital unions and family planning on mortality later during childhood points to their close link with socio-economic factors, such as, modernity and the western type life-style.

Finally, the relatively significant effect of health care variables during the first month of life compared to later childhood, as earlier observed in other studies, is supported here. Even though tetanus vaccination, as a proxy for utilisation of health services, is the only statistically significant variable selected from all health care behavioral variables, its influence is reduced with increasing age of the child. This means that while health care practices are important during the first year of life, other equally important household and individual-level socio-economic factors such as maternal education, as shown earlier in Chapter Five and Six, slowly replace the role of health care utilisation. Whether or not these results will be strengthened when these practices are linked to socio-economic, cultural and bio-medical factors is explored in later chapters.

CHAPTER EIGHT

BIO-DEMOGRAPHIC AND MICRO-ENVIRONMENTAL DETERMINANTS OF CHILDHOOD MORTALITY.

8.1 INTRODUCTION

This chapter is an attempt to identify the main bio-demographic and micro-environmental factors that are commonly known and taken here as proximate determinants of childhood mortality (Mosley and Chen, 1984). This attempt is in line with identifying pathways through which socio-economic and cultural factors influence overall child survival.

To achieve this objective, the chapter is divided into four major components, with the first section defining and constructing both bio-demographic and micro-environmental variables. The second is a univariate analysis with the aim of assessing mortality differentials and patterns for both infant and child mortality using the basic principle of attributable risk; the third is a multivariate analysis using both logistic and Cox hazards regression models, and the chapter ends with an overview of the main effects of the selected bio-demographic and micro-environmental variables on childhood mortality in Zambia. Selected statistically significant variables are later taken in subsequent chapters as proximate determinants of childhood survival in Zambia within the context of the modified conceptual framework.

8.2 DEFINITION AND CONSTRUCTION OF VARIABLES

Issues concerning bio-demographic variables in relation to childhood mortality have been discussed extensively in other studies (Hobcraft, McDonald, Rutstein, 1983; Rutstein, 1984; Cleland and Sathar, 1984; De Sweemer, 1984; Palloni, 1989; Hobcraft, McDonald, Rutstein, 1985). For comparative purposes, almost similar definitions have been adopted and modifications are only made where necessary. Moreover, this analysis includes mother's perceived size of child at birth (as a proxy for birth weight) and mother's pregnancy status at time of survey to complement other often discussed bio-demographic variables.

8.2.1 Bio-Demographic Variables

Table 8.1 shows the distribution of births in the five years before the survey according to the following bio-demographic variables: sex of child, birth type, birth order of child, length of preceding birth interval, survival status of preceding child, length of subsequent birth interval, size of child at birth, age of mother at birth, and mother's current pregnancy status. In many of these variables, those categories theoretically perceived to have lower risks of mortality are used as reference.

8.2.1.1 Sex of Child

This variable splits the births into almost two equal categories of male and female with the latter used here as baseline reference.

TABLE 8.1: DISTRIBUTION OF BIRTHS ACCORDING TO BIO-DEMOGRAPHIC VARIABLES.

VARIABLES	NUMBER	PERCENTAGE
SEX OF CHILD		
Male	3281	50.1
Female	3263	49.9
BIRTH TYPE		
Multiple	253	3.9
Single	6291	96.1
BIRTH ORDER		
1	1449	22.1
2-3	2024	30.9
4-5	1322	20.2
6+	1749	26.7
PRECEDING INTERVAL		
First births	1458	22.3
<24 months	986	15.1
24-35 months	2274	34.7
36+ months	1826	27.9
SURVIVAL OF PRECEDING CHILD		
Dead	957	14.6
Alive	5589	85.4
SUBSEQUENT INTERVAL		
<24 months	626	9.8
24-35 months	1299	20.3
36+ months	498	7.8
Last births	3971	62.1
SIZE OF CHILD AT BIRTH		
Small	694	12.1
Medium	3887	67.7
Large	1161	20.2
AGE OF MOTHER AT BIRTH		
<18 years	623	9.5
18-24 years	2664	40.7
25-34 years	2432	37.2
35+ years	825	12.6
MOTHER CURRENTLY PREGNANT		
Pregnant	956	14.6
Not pregnant/unsure	5588	85.4

8.2.1.2 Birth Type

This variable considers multiple births, often found to have higher levels of mortality. In this sample, however, multiple births apply to only 4 per cent of all births. Single births are used as reference category.

8.2.1.3 Birth Order

Birth order is here divided into four categories namely "1", "2-3", "4-5", and "6+". Since first births are often noted to have higher mortality levels and are likely to come from relatively young mothers, the "2-3" category is used here as reference.

8.2.1.4 Length of Preceding Birth Interval

Although first births have been included in this variable largely for technical reasons, much attention is paid to the three categories of "<24 months", "24-35 months", and "36+ months" in line with similar demographic studies. The category "24-35" is used as reference. It should be noted that the observed difference between births in categories "1" under birth order and first births under length of preceding birth interval is due to presence of births born as multiples as opposed to birth order where multiple births are counted as one birth.

8.2.1.5 Survival Status of Preceding Child

Closely linked to birth intervals and general child spacing is the argument that the survival chances of siblings are correlated (Cleland and Sathar, 1984; Curtis, Diamond, McDonald, 1993; Guo, 1993; Mturi and Curtis, 1995; Curtis and Steele, 1996). The survival status of the preceding child at the conception of the index child is included in the childhood mortality analysis for two main reasons. First is to control for familial mortality effects due to mortality risk correlation between siblings. Second is to control for potential biases in the birth interval effects linked to the death of the preceding child which is often associated with interruption of breastfeeding and other child spacing behaviours (Mturi and Curtis, 1995). The variable is categorized into "dead" and "alive" using the "alive" status of the preceding child as reference.

8.2.1.6 Length of Subsequent Birth Interval

As in the case of preceding birth intervals, main interest here is in the first three categories of "<24 months", "24-35 months" and "36+ months" in spite of the fact that last births in this case make up 62 per cent of total births. Similarly, the category "24-35 months" which comprises over 20 per cent of births is used here as reference.

8.2.1.7 Size of Child at Birth

Ideally, for this variable, birth weight would have been most preferable. However, birth weight information is only available to less than 40 per cent of total births in the sample. Using birth weight data would mean selecting only those children likely to have been delivered in medical institutions hence biasing the sample of selected births. The analysis has, therefore, used data derived from a question put to mothers during the survey on the size of their children at birth. The distribution of births according to size as shown by Table 8.1, looks reasonable with almost 68 per cent of births falling within the "medium" category. However, there is likely to be some shift of births from average to large as many mothers would proudly prefer large children. Similarly, some births from smaller categories might have been shifted into the "medium" category. The "medium" category is used here as reference.

8.2.1.8 Age of Mother at Birth of Children

This variable divides births into four categories of "<18 years", "18-24 years", "25-34 years" and "35+ years". The "25-34 years" category is used as reference in this case.

8.2.1.9 Mother Currently Pregnant

Due to the significance of breastfeeding and sexual abstinence in the discussion of child spacing in Sub-Saharan Africa, mother's current pregnancy status has been included to assess the association with length of both preceding and particularly subsequent birth intervals. The variable splits births into whether mother is currently pregnant or not. Almost 15 per cent of births are from mothers who were pregnant at time of the survey. Since the main concern here is behavioural, especially once mothers realize their pregnancy status and the impact this might have on surviving siblings, the analysis is not concerned about those mothers unsure of their status. Births from those mothers who were not pregnant and those unsure of their status are used as reference.

8.2.2 **Micro-environmental Variables**

Table 8.2 presents the distribution of births according to four micro-environmental variables: home floor material, household toilet facility, household drinking water source and household non-drinking water source.

8.2.2.1 Home Floor Material

This variable splits the sample into two categories. The first category comprises births from homes with either earth or sand floors. The second one comprises those births from homes with either cement, wood or tiles for floor materials.

TABLE 8.2: DISTRIBUTION OF BIRTHS ACCORDING TO MICRO-ENVIRONMENTAL VARIABLES.

VARIABLES	NUMBER	PERCENTAGE
HOME FLOOR MATERIAL		
Earth/Sand	3430	52.6
Cement/Wood/Tiles	3088	47.4
HOUSEHOLD TOILET FACILITY		
No facility	1976	30.3
Pit toilet	3055	46.8
Flush toilet	1495	22.9
HOUSEHOLD DRINKING WATER SOURCE		
Surface water	1849	28.4
Well water	1795	27.5
Piped water	2873	44.1
HOUSEHOLD NON-DRINKING WATER SOURCE		
Surface water	1868	28.6
Well water	1845	28.3
Piped water	2809	43.1

It should be noted here that births from households having carpets for floor material are included in the cement/wood/tile category. The latter, which comprises 47 per cent of the births, is used as reference.

8.2.2.2 Household Toilet Facility

Types of toilet facility have been categorized into the following: no facility, pit toilet, and flush toilet. Pit toilets include both traditional and ventilated improved pit latrines (VIP). On the other hand, the flush toilet, used here as reference, comprises both own and shared flush toilets.

8.2.2.3 Household Water Source

In both cases of drinking and non-drinking water sources, three categories are constructed namely "surface", "well" and "piped water". While piped water includes both private and public tap water, well water includes both private and public wells. Surface water includes sources such as springs, rivers, streams, ponds, and lakes. In both cases of either drinking or non-drinking water sources, births from households with piped water are used as reference. Since over 95 per cent of households use same sources for both drinking and non-drinking water, the distributions of births within the categories for both variables are very similar.

8.3 UNIVARIATE ANALYSIS

8.3.1 Neonatal Mortality

8.3.1.1 Mortality Differentials according to Bio-demographic Factors

Table 8.3 presents neonatal mortality differentials according to seven bio-demographic variables.

It should be noted here that length of subsequent birth intervals and mother's current pregnancy status are not considered during the first month of life since it is not physiologically feasible. Using a population attributable risk (PAR) of at least 10 per cent, Table 8.3 shows remarkable contributions of almost all variables to neonatal mortality differentials except the survivorship status of the preceding child. Most significant, however, are size of child at birth and the preceding birth interval. Although the estimates for multiple births should be taken with caution since they are based on small number of exposures, multiple births are more than six times at higher risk of dying compared to single births, supporting similar studies that have considered childhood mortality in association with twin births. This is also true for children perceived small at birth by their mothers. Small children are almost five times at higher risk of dying relative to children considered as average sized. While large children, and as expected, have lowest mortality risks, the category of small children is likely to include many premature births.

TABLE 8.3: NEONATAL MORTALITY ACCORDING TO BIO-DEMOGRAPHIC VARIABLES: 1987-91.

VARIABLES	RATE PER 1000	S.E.	RR	PAR	EXPOS
SEX OF CHILD					
Male	51.9	4.0	1.46	18.7	3281
Female	35.6	3.3	1.00	-	3263
BIRTH TYPE					
Multiple	229.1	31.6	6.21	16.8	253
Single	36.9	2.4	1.00	-	6291
BIRTH ORDER					
1	58.2	6.4	1.41	14.6	1449
2-3	41.4	4.6	1.00	-	2024
4-5	35.4	5.2	0.86	na	1322
6+	40.8	4.9	0.99	na	1749
PRECEDING INTERVAL					
First births	60.0	6.5	1.68	21.0	1458
<24 months	75.8	8.9	2.12	25.3	986
24-35 months	35.8	4.0	1.00	-	2274
36+ months	23.8	3.6	0.66	na	1826
SURVIVAL OF PRECEDING CHILD					
Dead	64.9	8.4	1.61	8.2	954
Alive	40.2	2.7	1.00	-	5589
SIZE OF CHILD AT BIRTH					
Small	158.6	15.7	4.97	37.6	694
Medium	31.9	2.9	1.00	-	3887
Large	24.4	4.6	0.76	na	1161
AGE OF MOTHER AT BIRTH					
<18 years	59.5	9.9	1.63	11.4	623
18-24 years	48.4	4.3	1.33	14.7	2664
25-34 years	36.4	3.9	1.00	-	2432
35+ years	38.3	6.9	1.05	1.3	825

NOTES: The two variables, namely subsequent interval and Mother currently pregnant, are not considered during first month of life.

Premature births make up 5 per cent of the sample of births in the five years preceding the survey (Gaisie, Cross and Nsemukila, 1993). Although this study looks at size of children as perceived by their mothers, the results here confirm the higher mortality risk associated with small birth weights.

With strong association with mortality differentials during the first month of life is the length preceding birth intervals. The mortality risk is lowest amongst births with birth intervals of at least 36 months, and births with less than 24 month intervals are more than twice at risk of dying compared to births with intervals of between 24 and 35 months, again, supporting similar studies that have looked at increased mortality risk associated with shorter preceding intervals. However, and unlike earlier studies that have associated longer birth intervals of more than 36 months to higher childhood mortality, longer intervals of at least 36 months are in fact associated with better survival chances during the first month of life and might as well be linked to better child spacing patterns. Mothers with longer birth intervals are most likely to have recovered fully from previous pregnancies. In the cases involving age of mother at birth and birth order of child, mortality patterns in the first month of life exhibit a U-shaped pattern. For instance, births to young mothers aged less than 18 years and to those aged 18-24 years are 63 and 33 per cent respectively at elevated risk of dying compared to births of mothers aged 25-34 years. On the other hand, births to women aged at least 35 years are only at 5 per cent increased risk of dying compared to the reference category. The pattern is similar to that of birth order where first order births are 41 per cent at increased risks of dying compared to birth orders 2-3 and after 5.

Although not significant on the basis of attributable risk, index children whose preceding sibling died are at higher risk of dying than where the sibling is alive. Index children with dead preceding sibling are more than 60 percent at higher risk of dying than children whose preceding siblings are alive.

As is often the case during the first few weeks of life, male births are 46 per cent at higher risk of dying compared to female births.

Many of the findings shown from Table 8.3 are not new on issues relating childhood mortality differentials with bio-demographic characteristics during first month of life (Rutstein, 1984; Hobcraft, et al., 1985), except that the U-shaped patterns in mortality differentials for birth order and mother's age are not as distinctive.

8.3.1.2 Mortality Differentials according to Micro-environmental Factors

Table 8.4 presents mortality differentials during the first month of life according to micro-environmental factors.

Like Table 8.3, all four variables considered here make significant contributions to neonatal mortality variations based on attributable risk of at least 10 per cent. Mortality differentials by both home floor material and type of toilet facility are remarkable. Children from homes made of earth and/or sand floors are 78 per cent at higher risk of dying compared to those children from homes with cement floors. Cement floors, especially in rural areas reflect relatively higher social status than ordinary earth floors.

As for type of toilet facility, children from households with no facility and those using pit toilets are 75 and 44 per cent at increased risks of dying, respectively, compared to children from households with flush toilets. Again, flush toilets reflect relatively higher socio-economic status of the household.

TABLE 8.4: NEONATAL MORTALITY ACCORDING TO MICRO-ENVIRONMENTAL VARIABLES: 1987-91.

VARIABLES	RATE PER 1000	S.E.	RR	PAR	EXPOS
HOME FLOOR MATERIAL					
Earth/Sand	55.4	4.1	1.78	29.1	3430
Cement[1]	31.2	3.2	1.00	-	3088
HOUSEHOLD TOILET FACILITY					
No facility	53.5	5.3	1.75	30.0	1976
Pit toilet	44.2	3.8	1.44	22.8	3055
Flush toilet	30.6	4.6	1.00	-	1495
HOUSEHOLD DRINKING WATER SOURCE					
Surface water	53.3	5.4	1.52	16.9	1849
Well water	48.5	5.3	1.38	12.7	1795
Piped water	35.1	3.5	1.00	-	2873
HOUSEHOLD NON-DRINKING WATER SOURCE					
Surface water	55.6	5.5	1.62	19.8	1868
Well water	46.6	5.1	1.35	12.2	1845
Piped water	34.4	3.5	1.00	-	2809

NOTES: 1 - Includes wood, tiles and carpet.

There are a lot of similarities in neonatal mortality levels by both drinking and non-drinking water sources as illustrated in Table 8.4. Children from households using surface and well water for either drinking and non-drinking purposes are at least 50 per cent and 35 per cent at increased risk of dying, respectively; both cases compared to those children from households with piped water. The similarities in the pattern of mortality differentials by both drinking and non-drinking water sources are understandable since many households tend to use the same source for both drinking and non-drinking purposes. What cannot be determined from the data is whether drinking water is boiled before drinking.

8.3.2 Post-neonatal Mortality

8.3.2.1 Mortality Differentials according to Bio-demographic Factors

Table 8.5 presents post-neonatal mortality according to nine bio-demographic variables. Unlike Table 8.3, Table 8.5 includes length of subsequent birth intervals and mother's current pregnancy status.

On the basis of the probable public health significance, only preceding and subsequent birth intervals have some strong association with post-neonatal mortality.

Unlike the experience during the first month of life, sex of child and mother's age at birth contribute least to mortality differentials during the post-neonatal period. While male births are only 6 per cent at increased risk of dying relative to female births, there is only 8 per cent risk difference between births from mothers aged less than 18 years and those aged between 25 and 34 years. Moreover, post-neonatal mortality is highest amongst births from 18-24 year old mothers and lowest amongst births from mothers of at least 36 years of age.

TABLE 8.5: POST-NEONATAL MORTALITY ACCORDING TO BIO-DEMOGRAPHIC VARIABLES: 1987-91.

VARIABLES	RATE PER 1000	S.E.	RR	PAR	EXPOS
SEX OF CHILD					
Male	66.7	4.7	1.06	2.9	3115
Female	62.9	4.5	1.00	-	3149
BIRTH TYPE					
Multiple	149.7	28.2	2.41	4.3	201
Single	62.1	3.2	1.00	-	6063
BIRTH ORDER					
1	82.3	7.9	1.23	8.7	1367
2-3	67.1	6.0	1.00	-	1942
4-5	58.9	6.9	0.88	na	1276
6+	52.6	5.7	0.78	na	1679
PRECEDING INTERVAL					
First birth	81.9	7.9	1.48	15.6	1373
<24 months	87.9	10.0	1.59	14.8	914
24-35 months	55.3	5.1	1.00	-	2194
36+ months	51.8	5.5	0.94	na	1783
SURVIVAL OF PRECEDING CHILD					
Dead	91.2	10.3	1.51	6.8	894
Alive	60.4	3.4	1.00	-	5369
SUBSEQUENT INTERVAL					
<24 months	271.2	23.7	6.15	60.4	536
24-35 months	44.1	5.9	1.00	-	1274
36+ months	44.5	9.7	1.01	0.3	482
Last births	48.7	3.5	1.10	7.0	3972
SIZE OF CHILD AT BIRTH					
Small	80.8	11.9	1.24	3.2	592
Medium	65.0	4.2	1.00	-	3765
Large	56.3	7.1	0.86	na	1133
AGE OF MOTHER AT BIRTH					
<18 years	68.7	11.0	1.08	1.6	587
18-24 years	70.1	5.3	1.11	5.4	2538
25-34 years	63.4	5.3	1.00	-	2345
35+ years	49.0	8.0	0.77	na	794
MOTHER CURRENTLY PREGNANT					
Pregnant	88.7	10.1	1.46	6.2	907
Not pregnant[1]	60.8	3.4	1.00	-	5357

NOTES: 1 - Includes those mothers who were not sure.

The lower risks associated with births of younger mothers compared to births of 18-24 year olds are likely to have resulted from under 18 year old mothers receiving child care support from older relatives.

Like the first month of life, children whose preceding siblings died are themselves at increased risk of dying during the post-neonatal period. For example, the index child whose preceding sibling died is over 50 percent at higher risk of dying than a child whose preceding sibling is alive.

Much of the significant contribution to post-neonatal mortality differentials comes from subsequent and preceding birth intervals.

Although births of less than 24 months subsequent interval are more than six times at increased risk of dying relative to the reference category, there is virtually no risk difference between births with 24-35 months and at least 36 months interval.

On the other hand, multiple births are 2.4 times more likely to die than single births during the post-neonatal period. The mortality differentials are less remarkable here than earlier noted for neonatal mortality.

As for the lengths of preceding birth intervals, post-neonatal mortality is inversely associated with the length.

While births of shorter preceding intervals are 59 percent at higher risk of dying, mortality is lowest for births of at least 36 months of interval. Although this pattern was earlier noted for neonatal mortality differentials, it is not as remarkable during the post-neonatal period.

As expected within a Sub-Saharan African child-spacing perspective, births to pregnant mothers at the time of the survey are 46 per cent at increased risk of dying compared to children from those mothers who were not pregnant or unsure of their status. There are two main explanations for this result. First, women are pregnant possibly as an attempt to replace a dead child. Secondly, whenever mothers realise their pregnancy status, there is an abrupt change to child care practices of the index child and that action can sometimes result in child neglect and death.

Unlike its remarkable influence during the first month of life, size of child at birth has reduced influence on mortality differentials during the post-neonatal period although small births are still over 20 per cent at increased risk of dying.

Lastly, reductions in influence on mortality inequalities are noted for birth order during post-neonatal despite first order births having higher mortality risks of about 23 percent compared to birth orders 2-3. On the other hand, mortality risks are remarkably low for birth orders after 5. This might possibly suggest that after the fifth birth orders mothers are more mature and experienced in child rearing than during the first order births.

8.3.2.2 Mortality Differentials according to Micro-environmental Factors

Table 8.6 presents post-neonatal mortality according to micro-environmental variables.

Unlike many of the bio-demographic variables, all micro-environmental variables have strong public health significance during the post-neonatal period with type of toilet facility having the strongest association with mortality.

TABLE 8.6: POST-NEONATAL MORTALITY ACCORDING TO MICRO-ENVIRONMENTAL VARIABLES: 1987-91.

VARIABLES	RATE PER 1000	S.E.	RR	PAR	EXPOS
HOME FLOOR MATERIAL					
Earth/Sand	73.8	4.9	1.34	15.0	3245
Cement[1]	54.9	4.3	1.00	-	2993
HOUSEHOLD TOILET FACILITY					
No facility	61.6	5.8	1.39	18.0	1873
Pit toilet	77.1	5.2	1.74	33.1	2923
Flush toilet	44.4	5.6	1.00	-	1450
HOUSEHOLD DRINKING WATER SOURCE					
Surface water	74.6	6.6	1.45	14.8	1753
Well water	77.1	6.8	1.50	16.0	1710
Piped water	51.4	4.4	1.00	-	2774
HOUSEHOLD NON-DRINKING WATER SOURCE					
Surface water	80.0	6.9	1.54	17.6	1767
Well water	69.9	6.4	1.35	12.1	1761
Piped water	51.8	4.4	1.00	-	2714

NOTES: 1 - Includes wood, tiles and carpet.

Although both surface and well drinking water sources are associated with higher mortality risks, it is surprising that the risks associated with drinking surface water are lower than those associated with well water. This pattern is not shown by non-drinking water where births associated with households with surface and well water sources are 54 and 35 per cent at higher risks of dying, respectively, compared to those with a piped water source. Possible reasons for such a pattern are discussed later. It should be stated, however, that mortality risks associated with surface and well drinking water remain remarkably high. Another unexpected finding is that associated with type of toilet facility. Although households with no toilet facility and those with pit toilets continue being associated with elevated risks of dying, those households with no facility have 35 per cent lower risk of dying compared to children from households using pit toilets. Overall, children from households using pit toilets are 75 per cent at increased risk of dying compared to children from households with flush toilets. Again, possible explanations for these patterns in mortality, which are linked to overall child care patterns, are discussed in later sections. Expectedly, however, children from homes with earth and/or sand floor materials are 34 per cent at higher risks of dying compared to children coming from homes with cement floor materials.

8.3.3 Child Mortality

8.3.3.1 Mortality Differentials according to Bio-demographic Factors

Table 8.7 presents child mortality differentials according to nine bio-demographic variables. Although both subsequent and preceding birth intervals continue to have public health significance during the late childhood period, there is some increase in influence on mortality from the child's order and mother's age which is greater than during the post-neonatal period.

TABLE 8.7: CHILD MORTALITY ACCORDING TO BIO-DEMOGRAPHIC VARIABLES: 1987-91.

VARIABLES	RATE PER 1000	S.E.	RR	PAR	EXPOS
SEX OF CHILD					
Male	50.3	4.2	1.05	2.4	2914
Female	47.8	4.1	1.00	-	2957
BIRTH TYPE					
Multiple	59.5	18.8	1.22	0.6	173
Single	48.7	3.0	1.00	-	5698
BIRTH ORDER					
1	64.8	7.3	1.32	11.6	1259
2-3	49.1	5.3	1.00	-	1816
4-5	39.8	5.8	0.81	na	1203
6+	43.6	5.3	0.89	na	1593
PRECEDING INTERVAL					
First births	64.5	7.2	1.54	17.0	1265
<24 months	61.6	8.7	1.47	11.9	837
24-35 months	41.8	4.5	1.00	-	2076
36+ months	40.4	4.9	0.97	na	1693
SURVIVAL OF PRECEDING CHILD					
Dead	63.2	8.9	1.36	5.5	816
Alive	46.6	3.1	1.00	-	5054
SUBSEQUENT INTERVAL					
<24 months	136.1	18.8	2.00	20.0	408
24-35 months	67.9	7.6	1.00	-	1219
36+ months	88.3	14.1	1.30	7.6	461
Last births	29.5	2.8	0.43	na	3783
SIZE OF CHILD AT BIRTH					
Small	58.4	10.5	1.35	4.5	546
Medium	43.4	3.5	1.00	-	3528
Large	47.8	6.8	1.10	2.3	1071
AGE OF MOTHER AT BIRTH					
<18 years	71.8	11.6	1.53	9.6	548
18-24 years	54.3	4.9	1.16	7.7	2366
25-34 years	47.0	4.7	1.00	-	2201
35+ years	22.7	5.5	0.48	na	756
MOTHER CURRENTLY PREGNANT					
Pregnant	73.7	9.6	1.64	8.3	830
Not pregnant[1]	45.0	3.0	1.00	-	5041

NOTES: 1 - Includes those mothers who were not sure.

On the other hand, the survival status of the preceding child has little influence on the survivorship of the index child although index children whose preceding siblings died are 36 percent at elevated risk of dying during late childhood.

Most significant, however, is the length of subsequent intervals for births of less than 24 months at twice the risk of dying compared to births of 24-35 months interval. Somehow unexpected is the increased risk of dying for births with at least 36 months interval of about 30 per cent relative to the reference category. This on the other hand, supports the U-shaped pattern that has been discussed in similar studies that have dealt with birth intervals per se, and not necessarily with the subsequent birth interval. Among the reasons given for higher risks associated with longer birth intervals are problems linked to spontaneous abortions and generally reflecting problems of mothers' reproductive health.

However, this pattern is unusual for Sub-Saharan Africa, where, in the absence of spontaneous abortions, longer subsequent birth intervals are expected to have a risk reduction effect on the index child.

Equally important is mother's current pregnancy. Index children whose mothers were pregnant at time of the survey are 64 per cent at increased risk of dying, supporting the earlier suggestion of cultural practices associated with changes in subsequent child care as mothers discover their pregnancy status. An issue also discussed in more detail in the following sections.

Although mortality risks are lower for births associated with longer preceding birth intervals, births with less than 24 months of interval are 47 percent at increased risk of dying even during childhood as compared to births with preceding intervals of 24-35 months.

Whereas age of mother at birth shows clear negative association with child mortality with births from younger mothers aged less than 18 years at 53 per cent elevated risk of dying, mortality risks are lowest for births to mothers aged at least 35 years. Births to mothers aged at least 35 years are over 50 per cent at reduced risk of dying compared to the reference category of 25-34 years. These results support earlier findings based on the DHS data (Sullivan, Rutstein, Bicego, 1994). Comparing Latin American and Sub-Saharan African countries, Sullivan et al. found births to older women to have been on average at slightly lower relative risk in Sub-Saharan Africa than lower age births. Such lower risk of mortality might be explained by previous experience of child birth and general child care amongst older mothers. Such mothers, for example, are also most likely to be economically stable compared to mothers less than 25 years of age.

Even though multiple births continue to have elevated risk of dying at around 22 per cent compared to single births, smaller births are about 35 percent at higher risk of dying during later childhood. Rather unexpectedly, larger births are about 10 per cent at increased risk of dying compared to medium sized births during late childhood. Even though this could have been explained by difficulties associated with delivery of larger births, absence of such a pattern during the neonatal period makes this observation difficult to explain. However, that can be partially explained by size misreporting by mothers.

Lastly, first order births have higher mortality levels compared to birth orders of at least 4. This is despite some observed small U-shaped patterns influenced by some 8 per cent higher mortality risks for birth orders beyond the fifth birth.

8.3.3.2 Mortality Differentials according to Micro-environmental Factors

Table 8.8 presents child mortality differentials according to micro-environmental factors.

TABLE 8.8: CHILD MORTALITY ACCORDING TO MICRO-ENVIRONMENTAL VARIABLES: 1987-91.

VARIABLES	RATE PER 1000	S.E.	RR	PAR	EXPOS
HOME FLOOR MATERIAL					
Earth/Sand	53.5	4.3	1.20	9.3	3014
Cement[1]	44.7	4.0	1.00	-	2833
HOUSEHOLD TOILET FACILITY					
No facility	57.8	5.8	1.48	21.2	1761
Pit toilet	48.8	4.3	1.25	14.2	2706
Flush toilet	39.0	5.4	1.00	-	1387
HOUSEHOLD DRINKING WATER SOURCE					
Surface water	49.8	5.6	1.11	4.0	1627
Well water	54.5	5.9	1.21	7.3	1583
Piped water	45.0	4.2	1.00	-	2635
HOUSEHOLD NON-DRINKING WATER SOURCE					
Surface water	49.0	5.5	1.11	4.1	1631
Well water	56.4	5.9	1.28	9.8	1642
Piped water	44.0	4.2	1.00	-	2577

NOTES: 1 - Includes wood, tiles and carpet.

Even though type of household toilet facility has most significant influence on child mortality differentials, the pattern of higher risks associated with use of pit toilets noted earlier during the post-neonatal period are not observed during late childhood. In fact, mortality patterns during late childhood show expected patterns of higher risks associated with no toilet facility. While children from households without toilet facility are 48 per cent at higher risk of dying compared to those with flush toilets, those children from households using pit toilets are 25 per cent at higher risk of dying. One particular explanation is that during infancy, most children are not allowed to use any of the toilet facilities especially pit toilets. Between ages 1 and 5 children are not allowed to use pit toilets, too, for fear of them falling into the pit. In most instances, however, such children are allowed to use any surrounding area which includes their playing grounds. This observation is supported by evidence from Burkina Faso by Frank and Dakuyo (1985). While older children are likely to be more exposed to faecal contamination in play grounds, this is not likely to be the case for younger children who are mostly likely to be in closer supervision by their mothers than of older siblings. On the other hand, children at crawling stage are more likely to be exposed to faecal contamination once allowed to wander around playgrounds than those children at walking stage. This is likely to explain the observed pattern in mortality by toilet facility during the post-neonatal period especially if there are older siblings in the households who are most unlikely to use pit toilets, and thus resorting to nearby playgrounds.

As for sources of water, both drinking and non-drinking water sources show similar patterns of mortality risks where higher risks are more common with well water. During the post-neonatal period, however, such higher risks were only observed with drinking water source. While infants are likely to be given drinking water by their mothers, older children are likely to take non-drinking water either by themselves or under supervision of older siblings who would care less about differentiating drinking from non-drinking water. On the other hand, one possible explanation for higher risks associated more with well than surface water sources is that surface water is less likely to be still for longer periods of time compared to well water. Moreover, well water is more likely to be contaminated through faecal seepage if built nearer to pit toilets. This is particularly true for high density urban slums where little distance is allowed between wells and pit toilets.

Nevertheless, higher mortality risks are still common for births from homes with earth/sand floor materials at 20 per cent higher risks of dying compared to births from homes with cement floors.

8.3.4 Summary and Test for Statistical Significance

As in previous chapters, one-variable models are fitted for each variable to identify those with statistically significant gross effects on neonatal, and both post-neonatal and child mortality using logistic and Cox hazards regression models, respectively. Similarly, statistical significance is determined by use of p-values of model X^2 for logistic regression and global score for the Cox regression. Table 8.9, therefore, presents gross effects of bio-demographic factors on neonatal, post-neonatal and child mortality differentials.

TABLE 8.9: GROSS EFFECTS OF BIO-DEMOGRAPHIC FACTORS ON CHILDHOOD MORTALITY: TESTING FOR STATISTICAL SIGNIFICANCE.

VARIABLES	NEONATAL	POST-NEONATAL	CHILD
SEX OF CHILD	[0.00]	[0.49]	[0.59]
Male	1.47***	1.05	1.07
Female	1.00	1.00	1.00
BIRTH TYPE	[0.00]	[0.00]	[0.42]
Multiple	6.88***	1.80***	1.30
Single	1.00	1.00	1.00
BIRTH ORDER	[0.03]	[0.00]	[0.03]
1	1.42**	1.25**	1.31*
2-3	1.00	1.00	1.00
4-5	0.85	0.86	0.80
6+	0.99	0.84*	0.88
PRECEDING INTERVAL	[0.00]	[0.00]	[0.01]
First births	1.70***	1.47***	1.54***
<24 months	2.16***	1.50***	1.42**
24-35 months	1.00	1.00	1.00
36+ months	0.66**	0.95	0.99
SUBSEQUENT INTERVAL	na	[0.00]	[0.00]
<24 months	na	3.17***	1.94***
24-35 months	na	1.00	1.00
36+ months	na	1.17	1.29
Last births		0.71***	0.63***
SIZE OF CHILD AT BIRTH	[0.00]	[0.13]	[0.29]
Small	5.32***	1.27*	1.36
Medium	1.00	1.00	1.00
Large	0.76	0.96	1.08
AGE OF MOTHER AT BIRTH	[0.05]	[0.00]	[0.00]
<18 years	1.65**	1.26*	1.45*
18-24 years	1.34**	1.12	1.17
25-34 years	1.00	1.00	1.00
35+ years	1.05	0.66***	0.50***
MOTHER CURRENTLY PREGNANT	na	[0.00]	[0.11]
Pregnant	na	1.49***	1.27
Not pregnant[1]	na	1.00	1.00
PRECEDING CHILD	[0.00]	[0.00]	[0.03]
Dead	1.64***	1.41***	1.40**
Alive	1.00	1.00	1.00

NOTES: 1 - Includes those mothers who were not sure.
na - not applicable.
*** $p<0.01$; ** $p<0.05$; * $p<0.10$; [] p-value of X^2.

There is little evidence of a significant effect from sex of child on mortality differentials after the first month of life, but male births are 47 per cent at higher risk of dying during the neonatal period.

This has been associated to biological and physiological explanations common from many similar studies. Also true is the declining influence of multiple births on mortality differentials with increasing age of the child. While multiple births are almost seven times more likely to die during the first few weeks of life compared to single births, the risks are much lower during late childhood at 30 per cent increased risk of dying and the effect is not statistically significant.

In contrast, birth order has significant influence on mortality variations throughout the five year period with first order births at highest risk of dying. While mortality risks are lowest for birth orders beyond 3, there is little evidence of the often cited U-shaped mortality pattern with increased risk at higher parity. Similar results have also been observed for Sub-Saharan Africa by earlier studies using the DHS data (Sullivan et al., 1994).

As expected for length of preceding birth interval, its influence on mortality differentials is significantly consistent, although somehow declines with increasing age of the child. While births with less than 24 months interval are over twice at risk compared to those with intervals of 24-35 months, they are 50 per cent and 42 per cent at higher risks of dying during post-neonatal and late childhood, respectively. On the other hand, births associated with at least 36 months interval have lower mortality risks during the first month of life while little difference is noted for late child mortality once compared to intervals between 24 and 35 months.

More significant, however, and as expected within the Sub-Saharan African child spacing perspective is the remarkable effect of the length of subsequent birth intervals on childhood mortality. Births with less than 24 months subsequent intervals are over 3 times at higher risk of dying during the post-neonatal period compared to the 24-35 month interval. The influence is equally significant during late childhood with births associated with less than 24 months interval at almost twice the risk.

Unlike earlier studies, which stressed more the influence of preceding birth intervals and often ignored influence from subsequent birth intervals, the effects of subsequent intervals are found most revealing with particular reference to child spacing patterns in Sub-Saharan Africa. It is believed many changes to child care patterns are dramatically altered during the subsequent interval in accordance with traditional practices especially when mothers realize that they are pregnant . In extreme cases, and particularly true for some ethnic groups in Zambia, index children are abruptly separated from their parents and put under the care of their grandparents or other relatives mostly for fear of the belief that children would die once allowed to live with an expectant mother. This is also a way of ensuring that the child is not allowed to suckle the breast of an expectant mother. The dramatic change in child care and the abrupt disruption of breastfeeding exposes the child earlier to normal family meals further exposing the child to higher risks of contamination and possible death. This is most likely if the child is put under care of a relatively poorer household.

Apparently, this is not likely the case for preceding birth intervals where many of the risks can be explained by mother's well being and often referred to as maternal depletion. Although sibling competition is often cited as explanation for higher risks associated with subsequent birth intervals, the influence of socio-cultural links to child care during the interval can not be dismissed easily.

Unlike preceding birth intervals, the U-shaped mortality patterns often identified in similar studies are much more pronounced with subsequent intervals where delay to have a child after 36 months especially amongst traditional families is likely to result from sub-fecundity or spontaneous abortions which are less likely to be reported by most mothers.

Mortality patterns associated with subsequent birth intervals can be supported by those patterns associated with mother's current pregnancy status in the light of Sub-Saharan African child spacing behaviour. Children of pregnant mothers are 49 per cent at increased risk of dying compared to children whose mothers were not pregnant or not sure of being pregnant. Although not statistically significant during late childhood, children of pregnant mothers are 27 per cent at elevated risk of dying.

On the other hand, the mortality effect of the survivorship status of the preceding sibling is reduced with increasing age of the child. While index children are 64 percent at increased risk of dying within the first month of life if the preceding sibling died, they are 40 percent at higher risk during late childhood. The reduced influence of the survival status of preceding sibling with increasing age of the index child is possibly due to declining influence of the endogenous factors. Moreover, the economic situation of the household is likely to have stronger influence in explaining familial associations after the first month of life (Curtis and Steele, 1996).

As expected, the significant contribution of birth weight, and in this case size of child at birth, is remarkable during the first few weeks of life. Small births are over five times more likely to die during the neonatal period compared to average sized births. The small births category, however, is likely to include many premature births. On the other hand, mortality is lowest amongst those children considered large by their mothers. Since there is no likely explanation for some increased risks of dying for larger children during late childhood, it is suspected that this is a mere reflection of size misreporting especially in a society where most mothers would rather have large babies.

Lastly, births to younger mothers, aged less than 18 years of age, are at increased risk of dying during the first month of life. Births to mothers aged less than 18 years and those aged 18-24 years are 65 and 34 per cent at increased risk of dying during the first month of life, respectively, compared to births from the reference category. Despite some noted elevation in risk of dying for births to mothers aged over 34 years during the neonatal period, the increase in survival chances of births from such women can be attributed to maturity of mothers and possibly their experiences from previous births. Moreover, such mothers are most likely to be economically independent. During both the post-neonatal and late childhood periods, births to women aged over 34 years have highest survival chances.

Table 8.10 summarises the gross effect of micro-environmental factors on neonatal, post-neonatal and child mortality differentials.

TABLE 8.10: GROSS EFFECTS OF MICRO-ENVIRONMENTAL FACTORS ON CHILDHOOD MORTALITY: TESTING FOR STATISTICAL SIGNIFICANCE.

VARIABLES	NEONATAL	POST-NEONATAL	CHILD
HOME FLOOR MATERIAL	[0.00]	[0.00]	[0.15]
Earth/Sand	1.80***	1.26***	1.19
Cement[1]	1.00	1.00	1.00
HOUSEHOLD TOILET FACILITY	[0.00]	[0.00]	[0.07]
No facility	1.77***	1.41***	1.47**
Pit toilet	1.46**	1.48***	1.27
Flush toilet	1.00	1.00	1.00
HOUSEHOLD DRINKING WATER SOURCE	[0.00]	[0.00]	[0.36]
Surface water	1.53***	1.27**	1.11
Well water	1.39**	1.34***	1.23
Piped water	1.00	1.00	1.00
HOUSEHOLD NON-DRINKING WATER SOURCE	[0.00]	[0.00]	[0.21]
Surface water	1.63***	1.33***	1.11
Well water	1.36**	1.30***	1.29*
Piped water	1.00	1.00	1.00

NOTES: 1 - Includes wood, tiles and carpet.
*** $p<0.01$; ** $p<0.05$; * $p<0.10$; [] p-value of X^2.

With the exception of household toilet facility and perhaps non-drinking water source, none of the selected micro-environmental variables continue to have statistically significant influence on mortality differentials during late childhood. While contributing significantly during the first year of life, the influence of these environmental variables on mortality differentials declines with increasing age of the child.

Even though mortality patterns during the first month of life for all selected variables behave according to expectations, the higher risks associated with pit toilets and well water during the post-neonatal period are remarkable.

As for drinking and non-drinking water, the pattern that is observed during infancy continues even in late childhood when children are most likely to be exposed to many environmental hazards. The increased risk of dying at about 47 per cent which is associated with household toilet facilities, as noted during late childhood, are worth investigating further despite the fact that information on toilet use by older children is hardly collected by DHS surveys.

8.4 MULTIVARIATE ANALYSIS

8.4.1 Introduction

This section is an attempt to assess the independent influence of each individual variable on childhood mortality differentials. Selected variables are therefore sequentially fitted using both logistic and proportional hazards models.

Tables 8.11 and 8.12 present crosstabulation of children's size at birth by type of birth, and children's size at birth by age of mother at birth, respectively.

TABLE 8.11 CROSSTABULATION OF SIZE OF CHILD AT BIRTH BY TYPE OF BIRTH

	SIZE OF CHILD AT BIRTH			
TYPE OF BIRTH	< Average	Average	> Average	**TOTAL**
Multiple	99	113	17	229
Single	595	3774	1144	5513
TOTAL	694	3887	1161	5742

Chi-Square	Value	DF	Significance
Likelihood Ratio	156.0	2	0.0000

TABLE 8.12 CROSSTABULATION OF SIZE OF CHILD AT BIRTH BY AGE OF MOTHER AT BIRTH

	SIZE OF CHILD AT BIRTH			
AGE OF MOTHER	< Average	Average	> Average	**TOTAL**
< 18	86	394	67	547
18-24	319	1563	447	2329
25-34	219	1436	476	2131
35+	70	494	171	735
TOTAL	694	3887	1161	5742

Chi-Square	Value	DF	Significant
Likelihood Ratio	51.4	6	0.0000

On the other hand, Tables 8.13 and 8.14 present crosstabulation of home floor material by household toilet facility, and household toilet facility by drinking water source, respectively. In some of these crosstabulation, variables are strongly associated. This is especially the case for micro-environmental variables.

Although estimates are likely to be biased by including such variables in one model, only the inclusion of both drinking and non-drinking water sources in a single model is avoided.

TABLE 8.13 CROSSTABULATION OF HOME FLOOR MATERIAL BY HOUSEHOLD TOILET FACILITY

	HOUSEHOLD TOILET FACILITY			
HOME FLOOR	No facility	Pit	Flush	**TOTAL**
Earth/sand	1790	1622	17	3429
Cement/tiles	185	1426	1476	3087
TOTAL	1975	3048	1493	6516

Chi-Square	**Value**	**DF**	**Significance**
Likelihood Ratio	3388.1	2	0.0000

TABLE 8.14 CROSSTABULATION OF HOUSEHOLD TOILET FACILITY BY HOUSEHOLD DRINKING WATER SOURCE

	HOUSEHOLD TOILET FACILITY			
WATER SOURCE	No facility	Pit	Flush	**TOTAL**
Surface	989	857	2	1848
Well	819	952	24	1795
Piped	161	1242	1469	2872
TOTAL	1969	3051	1495	6515

Chi-Square	**Value**	**DF**	**Significance**
Likelihood Ratio	3481.9	4	0.0000

Hence drinking water source is adopted for multivariate analysis, instead. Since the two variables are considerably similar, the resulting estimates from using drinking water source are not likely to differ substantially from estimates that would have resulted from using non-drinking water. With respect to contamination, the use of drinking water source is found most appealing in this analysis.

8.4.2 Neonatal Mortality

8.4.2.1 Main Effects of Bio-demographic Variables on Neonatal Mortality.

Table 8.15 presents six logistic regression models with Model 1 demonstrating the gross effects of size of a child at birth on mortality during the first month of life.

TABLE 8.15: RELATIVE RISKS OF NEONATAL MORTALITY ASSOCIATED WITH BIO-DEMOGRAPHIC VARIABLES: RESULTS OF LOGISTIC REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
SIZE OF CHILD AT BIRTH						
Small	5.32***	4.30***	3.97***	4.14***	4.17***	4.15***
Large	0.76	0.79	0.82	0.80	0.80	0.80
BIRTH TYPE						
Multiple		4.09***	4.83***	4.81***	5.00***	4.78***
PRECEDING INTERVAL						
First births			1.61***	1.62***	1.46*	1.44*
<24 months			2.13***	2.14***	2.15***	2.10***
36+ months			0.62**	0.64**	0.64**	0.63**
SEX OF CHILD						
Male				1.65***	1.66***	1.65***
AGE OF MOTHER AT BIRTH						
<18 years					1.46	1.47
18-24 years					1.03	1.04
35+ years					1.26	1.22
PRECEDING CHILD						
Dead						1.41**
Model X^2	140.3	186.3	228.1	241.7	247.0	248.7
df	2	3	6	7	10	11

*** p<0.01; ** p<0.05; * p<0.10.

Whereas babies considered small at birth are over five times more likely to die during the neonatal period compared to average sized births, controlling for multiple births accounts for almost 20 per cent of the risks associated with small births.

Further control for length of preceding birth intervals only explains for less than 8 per cent of the risks associated with small births.

In contrast, however, and as illustrated by Model 3, controlling for preceding birth intervals elevates the risks associated with multiple births by about 18 per cent. Although controlling for sex of child has little effect on influences of multiple births and preceding birth intervals, the control for sex of child increases the risk of dying for small births.

Controlling for age of mother as shown by Model 5 changes little the existing mortality differentials, except for worsening the risk of dying amongst multiple births.

Lastly, controlling for the survival status of the preceding sibling changes little of the mortality risk during the first month of life. Except possibly for explaining some of the mortality risks associated with multiple births. On the other hand, index children whose preceding sibling died are 41 percent at elevated risk of dying, even when other bio-demographic factors are accounted for.

Even though mother's age at birth contribute little to mortality differentials, the contribution of size of child at birth, multiple births, preceding intervals and sex of child are statistically significant during the first month of life despite controlling for influences of other selected bio-demographic variables. These factors have also been found in similar demographic studies to exert strong influence on childhood mortality especially during the first month of life.

8.4.2.2 Main Effects of Micro-environmental Variables on Neonatal Mortality

Table 8.16 presents three logistic regression models on the gross and net effects of selected micro-environmental variables on childhood mortality during the first month of life.

TABLE 8.16: RELATIVE RISKS OF NEONATAL MORTALITY ASSOCIATED WITH MICRO-ENVIRONMENTAL VARIABLES: RESULTS OF LOGISTIC REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3
HOME FLOOR MATERIAL			
Earth/Sand	1.80***	1.97***	1.90***
HOUSEHOLD DRINKING WATER SOURCE			
Surface water		0.89	0.86
Well water		0.86	0.84
HOUSEHOLD TOILET FACILITY			
No facility			1.15
Pit latrine			1.11
Model X^2	21.7	22.3	22.6
df	1	3	5

*** p<0.01

Model 1 presents the gross effect of home floor material on neonatal mortality. Births from homes with earth/sand floors are 80 per cent at higher risk of dying compared to those births from cement floor homes.

Whereas controlling for household drinking water source elevates the risk of dying for births from earth/sand floor homes as shown by Model 2, the risks associated with surface and well drinking water sources are drastically reduced.

This probably means that the risks associated with surface and well water are most likely to be explained by the household environment within homes since after one controls for home floor materials, the risks of dying become more associated with piped water.

Although controlling for household toilet facility explains little of the risk associated with both floor materials and drinking water source, controlling for the later variables explains substantially the risks associated with toilet facilities. Even though mortality differentials according to toilet facility are reduced substantially after controlling for other environmental variables, child survival chances are still highest among children with flush toilets.

On the other hand, the continued higher mortality risk associated with children from homes with earth/sand floors, after controlling for other variables, might be attributed to the household socio-economic situation.

8.4.3 Post-neonatal Mortality

8.4.3.1 Main Effects of Bio-demographic Variables on Post-neonatal Mortality

Table 8.17 presents eight proportional hazards models of the gross and net effects of bio-demographic variables on childhood mortality during the 1-11 months of life.

Whereas Model 1 presents the gross effects of the length of subsequent birth intervals on post-neonatal mortality, controlling for mother's pregnancy status has varying influences resulting from the subsequent intervals.

TABLE 8.17: RELATIVE RISKS OF POST-NEONATAL MORTALITY ASSOCIATED WITH BIO-DEMOGRAPHIC VARIABLES: RESULTS OF COX HAZARDS REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8
SUBSEQUENT INTERVAL								
<24 months	3.17***	3.12***	3.11***	3.03***	3.03***	3.30***	3.29***	3.24***
36+ months	1.17	1.22	1.21	1.21	1.21	1.33	1.33	1.33
Last births	0.71***	0.70***	0.69***	0.71***	0.71***	0.76**	0.76**	0.75**
MOTHER CURRENTLY PREGNANT								
Pregnant		1.48***	1.50***	1.47***	1.46***	1.51***	1.51***	1.48***
BIRTH TYPE								
Multiple			1.98***	2.10***	2.09***	1.68***	1.68***	1.66**
PRECEDING INTERVAL								
First births				1.40***	1.41***	1.34**	1.34**	1.34**
<24 months				1.37***	1.36***	1.29**	1.29**	1.29**
36+ months				0.99	1.00	1.04	1.04	1.04
AGE OF MOTHER AT BIRTH								
<18 years					0.93	1.05	1.05	1.06
18-24 years					0.97	0.99	0.99	0.98
35+ years					0.78*	0.81	0.81	0.81
SIZE OF CHILD AT BIRTH								
Small						1.18	1.18	1.19
Large						0.98	0.98	0.98
SEX OF CHILD								
Male							1.07	1.07
PRECEDING CHILD								
Dead								1.23*
Model X^2	299.2	315.9	331.4	350.2	352.2	307.4	308.2	313.1
df	3	4	5	8	11	13	14	15

*** p<0.01; ** p<0.05; * p<0.10.

While controlling for mother's pregnancy explains slightly some risks associated with length of subsequent birth intervals of less than 24 months, it elevates the risks associated with intervals of at least 36 months and surprisingly by similar proportions.

Although controlling for birth type explains little of the effects of both subsequent birth intervals and mother's pregnancy status as illustrated by Model 3, controlling for length of preceding birth intervals as shown in Model 4 has remarkable results. Whereas controlling for length of preceding birth interval explains little of the effects of subsequent intervals of at least 36 months, it does explain some of the risks associated with subsequent intervals of less than 24 months. Moreover, controlling for length of preceding birth intervals as demonstrated by Model 4 elevates the risks associated with multiple births.

As for Model 5, however, adding age of mother at birth to the model explains little of the covariation in mortality associated with other bio-demographic variables, although somehow explaining some of the risks associated with multiple births. On the other hand, and comparing Model 5 to results from Table 8.9, inequalities in post-neonatal mortality are mostly explained by variables linked to child-spacing complemented by multiple births.

With the exception of preceding birth intervals and especially birth type where the associated risks are over 40 per cent higher than the reference, controlling for size of child at birth in Model 6 worsens the risks associated with length of subsequent birth intervals, mother's pregnancy status and age of mother at birth.

On the other hand, controlling for sex of the child explains nothing of the risks associated with other bio-demographic variables. While controlling for the survival status of the preceding sibling explains little of the risks associated with other variables, it does explain for some of the mortality risk associated with multiple births. Moreover, the index children whose preceding sibling died are 23 percent at higher risk of dying during the post-neonatal period.

Overall, length of subsequent birth intervals, birth type, mother's current pregnancy, length of preceding birth intervals and the survival status of the preceding child all have statistically significant effects on post-neonatal mortality.

8.4.3.2 Main Effects of Micro-environmental Variables on Post-neonatal Mortality

Table 8.18 presents three proportional hazards models on the effects of micro-environmental variables on post-neonatal mortality.

TABLE 8.18: RELATIVE RISKS OF POST-NEONATAL MORTALITY ASSOCIATED WITH MICRO-ENVIRONMENTAL VARIABLES: RESULTS OF COX HAZARDS REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3
HOUSEHOLD TOILET FACILITY			
No facility	1.41***	1.19	1.15
Pit toilet	1.48***	1.33**	1.31**
HOUSEHOLD DRINKING WATER SOURCE			
Surface water		1.17	1.11
Well water		1.22*	1.16
HOME FLOOR MATERIAL			
Earth/Sand			1.09
Model X^2	13.8	17.5	17.8
df	1	3	5

*** p<0.01; ** p<0.05; * p<0.10.

As earlier noted from Table 8.10, there are increased mortality risks associated with pit toilets compared to having no toilet facility, despite both categories having higher risks of over 40 per cent when compared to births from homes with flush toilets. Whereas controlling for drinking water source, as illustrated by Model 2, explains about 22 per cent of the relative risks associated with having no toilet facility, it explains little of the risks associated with pit toilets.

Moreover, well water source as opposed to surface water source continue to be associated with higher risks of dying during the post-neonatal period.

Even though controlling for home floor explains some of the risks associated with well water source and to a lesser extent the risks associated with having no toilet facility, it does not explain substantially the risks associated with having pit toilets.

On the other hand, and with reference to Table 8.10, controlling for household toilet and drinking water source seem to account for much of the mortality risks associated with earth/sand floor homes.

8.4.4 Child Mortality

8.4.4.1 Main Effects of Bio-demographic Variables on Child Mortality

Table 8.19 presents eight proportional hazards models according to the effects of bio-demographic variables on child mortality.

TABLE 8.19: RELATIVE RISKS OF CHILD MORTALITY ASSOCIATED WITH BIO-DEMOGRAPHIC VARIABLES: RESULTS OF COX HAZARDS REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8
SUBSEQUENT INTERVAL								
<24 months	1.94***	1.91***	1.88***	1.85***	2.23***	2.23***	2.23***	2.18***
36+ months	1.29	1.32	1.35	1.35	1.66**	1.67**	1.66**	1.66**
Last births	0.63***	0.65***	0.64***	0.64***	0.70**	0.70**	0.70**	0.69**
AGE OF MOTHER AT BIRTH								
<18 years		1.39*	1.37*	1.32	1.39	1.41	1.41	1.36
18-24 years		1.12	1.11	1.19	1.13	1.14	1.14	1.09
35+ years		0.55**	0.56**	0.48***	0.50**	0.50**	0.50**	0.50**
MOTHER CURRENTLY PREGNANT								
Pregnant			1.31**	1.32*	1.39**	1.39**	1.40**	1.34*
BIRTH ORDER								
1				1.21	1.15	1.15	1.15	1.16
4-5				0.94	0.91	0.91	0.91	0.87
6+				1.36	1.33	1.34	1.33	1.28
SIZE OF CHILD AT BIRTH								
Small					1.32	1.34	1.32	1.33
Large					1.07	1.07	1.07	1.08
SEX OF CHILD								
Male						1.10	1.10	1.11
BIRTH TYPE								
Multiple							1.20	1.21
PRECEDING CHILD								
Dead								1.31
Model X^2	53.2	63.9	67.2	71.7	73.6	74.1	74.2	77.5
df	3	6	7	10	12	13	14	15

*** p<0.01; ** p<0.05; * p<0.10.

Although controlling for age of mother at birth explains for some of the risks associated with subsequent birth intervals of less than 24 months, it elevates the risks associated with subsequent birth intervals of at least 36 months. This is also true when mother's current pregnancy is controlled for, as demonstrated by Model 3. While controlling for birth order, as shown by Model 4, accounts for some of the risks associated with subsequent birth intervals of less than 24 months and for risks associated with being born to young and old mothers, it somehow worsens the risks of dying for births from women aged 18-24 years.

Also noted from this analysis is that the contribution of mother's age at birth is less significant during infancy than during later childhood periods. One possible explanation is that during infancy most young mothers receive considerable support in child care from their parents and other older kin members. It is, therefore, possibly true that such support is reduced significantly with increasing age of both the mother and the child.

Apart from explaining some of the risks associated with birth order, as shown in Model 5, controlling for size of the child at birth increases the risks of dying for all other variables except for births of mothers aged 18-24 years. Substantial increases in risks are noted particularly for length of subsequent birth intervals where mortality risks for intervals of less than 24 months are elevated by almost 38 per cent. This is possibly explained by the closer association between children who are small for their size, shorter birth intervals and mother's health and nutritional status.

On the other hand, controlling for both sex of child and birth type, as illustrated by Models 6 and 7, explain nothing of the risks associated with many of the bio-demographic variables considered during later childhood.

Despite lacking *statistical significance, the control for* survival status of the preceding child accounts for some of the mortality risks associated with children of expectant mothers.

Most statistically significant contributions during late childhood come from length of subsequent birth intervals, age of mother at birth and mother's current pregnancy. Preceding birth intervals are not included in the models shown in this section since the overall contribution of the variable during late childhood is negligible.

8.4.4.2 Main Effects of Micro-environmental Variables on Child Mortality

Table 8.20 presents three proportional hazards models based on the effects of environmental variables on child mortality.

TABLE 8.20: RELATIVE RISKS OF CHILD MORTALITY ASSOCIATED WITH MICRO-ENVIRONMENTAL VARIABLES: RESULTS OF COX HAZARDS REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3
HOUSEHOLD TOILET FACILITY			
No facility	1.47**	1.51*	1.49*
Pit toilet	1.27	1.30	1.29
HOUSEHOLD DRINKING WATER SOURCE			
Surface water		0.90	0.87
Well water		1.02	0.98
HOME FLOOR MATERIAL			
Earth/sand			1.06
Model X^2	5.25	5.44	5.52
df	2	4	5

** p<0,05; * p<0.10

Unlike earlier observations made during the post-neonatal period, births from homes without toilet facilities are at elevated risk of dying compared to those using pit toilets, as shown by Model 1. Controlling for drinking water source worsens the risks of dying for both toilet facility categories.
On the other hand, additional control for home floor material explains for some of the risks associated with both toilet

facility and drinking water source. Nevertheless, only risks associated with toilet facility remain statistically significant after controlling for other environmental variables.

8.5 OVERVIEW

During the first month of life, neonatal mortality is strongly associated with size of child at birth (as proxy for birth weight), multiple births, length of preceding birth intervals, sex of the child and the survival status of preceding child even when other bio-demographic factors are controlled for. Children perceived as small for their birth weight, twin births, those born in less than two years of preceding interval and male births are all at elevated risk of dying during the first month of life. During the post-neonatal period, however, the length of subsequent birth intervals, mother's pregnancy status, multiple births, the length of preceding birth interval and to a lesser extent survivorship status of preceding child have the most significant effect on post-neonatal mortality. During this period, there is little effect from both size of child at birth and sex of the child.

During the late childhood, only three factors, namely length of subsequent birth interval, mother's age at birth and mother's pregnancy status, continue to have significant influence on child mortality when other bio-demographic factors are controlled for. It is, therefore, clear from this analysis that bio-demographic factors have most influence on childhood mortality during the first year of life. This is particularly true for neonatal mortality that is often associated with birth conditions of the child. However, that influence declines with increasing age of the child.

On the other hand, mother's age at birth has little effect during the first year of life, but exerts some significant effect on child mortality. Although children born to mothers aged less than 18 years are at increased risk of dying, there is no evidence from this study to show any increased mortality risk to children born to older mothers of at least 35 years, as documented in similar demographic studies. The little impact from mother's age on mortality during infancy is possibly explained by the fact that most young mothers receive considerable support from their parents and older relatives in caring for their children. The reduced mortality risk associated with children of older mothers is possibly a reflection of child rearing experience and that such mothers are most likely to be economically stable compared to younger mothers.

Most important from this study, however, is the relationship between subsequent, preceding birth intervals and childhood mortality. Also important is the strong association between mother's pregnancy status and childhood mortality within the general context of Sub-Saharan African child spacing pattern.

As noted earlier, the U-shaped mortality pattern associated with child spacing through birth intervals is only sustained with subsequent rather than preceding birth intervals. In fact, longer preceding birth intervals are associated with better child survival chances further pointing to the adequate time given to the mother to recover from previous births. There is little evidence here to show sibling competition for both maternal care and household resources since, and most often for Sub-Saharan African child spacing pattern, newly borns receive more attention than older siblings. Moreover, the effect of controlling for the survival status of the preceding sibling is only important during the first year of life.

On the other hand, children with longer than 36 months of subsequent birth intervals have higher mortality risks, possibly reflecting other unexplained socio-economic conditions and practices. In both preceding and subsequent birth intervals, however, shorter intervals of less than two years are associated with considerable mortality risk. The worsening of survival chances of children associated with expectant mothers supports the possible neglect linked to older siblings once mothers realise their pregnancy, even when the survival status of older siblings is taken into consideration.

As for micro-environmental factors, only house floor material has significant influence on neonatal mortality when other micro-environmental factors are controlled for.

During both the post-neonatal and late childhood periods, however, only type of toilet facility continues to exert some significance on child mortality. It should be noted that almost all micro-environmental variables are highly correlated and this might influence observed mortality rates during the first five years of life considered in this study.

Moreover, while home floor has strong association with neonatal mortality and might reflect the socio-economic conditions of some households with earth/sand floors, the increased association between the type of toilet facility and both post-neonatal and child mortality is a reflection of children's exposure to faecal contamination as they increasingly come into contact with household sanitary arrangements. The strong association between neonatal mortality and earth/sand floors is also likely to reflect tetanus infections especially amongst households using cattle dung for floor materials.

CHAPTER NINE

MAJOR DETERMINANTS OF CHILDHOOD MORTALITY: AN INTEGRATED ANALYSIS

9.1 INTRODUCTION

The purpose of this chapter is to integrate the findings from the previous four chapters in order to demonstrate how the effect of selected socio-economic and cultural variables on childhood mortality in Zambia in the five years prior to the survey operates through both intermediate behavioral and proximate variables. Furthermore, it attempts to show the contribution of intermediate behavioral variables in mediating the relationship between socio-economic and cultural variables and the proximate variables.

9.2 MODEL ESTIMATION AND INFERENCE

The exercise of model estimation and inference in this chapter is based on two main concerns, namely effect mediation and assessing the contribution of both intermediate behavioral and proximate variables on the estimated model. Since our major interest is to identify possible pathways through which key socio-economic and cultural factors influence childhood mortality, effect mediation is assessed by observing changes in the estimated effect of key socio-economic and cultural variables on childhood mortality risk when behavioral and subsequently proximate variables are introduced. If, for example, the estimated coefficient for any of the socio-economic variables falls towards the null value (i.e. 1.00 in relative risk term), it is inferred that part of the effect of that variable on mortality risk operates through that behavioral or proximate variable.

On the other hand, the importance of each included variable is assessed by a change in the model log-likelihood associated with that variable. In this case, where both logistic and hazards regression models are used within the SPSS program, as discussed in earlier sections, the importance of individual variables is assessed by the change in the model X^2 value associated with the included variable. In both logistic and hazards regression models, selected socio-economic and cultural variables are first included in the baseline model to which individual behavioral and proximate variables are sequentially added. It is from this process that changes in estimated coefficients of variables in the baseline model are assessed. The effect mediation is also extended to both behavioral and proximate variables to explore the relationship between these intermediate variables.

Given these objectives, and as in earlier models, the analysis makes no attempt at identifying "best-fitting" models.

9.3 NEONATAL MORTALITY PATTERNS

Table 9.1 presents the net relative risk of dying during the first month of life associated with some selected socio-economic and cultural variables.

TABLE 9.1: RISK OF NEONATAL MORTALITY ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL FACTORS: RESULTS OF LOGISTIC REGRESSION.

VARIABLE	MODEL
SOCIO-ECONOMIC VARIABLES	
Household Children Size	
3+	0.26***
2	0.32***
None	2.70***
Household Bicycle	
No	0.65***
Province of Residence	
Central	1.04
Copperbelt	0.90
Eastern	1.43
Luapula	1.33
Northern	1.03
North-Western	2.04
Southern	1.04
Western	1.43
Father's Occupation	
Never worked	0.91
Agricultural self-employed	1.24
Blue collar	0.98
Household economic status	
Low	1.35
CULTURAL VARIABLES	
Religion	
Other	0.96
Protestant	0.69**
Ethnicity	
Bemba speaking	0.60**
Tonga speaking	0.73
North-Western	0.43**
Barotse (Lozi speaking)	0.91
Nyanja speaking	0.65*
Type of marital union	
Formerly married	1.40*
Polygamous	0.79
Model Chi-square (X^2)	208.7
Degree of freedom (df)	25

Among the variables that are not statistically significant are province of residence, father's occupation and household economic status.

Although province has little influence on childhood mortality during the first month of life when other socio-economic and cultural factors are controlled for, mortality is lowest in Copperbelt and Lusaka Provinces and highest in North-Western, Eastern, Western, and Luapula Provinces. In North-Western Province, for example, children are more than twice at risk of dying than those children from Lusaka Province. It should be said here that neonatal mortality is lowest in the relatively developed urban regions where there is concentration of health services. Moreover, the higher risk of dying during this period is concentrated in poor rural regions often without adequate health care services.

Another socio-economic variable with no significant effect on neonatal mortality is father's occupation. While the risk of dying is highest amongst children from agricultural self-employed fathers, it is lowest among children of never worked fathers. Children from agricultural self-employed fathers who largely include many subsistence farmers are 24 percent more likely to die than children from fathers with white collar jobs. One possible explanation for the observed lower risk among children of never-worked fathers is that fathers working on their own businesses, such as store keepers, are more likely to be included in the never-worked category. Children of store keepers especially in rural areas are most likely to have lower mortality levels. Nevertheless, caution should be taken with this category since the estimate is based on fewer than 500 births.

Household economic status is another variable not showing significant effect on neonatal mortality, although children from lower economic groups are 35 percent more likely to die than their counterparts from higher status households.

Since the above three variables contribute little to explaining mortality variation during the first month of life , they are not included in subsequent models. For the policy significance of regional variation, rural-urban residence is included in subsequent models.

a) **Controlling for Behavioural Variables**

From Table 9.2, Model 1 presents the net relative risk of neonatal mortality associated with selected socio-economic and cultural variables. All the selected variables have significant effects on childhood mortality during the first month of life. Children from rural areas are 38 percent more likely to die during the first month of life than children from urban areas. Although controlling for some behavioral variables, such as, duration of sexual abstinence, household density and kinship amplifies the regional effects on neonatal mortality, adding the discussion of family planning amongst spouses to the model wanes the significant effects associated with region. Furthermore, the elevation of mortality risk associated with controlling for some behavioural variables suggests that urban childhood mortality is linked to high risk mortality behaviours. For instance, urban children are most likely to be associated with shorter durations of sexual abstinence, probably suggesting some break down of certain traditional taboos on post-partum abstinence during the process of urbanisation.

TABLE 9.2: RISK OF NEONATAL MORTALITY ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL, AND INTERMEDIATE BEHAVIORAL FACTORS: RESULTS OF LOGISTIC REGRESSION.

VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7
SOCIO-ECONOMIC VARIABLES							
Region							
Rural	1.38**	1.42**	1.43**	1.38**	1.36*	1.37**	1.32
Household Children Size							
3+	0.26***	0.25***	0.27***	0.27***	0.28***	0.27***	0.24***
2	0.32***	0.29***	0.31***	0.31***	0.31***	0.32***	0.29***
None	2.80***	2.70***	2.61***	2.59***	2.60***	2.51***	2.76***
Household Bicycle							
No	0.68***	0.72**	0.74*	0.72**	0.72**	0.74*	0.72*
CULTURAL VARIABLES							
Religion							
Other	0.98	0.78	0.78	0.69	0.70	0.73	0.74
Protestant	0.71**	0.69**	0.69**	0.68**	0.68**	0.68**	0.71*
Ethnicity							
Bemba speaking	0.63**	0.52***	0.53***	0.54***	0.56***	0.55***	0.60**
Tonga speaking	0.77	0.81	0.83	0.90	0.94	0.91	0.94
North-Western	0.72	0.79	0.80	0.84	0.84	0.86	0.74
Barotse	1.11	1.06	1.08	1.08	1.09	1.07	1.18
Nyanja speaking	0.77	0.73	0.73	0.76	0.77	0.72	0.71
Type of marital union							
Never married	1.07	1.23	1.24	1.30	1.22	1.01	na
Formerly married	1.38*	1.68**	1.65**	1.68**	1.66**	1.38	na
Polygamous	0.80	0.84	0 83	0.83	0.83	0.84	0.84
INTERMEDIATE BEHAVIORAL VARIABLES							
Duration of sexual abstinence							
0-2 months		4.56***	4.53***	4.55***	4.77***	4.88***	4.46***
3-6 months		1.80***	1.77***	1.86***	1.93***	1.96***	1.92**
Household density							
0-2 persons/room			1.07	1.09	1.10	1.21	1.07
3 persons/room			0.99	1.00	1.00	1.09	1.01
4 persons/room			0.72	0.70	0.70	0.72	0.60*
Tetanus vaccination							
None				1.91***	1.92***	1.89***	1.76***
One				1.30	1.30	1.29	1.29
Sex while breastfeeding							
Wait					1.40*	1.40*	1.58**
Kinship							
Relative						1.36*	1.14
Discussion of FP with partner							
Never							0.98
Once or twice							0.73
Model Chi-square (X^2)	206.8	251 4	255 2	267.8	271.6	276.0	237.5
Degree of freedom (df)	15	17	20	22	23	24	24

It is also noted that urban children with higher levels of mortality are more likely to belong to dependant mothers than those of household head. In fact, the general effect of rural-urban residence on mortality is explained largely by factors linked to discussion of family planning amongst spouses.

This suggests that discussion of family planning among couples is working here as a proxy for factors associated with modernity and especially western type life-style. This is true since urban life-styles, as opposed to rural life-styles, are associated with modern life and practices. One other possible explanation is linked to increased use of health services in urban areas since most rural family planning services are provided by public health institutions.

As for the household number of children, adding behavioural variables to the model, as demonstrated by Model 7, does little to explain the risks associated with households considered here as mortality-prone. Children from such households are almost 3 times more likely to die than children from single-child households.

It is also observed that owning a bicycle is linked to higher mortality risk. Children from homes without a bicycle are almost one-third more likely to survive during first month of life than children from homes with bicycles. Including behavioral variables to the model, as shown by Model 7, reduces the survival chances of children from households without bicycles suggesting that children from household possessing bicycles are associated with high mortality risk behaviours such as shorter durations of sexual abstinence. Although rural-urban confounding might be present here since rural households own more bicycles than urban households, households with bicycles in rural areas represent those homes with relatively higher socio-economic status.

Mother's religious affiliation, on the other hand, has been documented to have some significant effect on childhood mortality variation (Barbieri, 1991) reflecting cultural and certain religious practices. From Model 1, neonatal mortality is lowest among children of Protestant mothers as opposed to children of Catholic mothers. Children of Protestant mothers are almost 30 percent more likely to survive the first one month of life than their counterparts born to Catholic mothers. However, controlling for behavioral variables accounts for about 24 percent of the risk associated with children of mothers from other religious categories, although not statistically significant. In contrast, the control for behavioral influence has little effect on children from Protestant homes. On the other hand, controlling for the discussion of family planning among spouses reduces the significance associated with Protestant households. The reduced mortality differentials between Catholic and Protestant children after controlling for the discussion of family planning might reflect differences in religious policies and practices towards family planning and most especially contraception. On the other hand, higher neonatal mortality among Catholic children might also reflect lower health service utilisation amongst these households.

Like religion, ethnicity is another factor often associated with cultural influence on childhood mortality variation (Cantrelle and Locoh, 1990; Tabutin and Akoto, 1992; Wenlock, 1979).

It is noted from model 1 that mortality is lowest amongst children from Bemba speaking mothers and highest amongst Lozi (Barotse) speaking mothers. While Bemba speaking children are 37 percent more likely to survive the first month of life compared to other ethnic groups (not included in the six categories), Lozi speaking children are 11 percent more likely to die. Although controlling for behavioral variables, such as, duration of sexual abstinence improves the survival chances of Bemba speaking children, controlling for the discussion of family planning amongst spouses has the opposite effect. Moreover, adding behavioral variables to the model, as demonstrated by Model 7, elevates the risks associated with all other ethnic groups except for the Nyanja speaking. It should be said, however, that controlling for all selected behavioral variables does not fully explain the child survival advantages to children of Bemba speaking mothers.

One other variable that has been constructed to reflect cultural effects on childhood mortality is the type of marital union the mother has. While neonatal mortality is lowest among children from polygynous unions, children of formerly married mothers are 38 percent at higher risk of dying than children from monogamous unions. Children of never married mothers are only 7 percent more likely to die than children from monogamous unions. Although controlling for the duration of sexual abstinence suggests that monogamous unions have shorter sexual abstinence durations than formerly married mothers and those in polygynous unions, controlling for kinship relationship accounts for the significance associated with formerly married mothers. While children of married mothers have higher neonatal mortality, their mothers are most likely to live as dependants with other kin members. The control for the kinship variable also accounts for some of the mortality risks associated with children of never married mothers suggesting similar modes of living as those children from formerly married mothers.

What is most interesting here, however, is that controlling for the discussion of family planning among spouses accounts for the mortality significance associated with kinship relationships. This possibly reflects variations in life styles between dependant mothers and owners of the household, despite living in the same household. This is especially the case when household ownership belongs to individuals with relatively higher socio-economic status, such as, increased level of education.
Overall, however, childhood mortality remains lowest amongst children from polygynous unions even after controlling for socio-economic, cultural and behavioural variables, suggesting that children from such homes are most likely to receive additional child care support from kin members and co-wives during the first month of life. This practice has been documented before by Helen Ware (1984).

b) **Controlling for Proximate Variables**

Table 9.3 summarises the net relative risk of neonatal mortality associated with socio-economic, cultural and intermediate behavioral variables while controlling for bio-demographic and micro-environmental variables referred to here as proximate variables. It becomes clear from comparing models 1 and 8 that only two socio-economic and cultural variables, namely household number of children and mother's religion, remain statistically significant after controlling for proximate variables.

TABLE 9.3: RISK OF NEONATAL MORTALITY ASSOCIATED WITH SELECTED SOCIO-ECONOMIC AND CULTURAL, INTERMEDIATE BEHAVIORAL AND PROXIMATE DETERMINANTS: RESULTS OF LOGISTIC REGRESSION.

VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8
SOCIO-ECONOMIC VARIABLES								
Region								
Rural	1.32	1.26	1.34	1.26	0.85	0.83	0.84	0.83
Household Children Size								
3+	0.24***	0.18***	0.21***	0.20***	0.20***	0.20***	0.20***	0.19***
2	0.29***	0.28***	0.30***	0.29***	0.29***	0.29***	0.29***	0.29***
None	2.76***	3.00***	2.88***	2.93***	2.94***	2.90***	2.91***	3.00***
Household Bicycle								
Absent	0.72*	0.78	0.85	0.85	0.84	0.83	0.84	0.82
CULTURAL VARIABLES								
Religion								
Other	0.74	0.86	0.89	0.92	0.85	0.84	0.81	0.80
Protestant	0.71*	0.76	0.71*	0.71*	0.71*	0.71*	0.72*	0.70*
Ethnicity								
Bemba speaking	0.60**	0.66*	0.72	0.69	0.68	0.69	0.69	0.68
Tonga speaking	0.94	1.04	1.01	1.01	1.06	1.07	1.08	1.06
North-Western	0.74	0.63	0.58	0.64	0.60	0.61	0.63	0.61
Barotse	1.18	1.07	0.86	0.87	0.88	0.87	0.89	0.90
Nyanja speaking	0.71	0.81	0.79	0.76	0.74	0.75	0.77	0.75
Type of marital union								
Never married	na	na	na	na	na	na	na	na
Formerly married	na	na	na	na	na	na	na	na
Polygamous	0.84	0 84	0.89	0.93	0.88	0.89	0.87	0.88
INTERMEDIATE BEHAVIORAL VARIABLES								
Duration of sexual abstinence								
0-2 months	4.46***	4.77***	4.50***	4.18***	4.12***	4.03***	4.09***	4.11***
3-6 months	1.92**	1.99***	1.95**	1.77**	1.79**	1.79**	1.82**	1.82**
Household density								
0-2 persons/room	1.07	1.27	1.31	1.32	1.31	1.29	1.32	1.33
3 persons/room	1.01	1.24	1.23	1.21	1.23	1.21	1.24	1.24
4 persons/room	0.60*	0.73	0.71	0.72	0.73	0.74	0.74	0.75
Tetanus vaccination								
None	1.76***	1.64**	1.38	1.35	1.28	1.28	1.27	1.27
One	1.29	1.27	1.19	1.18	1.19	1.16	1.16	1.16
Sex while breastfeeding								
Wait	1.58**	1.51*	1.45	1.51*	1.50*	1.47	1.45	1.47*
Kinship								
Relative	1.14	1.30	1.23	1.12	1.15	1.14	1.18	1.19
Discussion of FP with partner								
Never	0.98	0.92	0.87	0.96	0.91	0.91	0.91	0.91
Once or twice	0.73	0.69*	0.64**	0.66*	0.67*	0.66*	0.68*	0.67*
PROXIMATE DETERMINANTS								
Birth type								
Multiple		12.0***	7.24***	7.52***	7.56***	7.53***	7.55***	7.81***
Size of child at birth								
Small			3.80***	3.61***	3.79***	3.83***	3.85***	3.82***
Large			0.90	0.91	0.91	0.88	0.89	0.89
Preceding birth interval								
First births				0.94	0.93	0.95	0.97	0.97
<24 months				1.83***	1.80***	1.81***	1.84***	1.85***
36+ months				0.46***	0.46***	0.47***	0.45***	0.44***
Home floor material								
Earth/sand					1.87**	1.89***	1.87**	1.90***
Sex of child								
Male						1.41**	1.42**	1.42**
Age of mother at birth								
<18 years							1.05	1.04
18-24 years							0.85	0.85
35+ years							1.15	1.14
Preceding Child								
Dead								0.76
Model Chi-square (X^2)	237.5	323.9	370.8	400.0	407.1	411.4	412.9	414.6
Degree of freedom (df)	24	25	27	30	31	32	35	36

This means that the correlation between the number of children in a home and neonatal mortality remains unexplained even after controlling for both behavioural and proximate variables. This is also true for the survival advantage associated with children of Protestant mothers. Particularly remarkable in explaining for the significant effects associated with owning a bicycle and mother's ethnicity are controls for multiple births and size of children at birth. The fact that controlling for the size of the child at birth accounts for the mortality significance associated with children of Bemba speaking mothers, might as well reflect certain ethnic practices associated with mother's nutritional status during pregnancy. It may also reflect differences between ethnic groups in the utilisation of health services for both antenatal and delivery purposes. Although controlling for proximate variables explain little of the survival advantages associated with children from Protestant homes, including the preceding birth intervals elevates the mortality risk associated with other religious beliefs. This also suggests that children of Catholic mothers are associated most with shorter preceding birth intervals. Moreover, the emerging significance of the discussion of family planning among spouses after controlling for bio-demographic variables further strengthens the relationship between western type life-styles and the utilisation of modern health services or what Caldwell might call modernity. This is especially the case since controlling for bio-demographic variables such as size of the child at birth accounts for the significance associated with tetanus vaccination, an index of health service utilisation. Also of interest is the fact that controlling for the preceding birth intervals elevates the mortality risk associated with children whose mothers would rather wait than have sex while breastfeeding. This suggests that children of mothers who have abandoned the post-partum sexual taboo are not using family planning to prolong the birth interval or during the period of breastfeeding. On the other hand, children from polygynous unions continue to have lower mortality risk even when both intermediate behavioural and proximate variables are controlled for.

Although mortality inequalities by region of residence are not statistically significant, controlling for the micro-environmental variable of home floor material accounts for almost one-third of the risk associated with children from rural areas. Moreover, controlling for the floor material improves the survival chances of rural as compared to urban children. Again, this result might reflect the low use of health services for purposes of birth delivery among rural households (Gaisie, et al., 1993). Delivering births from homes with earth/sand floors is most likely to expose young children to tetanus infection. It is also shown from this analysis that even though the significance associated with household density is explained by controlling for both socio-economic and bio-demographic variables, neonatal mortality remains highest in households with fewer persons per sleeping room, as earlier discussed in Chapter Seven. The fact that mortality is highest amongst households perceived to have favourable household densities and since well to do households in Zambia have higher densities point to issues of household survival strategies as discussed else where by

Ohadike (1971). Moreover, this observed pattern questions the adequacy of using persons per sleeping room as indicator of crowding without taking into account size and space of the dwelling. This is particularly true in the Zambian case where these modes of living may reflect kin survival strategies in the midst of poverty.

Although the number of children in a household emerges as the most influential socio-economic predictor variable during the neonatal period, it raises some technical problems since the variable includes dead children and, therefore, is more likely to confound with the survival status of observations. This is equally suspected of the behavioural variable of household density used here to measure household crowding levels.

Table 9.4 is, therefore, a re-run of Table 9.3 excluding the two mentioned variables.

From Table 9.4, it becomes clear that none of the socio-economic characteristics is strongly associated with the risks of neonatal mortality. On the other hand, mother's religious affiliation has some association with mortality during the first month of life. Children of Protestant mothers continue to have survival advantages over children of Catholic mothers.

As for the intermediate behavioural factors shaping the child survival outcomes during the first month of life, shorter durations of sexual abstinence continue to be associated with high risk mortality even though one cannot rule out possible influences of reverse causation since shorter durations of sexual abstinence may result because the child died.

TABLE 9.4: RISK OF NEONATAL MORTALITY ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL, INTERMEDIATE BEHAVIOURAL AND PROXIMATE DETERMINANTS: RE-RUN OF LOGISTIC REGRESSION.

VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8
SOCIO-ECONOMIC VARIABLES								
Region								
Rural	1.39*	1.40*	1.44**	1.37*	0.85	0.85	0.85	0.85
Household Bicycle								
Absent	0.78	0.84	0.91	0.88	0.86	0.86	0.86	0.87
CULTURAL VARIABLES								
Religion								
Other	0.71	0.85	0.82	0.87	0.82	0.81	0.80	0.80
Protestant	0.69**	0.72*	0.70**	0.70**	0.69**	0.69**	0.69**	0.70*
Ethnicity								
Bemba speaking	0.57**	0.64*	0.72	0.71	0.70	0.69	0.69	0.70
Tonga speaking	0.75	0.79	0.79	0.83	0.88	0.88	0.89	0.90
North-Western	0.71	0.66	0.59	0.67	0.63	0.63	0.65	0.66
Barotse	1.30	1.25	1.01	1.04	1.03	1.02	1.04	1.02
Nyanja speaking	0.68	0.78	0.75	0.75	0.73	0.73	0.74	0.75
Type of marital union								
Never married	na	na	na	na	na	na	na	na
Formerly married	na	na	na	na	na	na	na	na
Polygamous	0.72	0.66*	0.73	0.78	0.73	0.74	0.73	0.73
INTERMEDIATE BEHAVIOURAL VARIABLES								
Duration of sexual abstinence								
0-2 months	4.40***	4.63***	4.34***	4.26***	4.20***	4.03***	4.07***	4.05***
3-6 months	1.88**	1.96**	1.91**	1.80**	1.84**	1.81**	1.83**	1.82**
Tetanus vaccination								
None	1.78***	1.74***	1.46*	1.46*	1.41	1.38	1.38	1.37
One	1.24	1.20	1.14	1.12	1.13	1.09	1.09	1.09
Sex while breastfeeding								
Wait	1.59**	1.55**	1.52*	1.49*	1.49*	1.45*	1.44	1.43
Kinship								
Relative	1.62**	1.78***	1.65**	1.40	1.43*	1.42	1.45*	1.44*
Discussion of FP with partner								
Never	1.25	1.23	1.20	1.23	1.15	1.15	1.15	1.14
Once or twice	0.80	0.77	0.76	0.74	0.74	0.73	0.73	0.73
PROXIMATE DETERMINANTS								
Birth type								
Multiple		7.72***	4.77***	5.63***	5.70***	5.63***	5.65***	5.55***
Size of child at birth								
Small			4.27***	3.91***	4.08***	4.19***	4.21***	4.22***
Large			0.78	0.82	0.82	0.80	0.81	0.80
Preceding birth interval								
First births				1.89***	1.84***	1.88***	1.87**	1.85**
<24 months				2.30***	2.28***	2.29***	2.32***	2.30***
36+ months				0.66*	0.65*	0.66*	0.65*	0.65*
Home floor material								
Earth/sand					1.98***	1.99***	1.98***	1.96***
Sex of child								
Male						1.54***	1.55***	1.55***
Age of mother at birth								
<18 years							1.14	1.14
18-24 years							0.95	0.92
35+ years							1.17	1.17
Preceding Child								
Died								1.21
Model Chi-square (X^2)	97.1	170.1	236.6	270.4	278.6	286.1	287.2	288.1
Degree of freedom (df)	18	19	21	24	25	26	29	30

One other significant observation is concerned with the inequalities in the risk of mortality between children of owners of the household and children of dependant relatives living within the same household. Children of dependants are 44 percent at higher risk of dying than children of household owners.

Finally, the study illustrates the considerable influence proximate variables have on neonatal mortality. It is shown that multiple births, small children at birth, shorter preceding birth intervals and male births are strongly associated with mortality during the first month of life. Also important are the first order births which are at increased risk of dying during this period. On the other hand, the age of the mother has little influence on neonatal mortality. The lower mortality risk associated with longer preceding birth intervals supports the view that longer intervals enable mothers to recover from previous births. Most interesting is that controlling for home floor material accounts for much of the risks associated with rural births. Children from homes with earth or sand floors are almost twice at higher risk of dying than children from homes with cement or tile floor materials. With a substantial proportion of births in Zambia delivered from home, this high risk might explain possible link to tetanus infections.

Equally important is the observed excessive male deaths compared to female deaths which might possibly explain some of the male omissions noted from Chapter Three through analysis of sex-ratio. Even though higher excess male mortality risk during the neonatal period has also been found in many Sub-Saharan African countries, this may possibly be associated with the poorer access to high quality maternity health services.

9.4 POST-NEONATAL MORTALITY PATTERNS

a) Controlling for Behavioural Variables

Table 9.5 presents the net relative risk of post-neonatal mortality according to socio-economic, cultural and intermediate behavioural variables. From model 1, and except for access to electricity, almost all selected socio-economic and cultural variables have some statistically significant effect on post-neonatal mortality. When intermediate behavioural variables are accounted for, however, only three variables namely household number of children, father's occupation and mother's type of marital union continue to exert some significant effect on post-neonatal mortality.

Like the first month of life, controlling for behavioural variables has little effect on the influence the household number of children has on post-neonatal mortality. Children from mortality-prone households are still at 185 percent higher risk of dying than children from single-child households. Similar evidence of this result has been documented in Das Gupta's (1990) work on rural Punjab where there was a strong tendency for child deaths to cluster within a small number of families. In that study, for example, one-eighth of the families accounted for almost two-thirds of child deaths, and were twelve times more likely to lose a child than the rest of the population.

TABLE 9.5: RISK OF POST-NEONATAL MORTALITY ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL AND INTERMEDIATE BEHAVIORAL FACTORS: RESULTS OF COX HAZARDS REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8	MODEL 9
SOCIO-ECONOMIC VARIABLES									
Household Children Size									
3+	0.21***	0.21***	0.22***	0.22***	0.22***	0.23***	0.23***	0.23***	0.21***
2	0.35***	0.37***	0.38***	0.38***	0.38***	0.38***	0.39***	0.38***	0.38***
None	3.08***	2.76***	2.74***	2.70***	2.69***	2.86***	2.86***	2.83***	2.85***
Province of Residence									
Central	0.89	0.87	0.85	0.80	0.76	0.77	0.75	0.77	0.78
Copperbelt	1.25	1.17	1.13	1.07	1.01	0.97	0.96	0.96	1.02
Eastern	1.25	1.21	1.16	1.16	1.14	1.27	1.27	1.33	1.37
Luapula	1.54**	1.33	1.27	1.22	1.20	1.28	1.27	1.30	1.42
Northern	1.45**	1.35	1.40*	1.33	1.32	1.39	1.40	1.38	1.45
North-Western	0.95	1.01	1.00	0.98	0.94	1.09	1.08	1.07	0.99
Southern	1.02	1.19	1.18	1.10	1.11	1.13	1.12	1.14	1.21
Western	1.27	1.28	1.27	1.21	1.23	1.26	1.21	1.26	1.29
Father's Occupation									
Never worked	0.44**	0.46**	0.46**	0.46**	0.46**	0.42*	0.41*	0.40*	0.35**
Agricultural self-emp.	0.96	0.90	0.91	0.88	0.88	0.82	0.81	0.79	0.80
Blue collar	0.95	0.99	1.00	0.97	0.94	0.94	0.94	0.94	0.97
Mother's Education									
No education	1.11	1.14	1.15	1.13	1.11	1.02	0.99	0.93	0.98
Primary	1.23*	1.29*	1.29*	1.29*	1.30*	1.25	1.23	1.21	1.23
Access to Electricity									
Absent	1.25	1.26	1.23	1.24	1.24	1.27	1.27	1.24	1.30
CULTURAL VARIABLES									
Type of marital union									
Formerly married	1.17	1.23	1.21	1.22	1.21	na	na	na	na
Polygamous	1.37***	1.45***	1.46***	1.50***	1.49***	1.47***	1.41***	1.41***	1.43***
INTERMEDIATE BEHAVIORAL VARIABLES									
Duration of breastfeeding									
0-6 months		4.34***	4.31***	3.03***	3.05***	3.18***	3.19***	3.14***	3.08***
7-18 months		2.17***	2.14***	2.13***	2.12***	2.09***	2.06***	2.02***	2.04***
Household density									
0-2 persons/room			1.32*	1.26	1.26	1.33*	1.33*	1.33*	1.40**
3 persons/room			1.26	1.25	1.28*	1.34*	1.34*	1.34*	1.38**
4 persons/room			1.10	1.11	1.11	1.19	1.19	1.21	1.23
Age for solids									
Not given				1.93***	1.67***	1.45**	1.44**	1.38*	1.52**
0-3 months				1.24*	1.23*	1.20	1.20	1.23*	1.30**
Age for plain water									
Not given					1.99***	2.02***	2.04***	2.08***	2.10***
0 months					1.14	1.11	1.10	1.11	1.08
Discussion of FP with partner									
Never						1.06	1.05	1 06	1.03
Once or twice						1.07	1.05	1.08	1.13
Number of marital unions									
More than one							1.26**	1.26**	1 27**
Tetanus vaccination									
None								1.31**	1.32**
One								1 02	1 02
Duration of sexual abstinence									
0-2 months									0 90
3-6 months									1 06
Model Chi-square (X^2)	755 3	815 9	815 9	864 4	883 2	760.2	751 8	751 2	763 3
Degree of freedom (df)	19	21	24	26	28	29	30	32	34

As for father's occupation, children of never worked fathers continue to show higher survival chances despite that such estimates should be taken with caution since they are based on fewer than 500 births.

Most interesting, however, and unlike the first month of life, children from polygynous unions are at increased risk of dying than children from monogamous unions. In fact, controlling for behavioural variables elevates the risk of dying for children in polygynous unions by 16 percent suggesting that children from monogamous unions are associated with high risk mortality behaviours. This is particularly the case when the duration of breastfeeding and the introducing of solid feeds are controlled for suggesting that children from monogamous unions are not only associated with shorter durations of breastfeeding, but are also introduced earlier to solid feeds. The control for the feeding patterns also account for the mortality significance associated with the province of residence. Controlling for both the duration of breastfeeding and the early introduction of children to solid feeds explain for the significance associated with both Luapula and Northern Provinces; coincidentally both largely Bemba speaking regions. This might also suggest that there are certain ethnic practices possibly linked to early childhood feeding patterns.

On the other hand, and despite emerging as one of the individual-level socio-economic variables, the influence of mother's education is accounted for, especially, when the discussion of family planning among spouses is controlled for, further strengthening the argument that family planning practices and levels of mother's education are associated with modernity or the western type life-style. Indeed, modern education, probably more than anything else, shapes health-related knowledge and attitudes (Guo, 1993). In fact, controlling for the duration of breastfeeding has a tendency to elevate the mortality risk for both children of none and primary educated mothers suggesting that children to mothers with at least secondary education are associated with shorter duration of breastfeeding.

As for the influence of intermediate behavioural variables once socio-economic and cultural variables are accounted for, it is generally observed that behavioural variables have greater effect during the post-neonatal period than the first month of life. While children breastfed for shorter durations are at increased risk of dying, those children introduced to solid feeds in the first three months of life are at 30 percent higher risk of dying than children introduced to solids after the third month. Caution must be taken when interpreting estimates for children not introduced to feeds since they are most likely to have died before they could be fed.

Unlike the first month of life, there is clear inverse relationship during the post-neonatal period between household density and post-neonatal mortality further reflecting survival advantages to children in higher density households. This possibly reflects the Zambian mode of living where higher socio-economic status households adopt children from poorer kin members as an economic survival strategy which also forms the kinship welfare support system.

On the other hand, and like the first month of life, children of mothers married more than once and for those whose mothers received no tetanus vaccination are at increased risk of dying. Not only does this reflect the socio-economic implication of marital instability, but also presents the mortality risk associated with lower utilisation of health services during the first year of life.

b) Controlling for Proximate Variables

Table 9.6 presents the net relative risk of post-neonatal mortality associated with socio-economic, cultural and behavioral variables.

TABLE 9.6: RISK OF POST-NEONATAL MORTALITY ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL, INTERMEDIATE BEHAVIORAL AND PROXIMATE DETERMINANTS: RESULTS OF COX HAZARDS REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7
SOCIO-ECONOMIC VARIABLES							
Household Children Size							
3+	0.21***	0.20***	0.20***	0.19***	0.18***	0.18***	0.17***
2	0.38***	0.35***	0.36***	0.36***	0.35***	0.35***	0.33***
None	2.85***	3.43***	3.38***	3.39***	3.39***	3.38***	3.60***
Province of Residence							
Central	0.78	0.76	0.75	0.76	0.74	0.77	0.71
Copperbelt	1.02	1.09	1.06	1.05	1.03	1.02	0.99
Eastern	1.37	1.10	1.06	1.06	1.02	1.07	1.07
Luapula	1.42	1.01	0.95	0.96	0.95	0.99	0.96
Northern	1.46	1.21	1.19	1.19	1.15	1.20	1.14
North-Western	0.99	0.91	0.87	0.87	0.84	0.88	0.83
Southern	1.22	1.17	1.12	1.12	1.09	1.12	1.10
Western	1.29	1.23	1.20	1.13	1.11	1.15	1.15
Father's Occupation							
Never worked	0.35**	0.35**	0.35**	0.34**	0.37*	0.38*	0.39*
Agricultural self-emp.	0.80	0.80	0.78	0.78*	0.79	0.82	0.83
Blue collar	0.97	1.03	1.00	0.99	1.00	1.01	1.03
Mother's Education							
No education	0.98	1.07	1.05	1.06	1.04	1.08	1.05
Primary	1.23	1.15	1.16	1.16	1.13	1.15	1.14
Access to Electricity							
No	1.30	1.45**	1.49**	1.48**	1.50**	1.54**	1.52**
CULTURAL VARIABLES							
Type of marital union							
Formerly married	na	na	na	na	na	na	na
Polygamous	1.43***	1.33**	1.36**	1.37**	1.36**	1.37**	1.40**

INTERMEDIATE BEHAVIORAL VARIABLES							
Duration of breastfeeding							
0-6 months	3.08***	3.93***	4.20***	4.16***	4.21***	4.23***	4.33***
7-18 months	2.04***	1.78***	1.82***	1.82***	1.86***	1.86***	1.91***
Household density							
0-2 persons/room	1.40**	1.71***	1.63***	1.64***	1.69***	1.71***	1.72***
3 persons/room	1.38**	1.51**	1.51**	1.53***	1.57***	1.56***	1.53***
4 persons/room	1.23	1.26	1.25	1.24	1.25	1.26	1.22
Age for solids							
Not given	1.52**	1.48**	1.44*	1.43*	1.43*	1.42*	1.39*
0-4 months	1.30**	1.18	1.19	1.18	1.20	1.19	1.16
Age for plain water							
Not given	2.10***	1.69**	1.74**	1.72**	1.63**	1.62*	1.62*
0 months	1.08	1.04	1.01	1.00	1.00	0.99	1.04
Discussion of FP with partner							
Never	1.03	1.30*	1.27*	1.29*	1.33**	1.34**	1.36**
Once or twice	1.13	1.23	1.23	1.22	1.25	1.25	1.26*
Number of marital unions							
More than one	1.27**	1.20	1.26*	1.25*	1.24*	1.24*	1.27*
Tetanus vaccination							
None	1.32**	1.18	1.18	1.20	1.18	1.19	1.18
One	1.02	0.96	0.98	0.98	0.97	0.96	0.96
Duration of sexual abstinence							
0-2 months	0.90	0.83	0.84	0.87	0.85	0.84	0.83
3-6 months	1.06	0.98	0.98	1.03	1.00	1.00	0.97
PROXIMATE DETERMINANTS							
Subsequent birth interval							
<24 months		2.05***	2.03***	2.05***	2.05***	2.07***	2.12***
36+ months		1.22	1.26	1.25	1.21	1.21	1.16
Last births		0 29***	0.29***	0.29***	0.29***	0.29***	0.27***
Mother currently pregnant							
Pregnant			1.50***	1.51***	1.52***	1.53***	1.54***
Birth type							
Multiple				2.48***	2.49***	2.53***	2.78***
Preceding birth interval							
First births					0.81	0.81	0.83
<24 months					1.13	1.13	1.15
36+ months					0.86	0.85	0.86
Home floor material							
Earth/sand						0.88	0.90
Preceding Child							
Dead							0.61***
Model Chi-square (X^2)	763 3	1082 7	1100.3	1108 8	1125.6	1120.0	1128.0
Degree of freedom (df)	34	37	38	39	42	43	44

Although controlling for proximate variables accounts for some of the mortality risk associated with children from polygynous unions, it elevates the risk associated with mortality-prone households and to a lesser extent father's occupation.

Most important, however, is that controlling for proximate variables increases the mortality risk and significance associated with access to electricity.

Controlling for all selected proximate variables elevates mortality for children from homes without electricity by about 80 percent. Not only are children from homes with electricity associated with shorter subsequent and preceding birth intervals, they are also associated with high risk home floor conditions. Ironically, these conditions include those homes with cement floors suggesting that presence of such floors is not adequate guarantee for safer home conditions. This especially reflects urban conditions where most homes with cement floors are found.

Equally important is the relationship between intermediate behavioural variables and post-neonatal mortality once the proximate variables are controlled for. Apart from explaining for some of the mortality risk associated with introducing children to early feeds, number of marital unions mother has been involved in and tetanus vaccination, controlling for proximate variables, in fact, elevates the risks associated with the duration of breastfeeding, household density and the discussion of family planning among spouses. For example, controlling for the subsequent birth intervals elevates the mortality risk associated with the number of persons per sleeping room, suggesting that shorter subsequent birth intervals are associated with households with relatively more persons per sleeping room. On the other hand, children of mothers who never discuss family planning with partners are at 34 percent higher risk of dying than children whose parents discuss family planning most often.

As for the proximate variables, when socio-economic, cultural and behavioural variables are accounted for, only subsequent birth intervals, mother's pregnancy status, multiple births and the survival status of preceding child continue to exert significant effect on post-neonatal mortality. Children associated with shorter subsequent birth intervals are more than twice at increased risk of dying than children associated with birth intervals of between 24 and 35 months. Although children with shorter preceding birth intervals continue to have lower survival chances, the variable is not statistically significant. On the other hand, children of expectant mothers are at 53 percent higher risk of dying than children from non-expectant mothers. While mortality risk associated with children of expectant mothers may constitute some form of neglect when mothers realise their pregnancy status, the estimates might also be reflecting an attempt by these mothers to replace their dead children thus introducing problems of reverse causation. The neglect of children resulting from changes in child care practices is often linked to abrupt cessation of breastfeeding and immediate switch to normal adult meals exposing children further to contamination and infections. Traditionally, it is taboo for a mother to continue breastfeeding her child when she realises that she is pregnant. It is believed that a child would subsequently die if that was done. In many cases, both parents are blamed for the death of a sibling preceding mother's conception. However, it is possible that mortality risks for such children result from changes in child care behaviour and most especially alterations to feeding practices. In extreme cases, a child would be made to stay with other kinship members; away from the mother until a new baby is born. This is especially fatal when these young children are allowed to live in poorer households away from their parents. What is even more interesting in this case is that index children whose older sibling died have better survival chances than children whose older sibling is alive. Moreover, the influence of this variable on post-neonatal mortality, and unlike neonatal mortality, is statistically significant. While the importance of the subsequent birth interval, as opposed to the preceding birth interval, during this period might possibly minimise the effects attributed to sibling competition, it seems more likely that the high mortality risk associated with index children whose older sibling is alive is linked to cross-infection between siblings and to household patterns of child care. This is most likely with high prevalence of communicable diseases. On the other hand, multiple births continue to show higher mortality risk even when socio-economic, cultural and behavioural variables are controlled for during the post-neonatal period.

Like the previous section on neonatal mortality, Table 9.7 is a re-run of the Cox hazards models earlier presented in Table 9.6 excluding both children household size and household density variables.

In the circumstances that the survival advantage of children from fathers who have never worked are possibly influenced by the small observations in that category, the most influential community-level socio-economic characteristic to have emerged during the post-neonatal period is access to electricity. Representing community-level infrastructural development, this result shows that children from homes without electricity are at increased risk of dying during the post-neonatal period than children from homes with electricity.

TABLE 9.7: RISK OF POST-NEONATAL MORTALITY ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL, INTERMEDIATE BEHAVIOURAL AND PROXIMATE DETERMINANTS: RE-RUN OF COX HAZARDS REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7
SOCIO-ECONOMIC VARIABLES							
Province of Residence							
Central	0.77	0.75	0.71	0.71	0.73	0.75	0.72
Copperbelt	0.99	1.00	0.94	0.94	0.93	0.93	0.93
Eastern	1.48*	1.45	1.34	1.35	1.31	1.35	1.33
Luapula	1.57**	1.24	1.16	1.16	1.18	1.21	1.20
Northern	1.33	1.06	1.03	1.04	1.04	1.06	1.05
North-Western	0.92	0.85	0.82	0.82	0.84	0.86	0.86
Southern	0.86	0.82	0.78	0.78	0.78	0.79	0.78
Western	1.30	1.17	1.13	1.11	1.15	1.15	1.13
Father's Occupation							
Never worked	0.35**	0.36*	0.37*	0.35**	0.34**	0.35**	0.34**
Agricultural self-emp.	0.78*	0.78*	0.77*	0.77*	0.77*	0.78	0.78
Blue collar	0.95	1.02	1.01	1.00	1.01	1.02	1.01
Mother's Education							
No education	0.90	0.92	0.95	0.95	0.99	1.01	1.00
Primary	1.10	1.07	1.10	1.10	1.13	1.15	1.13
Access to Electricity							
Absent	1.42**	1.54**	1.55**	1.54**	1.53**	1.56**	1.60***
CULTURAL VARIABLES							
Type of marital union							
Formerly married	na	na	na	na	na	na	na
Polygamous	1.23*	1.19	1.20	1.19	1.22	1.23	1.24
INTERMEDIATE BEHAVIOURAL VARIABLES							
Duration of breastfeeding							
0-6 months	3.57***	4.37***	5.09***	5.11***	4.86***	4.89***	4.99***
7-18 months	2.30***	2.14***	2.26***	2.28***	2.18***	2.19***	2.24***
Age for solids							
Not given	2.01***	2.02***	1.97***	1.97***	1.99***	1.97***	1.98***
0-4 months	1.34**	1.26*	1.27*	1.26*	1.27*	1.26*	1.27*
Age for plain water							
Not given	2.09***	1.72**	1.76**	1.76**	1.79**	1.79**	1.79**
0 months	1.06	1.10	1.09	1.09	1.10	1.09	1.09
Discussion of FP with partner							
Never	1.37**	1.63***	1.62***	1.63***	1.56***	1.56***	1.58***
Once or twice	1.25*	1.33**	1.36**	1.36**	1.32**	1.33**	1.35**
Number of marital unions							
More than one	1.47***	1.54***	1.59***	1.59***	1.67***	1.67***	1.67***
Tetanus vaccination							
None	1.33**	1.21	1.22	1.22	1.24	1.24	1.25*
One	0.98	0.94	0.93	0.93	0.93	0.93	0.93
Duration of sexual abstinence							
0-2 months	0.68**	0.64***	0.64***	0.64***	0.67**	0.66**	0.66***
3-6 months	0.95	0.85	0.86	0.87	0.90	0.90	0.90
PROXIMATE DETERMINANTS							
Subsequent birth interval							
<24 months		2.47***	2.34***	2.35***	2.31***	2.33***	2.32***
36+ months		1.26	1.34	1.33	1.32	1.32	1.33
Last births		0.45***	0.44***	0.43***	0.44***	0.44***	0.44***
Mother currently pregnant							
Pregnant			2.13***	2.14***	2.06***	2.06***	2.04***
Birth type							
Multiple				1.47	1.53	1.59*	1.59*
Preceding birth interval							
First births					1.52***	1.51***	1.52***
<24 months					1.35**	1.35**	1.36**
36+ months					1.10	1.10	1.11
Home floor material							
Earth/sand						0.93	0.93
Preceding Child							
Dead							1.02
Model Chi-square (X^2)	277.8	524.4	566.0	566.9	577.5	577.1	582.4
Degree of freedom (df)	28	31	32	33	36	37	38

Most interesting observation, however, is the absence of influence from mother's education despite the primacy given to it as the sole determinant of child survival by studies such as Caldwell's (1979) and Cleland and van Ginneken (1989).

As for the intermediate behavioural factors influencing child survival during the post-neonatal period, feeding and reproductive behavioural characteristics have shown significant influence on post-neonatal deaths. Although many of the feeding variables, such as duration of breastfeeding and especially those children not given any feed, are possibly influenced by reverse causation as earlier highlighted, children introduced to solid feeds during the first four months of life are at increased risk of dying than children introduced after the fourth month. One possible explanation might be due to early age contamination through feeds leading to diarrhoeal infection.

Most influential among reproductive behavioural factors are the discussion of family planning amongst spouses and the number of marital unions the mother has been involved in. While the discussion of family planning amongst spouses might be representing issues linked to health service utilisation since family planning in Zambia is largely provided by public health institutions, it might also reflect issues connected to modernity factors. This is possibly the case since the discussion of family planning amongst spouses has been largely responsible in accounting for some of the contributions from mother's education, as earlier noted. Children of parents who never discuss family planning are 58 percent at higher risk of dying than children whose parents discuss family planning more often. Moreover, the fact that children of mothers who have married more than once have increased risk of dying might reflect some of the socio-economic implications of marital instability. Children of mothers who have married more than once are 67 percent at increased risk of dying than their contemporaries from mothers who have only married once.

Comparing Tables 9.6 and 9.7 indicates some changes to bio-medical parameter estimates once household number of children and household density are excluded from the analysis. Most notable is the improvement in the influence of preceding birth intervals, subsequent birth intervals and mother's pregnancy status at the time of the survey on mortality risk. In contrast, Table 9.7 shows some reduced influence from multiple births although twin births continue to experience excessive mortality risk than singleton births.

Despite controlling for the survival status of the preceding sibling, mothers who were pregnant at the time of the survey continue to experience excessive child deaths even though this result is possibly influenced by reverse causation.

Unlike the first month of life, home floor material has little influence during the post-neonatal period further strengthening possibilities of a link between earth floors and neonatal tetanus during the first month of life.

Overall, however, children born during the birth intervals of less than 24 months have higher risks of dying while the observed survival advantage of the last births may possibly result from selectivity, since they were alive at the time of the survey.

9.5 CHILD MORTALITY PATTERNS

a) Controlling for Behavioural Variables

TABLE 9.8: RISK OF CHILD MORTALITY ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL FACTORS: RESULTS OF COX HAZARDS REGRESSION.

VARIABLE	MODEL
SOCIO-ECONOMIC VARIABLES	
Household Children Size	
3+	0.17***
2	0.29***
None	3.81***
Province of Residence	
Central	0.65
Copperbelt	1.32
Eastern	1.64*
Luapula	0.92
Northern	1.21
North-Western	0.57
Southern	0.98
Western	0.76
Mother's Education	
No education	1.36
Primary	1.54**
Mother's Current Type of Employment	
Not working	1.06
Unpaid worker	2.18**
Self-employed	1.15
Access to Electricity	
No	1.25
CULTURAL VARIABLES	
Ethnicity	
Bemba speaking	1.20
Tonga speaking	1.21
North-Western	1.41
Barotse (Lozi speaking)	1.60
Nyanja speaking	0.87
Type of marital union	
Never married	0.57
Formerly married	1.05
Polygamous	1.47**
Model Chi-square (X^2)	478.2
Degree of freedom (df)	25

Table 9.8 presents the net relative risk of mortality for

children aged between 1 and 5 years according to selected socio-economic and cultural variables.

Only two of the seven selected variables show no statistically significant effect on child mortality. These are access to electricity and ethnicity.

From Table 9.8, children from homes with no electricity are 25 percent more likely to die during late childhood than children from households with electricity.

As for ethnicity, mortality is highest amongst children of Lozi speaking mothers and lowest amongst those coming from Nyanja speaking mothers. Children of Lozi mothers are at 60 percent higher risk of dying than children from other ethnic in the reference category. Also at higher risk of dying are children from ethnic groups mostly from North-Western Province.

Since many of the selected variables have statistically significant effect on child mortality, they are included for further analysis, as shown in Table 9.9. However, ethnicity has been dropped from the analysis since it contributes little to the subsequent regression models.

From Table 9.9, model 1 shows that child mortality is highest in the Copperbelt Province when other socio-economic and cultural variables are taken into consideration. Children from the Copperbelt Province, and surprisingly one of the most developed regions, are at 44 percent higher risk of dying than children from equally developed Lusaka Province.

Controlling for behavioral variables, as demonstrated by model 7, accounts for some mortality risk associated with provincial residence. Most notable is the risk associated with provinces with highest mortality levels.

TABLE 9.9: RISK OF CHILD MORTALITY ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC, CULTURAL AND INTERMEDIATE BEHAVIORAL FACTORS: RESULTS OF COX HAZARDS REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7
SOCIO-ECONOMIC VARIABLES							
Household Children Size							
3+	0.17***	0.16***	0.17***	0.19***	0.19***	0.19***	0.19***
2	0.29***	0.26***	0.27***	0.26***	0.27***	0.27***	0.27***
None	3.81***	3.82***	4.09***	4.10***	4.08***	4.03***	3.88***
Province of Residence							
Central	0.72	0.65	0.64	0.66	0.63	0.65	0.63
Copperbelt	1.44*	1.36	1.29	1.22	1.17	1.20	1.07
Eastern	1.40	1.12	1.00	1.02	1.00	0.94	0.90
Luapula	1.03	0.93	0.85	0.75	0.72	0.68	0.63
Northern	1.30	1.18	1.26	1.20	1.19	1.10	1.12
North-Western	0.75	0.82	0.80	0.86	0.80	0.75	0.66
Southern	1.15	1.14	1.14	1.10	1.07	1.10	1.09
Western	1.07	1.07	1.03	0.77	0.73	0.76	0.77
Mother's Education							
No education	1.33	1.31	1.48	1.26	1.23	1.22	1.20
Primary	1.53**	1.57**	1.69**	1.49	1.48	1.49	1.49
Mother's Current Type of Employment							
Not working	1.07	1.05	1.05	1.11	1.15	1.15	1.17
Unpaid worker	2.17**	2.18*	2.04*	2.08	2.08	2.15	1.85
Self-employed	1.14	1.07	1.04	1.10	1.11	1.13	1.13
Access to Electricity							
No	1.24	1.29	1.24	1.25	1.23	1.23	1.21
CULTURAL VARIABLES							
Type of marital union							
Never married	0.57	0.43*	0.45*	na	na	na	na
Formerly married	1.06	1.09	1.08	na	na	na	na
Polygamous	1.48**	1.41*	1.46**	1.46**	1.39*	1.41*	1.45*
INTERMEDIATE BEHAVIORAL VARIABLES							
Age for solids							
Not given		4.77***	5 02***	4.57***	4.44***	3.85***	5.81***
0-3 months		1.18	1.21	1.20	1.21	1.15	1.13
Household density							
0-2 persons/room			1.48*	1.42	1.40	1.40	1.46
3 persons/room			1.88***	1.83**	1.82**	1.81**	1.86***
4 persons/room			1.39	1.48	1.46	1.48	1.41
Discussion of FP with partner							
Never				1 41*	1 38	1.35	1.39
Once or twice				1.24	1.21	1.20	1.25
Number of marital unions							
More than once					1.27	1.27	1.20
Age for liquids							
Not given						1.30	1.38
0-3 months						1.29	1.29
Duration of breastfeeding							
0-6 months							0 46
7-18 months							1.51**
Model Chi-square (X^2)	474 9	504 0	519 1	408 9	411.1	411.4	419 4
Degree of freedom (df)	20	22	25	25	26	28	30

Adding behavioral variables to the model, for example, accounts for 84, 60, and 36 percent of the excess risk to children from Copperbelt, Northern, and Eastern Provinces, respectively. Moreover, controlling for behavioral variables elevates the survival chances to children in mostly rural as opposed to urban regions. Particularly important in accounting for these regional mortality risk differences are variables linked to feeding practices which include age at which children are introduced to solids and the duration of breastfeeding. The influence of behavioral variables and particularly those to do with feeding practices is not surprising since it is during this period in childhood that many of the children are fully switched to normal adult meals. And it is during this age that they are most affected by the socio-economic environment surrounding the household.

As for the household number of children, adding behavioral variables to the model does little to alter the mortality risk. The mortality inequalities associated with the household number of children remain unexplained.

Another important variable that has received a lot of attention in the child mortality literature is education of the mother. Before controlling for behavioral variables, it is noted that mortality levels are highest for children of primary educated mothers. Children of mothers with primary education are over 60 percent more likely to die than children of mothers with no formal education. A similar pattern is noted for mortality risks in the first month of life. Later in life, however, children of mothers without formal education and those with primary education are at 33 and 53 percent higher risk of dying, respectively, than children born to mothers with at least secondary education. Controlling for behavioral variables accounts for 39 and 8 percent of the mortality risks associated with children from mothers without formal education and those with primary education, respectively. Particularly important in explaining the significance linked to maternal education is the control for the discussion of family planning amongst spouses. This result, also noted during the post-neonatal period, implies that issues linked to the discussion and knowledge of family planning might be important in explaining the pathways through which mother's education affects child survival. The fact that child mortality risk is highest amongst children of primary educated mothers might also indicate some threshold in the influence of education achievement on childhood mortality. Assuming this observation is not resulting from under reporting of births by mother's without education, the mortality threshold is most likely. Mothers with little formal education might, through western education, abandon certain traditional practices once vital in suppressing childhood mortality levels. On the other hand, primary education alone is not sufficient to push down further the associated mortality risk in the absence of other socio-economic support systems that are linked to higher levels of education. Earlier findings during the post-neonatal period, when higher status households are most associated with unsafe behavioral practices, might confirm the view that modernisation and especially urbanisation might influence childhood mortality upwards in the short-run when traditional practices are abandoned.

Closely linked to mother's formal education is her current employment status. According to model 1, children of mothers working as unpaid workers are more than twice at risk of dying than children from mothers working as white collar employees. Furthermore, children of self-employed mothers are 14 percent more likely to die than children of white collar workers.

Although controlling for behavioral variables accounts for some of the mortality risk associated with children of unpaid workers by 27 percent, it amplifies the risk associated with children of non-working mothers. Although much of the higher risk amongst children of unpaid working mothers is explained, much of that risk is accounted for by controlling for duration of breastfeeding. Moreover, including age when children are introduced to solids and the discussion of family planning among spouses reduces the significant effect associated with mothers working as unpaid workers.

Even though the amplified mortality risk associated with children from non-working mothers might suggest that children of white collar workers have high risk behavioral patterns, the excess levels of mortality for children of unpaid workers may be linked to reduced child care that is not compensated by income. This is particularly true when non-working mothers and those working without pay are compared. Non-working mothers are more likely to care for their children than unpaid working mothers who are further deprived of compensating income.

Like the mortality pattern observed during the post-neonatal period, children from polygynous unions have lower survival chances than children from monogamous unions. Such children are

48 percent more likely to die than their counterparts from monogamous unions. On the other hand, children from never married mothers have higher survival chances which are significantly improved when behavioral variables such as introduction to solid foods and household density are included.

The control for behavioral variables explains for some of the risk associated with children from polygynous unions despite reducing the significance slightly.

It could be suggested that lower mortality risk associated with children of never married mothers is possibly influenced by single educated working mothers. On the other hand, children of young mothers are also most likely to receive child care support from their grandparents. This is especially the case if the grandparents have higher economic status than the young mothers.

b) **Controlling for Proximate Variables**

Table 9.10 presents the net relative risk of child mortality associated with selected socio-economic, cultural, intermediate behavioural and proximate variables.

From model 6, the effect of three socio-economic and cultural variables namely household number of children, province of residence and type of marital union on child mortality remain unexplained even after controlling for behavioral and proximate variables.

In fact, controlling for the survival status of the preceding child elevates the risks associated with many of the variables.

TABLE 9.10: RISK OF CHILD MORTALITY ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL, INTERMEDIATEBEHAVIORALANDPROXIMATEDETERMINANTS:RESULTSOFCOXHAZARDSREGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
SOCIO-ECONOMIC VARIABLES						
Household Children Size						
3+	0.19***	0.13***	0.13***	0.13***	0.13***	0.12***
2	0.27***	0.20***	0.19***	0.19***	0.19***	0.17***
None	3.88***	3.50***	3.40***	3.44***	3.53***	3.60***
Province of Residence						
Central	0.63	0.60	0.60	0.60	0.61	0.55
Copperbelt	1.07	1.17	1.13	1.11	1.00	0.97
Eastern	0.90	0.77	0.75	0.72	0.75	0.78
Luapula	0.63	0.54*	0.54*	0.52*	0.53*	0.53*
Northern	1.12	1.08	1.09	1.08	1.11	1.05
North Western	0.66	0.68	0.67	0.67	0.69	0.67
Southern	1.09	1.06	1.06	1.04	1.05	1.01
Western	0.77	0.80	0.76	0.76	0.79	0.82
Mother's Education						
No education	1.20	1.23	1.30	1.27	1.39	1.40
Primary	1.49	1.40	1.40	1.39	1.48	1.46
Mother's Current Type of Employment						
Not working	1.17	1.13	1.14	1.14	1.18	1.16
Unpaid worker	1.85	1.39	1.48	1.42	1.47	1.51
Self-employed	1.13	0.97	0.97	0.96	0.98	0.99
Access to Electricity						
No	1.21	1.24	1.26	1.28	1.73*	1.90**
CULTURAL VARIABLES						
Type of marital union						
Never married	na	na	na	na	na	na
Formerly married	na	na	na	na	na	na
Polygamous	1.45*	1.44*	1.43*	1.46*	1.48**	1.49**
INTERMEDIATE BEHAVIORAL VARIABLES						
Age for solids						
Not given	5.81***	5.00***	5.31***	5.33***	5.13***	4.78***
0-3 months	1.13	1.05	1.04	1.04	1.05	1.04
Household density						
0-2 persons/room	1.46	1.80**	1.79**	1.77**	1.76**	1.85**
3 persons/room	1.86***	2.10**	2.07***	2.04***	2.01***	1.99***
4 persons/room	1.41	1.67*	1.65*	1.63*	1.64*	1.61*
Discussion of FP with partner						
Never	1.39	1.57**	1.55**	1.54**	1.58**	1.66**
Once or twice	1.25	1.21	1.22	1.22	1.25	1.27
Number of marital unions						
More than once	1.20	1.11	1.10	1.10	1.11	1.10
Age for liquids						
Not given	1.38	1.32	1.29	1.30	1.30	1.26
0-3 months	1.29	1.24	1.24	1.25	1.22	1.23
Duration of breastfeeding						
0-6 months	0.46	0.49	0.46	0.47	0.50	0.54
7-18 months	1.51**	1.28	1.28	1.28	1.27	1.33
PROXIMATE DETERMINANTS						
Subsequent birth interval						
<24 months		1.90***	1.92***	1.91***	1.95***	2.02***
36+ months		1.42	1.37	1.38	1.40	1.38
Last births		0.35***	0.35***	0.35***	0.35***	0.32***
Age of mother at birth						
<18 years			0.85	0.85	0.86	0.80
18-24 years			0.82	0.83	0.84	0.79
35+ years			0.60	0.62	0.62	0.60
Mother currently pregnant						
Pregnant				1.22	1.21	1.23
Household toilet facility						
No facility					0.60	0.57
Pit toilet					0.62	0.60*
Preceding Child						
Dead						0.61**
Model Chi-square (X^2)	419.4	516.1	519.1	521.3	523.0	526.9
Degree of freedom (df)	30	33	36	37	39	40

Although subsequent birth intervals account for some of the risk associated with household number of children, children from mortality-prone households are still over three times more likely to die than children from single-child households. While additional control for proximate variables account for extra mortality risk associated with provincial residence, except for Eastern and Western Provinces, it improves significantly the survival chances of children residing in Luapula province. With exception of probably Eastern and Western Provinces, it is noted that controlling for both behavioral and proximate variables accounts for the mortality inequalities between Lusaka and other provinces. Moreover, controlling for these intermediate and proximate variables shows clearly the survival advantages associated with rural provinces of Luapula, North-Western, Eastern, Western and to a lesser extent Central. In fact, mortality levels are highest amongst urban provinces of Lusaka, Copperbelt and Southern after intermediate behavioural variables are accounted for. It is also important to point out that while Luapula Province has the worst survival chances during infancy, the opposite is true during late childhood and might be explained by issues of health service provision and feeding practices, respectively.

Although not statistically significant, controlling for proximate variables elevates the risk of dying to children of mothers with no formal education by over 90 percent while having little influence on children of mothers with primary education. This suggests that mothers with at least secondary education are associated with high risk family formation patterns such as shorter birth intervals. Most important, however, is that high mortality risk is associated with children from homes with flush toilets further indicating that children from mothers perceived as well-to-do have both unsafe family formation patterns and sanitary conditions. Moreover, children from mothers in the often recommended childbearing age groups of 25-34 are the ones with higher levels of mortality when all other selected variables are accounted for.

As for mother's current type of employment, the risk associated with children of unpaid working mothers and those that are self-employed are partly accounted for by controlling for proximate variables. For instance, controlling for subsequent birth intervals accounts for about 54 percent of the mortality risk associated with children of unpaid working mothers.

It is also interesting that accounting for the proximate variables amplifies significantly the effect associated with children from polygynous unions suggesting that children from monogamous unions are linked to high risk proximate patterns. For example, controlling for household toilet facility elevates the risk of dying amongst children from polygynous unions indicating some high risk sanitary conditions in monogamous unions households. Ironically, in this case, unsafe toilet facilities happen to be flush toilets. This is especially the case in urban areas where, in spite of presence of flush toilets, it is common to find poorly maintained sewerage systems. In such conditions, therefore, presence of a flush toilet might in fact elevate the risk of diarrhoea infection and possibly death.

Most interesting, however, is the elevation of mortality risk associated with no electricity when toilet facilities and the survival status of preceding child are controlled for. Including toilet facilities amplifies mortality risk significantly for children from homes without electricity by 248 percent. Again this observation supports the view that children from homes with electricity are actually associated with unsafe toilets, and ironically these are flush toilets. This result also questions the adequacy of using presence of a flush toilets as measure of better sanitary condition, as often is the case in many demographic studies.

Even though controlling for proximate variables accounts for some of the risk linked to age at which children are introduced to solid foods, the opposite is true for household density where the risk for children from homes with densities of less than 3, 3 and 4 persons per sleeping room are elevated by about 85, 15 and 49 percent, respectively.

The amplified risk of dying for children from parents who never discuss family planning by about 69 percent after controlling for proximate variables suggest that children of parents discussing family planning often are associated with high risk child spacing patterns as demonstrated by subsequent birth intervals. Furthermore, issues of family planning and the proximate variables are often associated with modern health service utilisation.

On the other hand, however, the effects associated with duration of breastfeeding are explained by behavioral variables and especially subsequent birth intervals. Controlling for subsequent birth intervals accounts for 45 percent of the risk associated with breastfeeding for the 7-18 months duration. It seems children breastfed for shorter durations of less than six months have higher survival chances raising the issue of whether this results from confounding higher socioeconomic status variables where educated mothers are most likely to breastfeed for shorter periods.

Among the proximate variables, however, only subsequent birth interval, survival status of preceding child and toilet facility continue to have a significant effect on child mortality when socio-economic, cultural and intermediate behavioral variables are controlled for. Children with birth intervals of less than 24 months are 95 percent at higher risk of dying than children with intervals between 24 and 35 months. The risk of dying is also higher for children with birth intervals of at least 36 months. Such children are 40 percent more likely to die than children with the often recommended birth interval of between 24 and 35 months. The excess risk of dying for children with longer birth intervals might indicate problems relating to spontaneous abortion or other reproductive health problems encountered by some mothers.

On the other hand, the continued significant influence of the survivorship status of preceding sibling during both post-neonatal and child periods strengthens the argument of cross-infections amongst siblings within a household. This is especially the case during later childhood when there is increased interaction between the siblings.

As in previous sections, Table 9.11 presents a re-run of the Cox hazards models presented earlier in Table 9.10.

TABLE 9.11: RISK OF CHILD MORTALITY ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL, INTERMEDIATE BEHAVIOURAL AND PROXIMATE DETERMINANTS: RE-RUN OF COX HAZARDS REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
SOCIO-ECONOMIC VARIABLES						
Province of Residence						
Central	0.55	0.52*	0.52*	0.50*	0.52*	0.46**
Copperbelt	0.93	0.89	0.89	0.87	0.83	0.85
Eastern	1.02	0.95	0.92	0.89	0.93	0.90
Luapula	0.66	0.60	0.59	0.59	0.60	0.59
Northern	0.94	0.82	0.83	0.82	0.84	0.82
North-Western	0.64	0.61	0.60	0.59	0.60	0.59
Southern	0.79	0.72	0.72	0.70	0.72	0.72
Western	0.96	0.90	0.91	0.90	0.95	0.92
Mother's Education						
No education	0.88	0.88	0.95	0.93	0.98	0.95
Primary	1.24	1.23	1.24	1.22	1.26	1.22
Mother's Current Type of Employment						
Not working	1.23	1.24	1.20	1.18	1.20	1.18
Unpaid worker	1.97	1.72	1.77	1.65	1.70	1.65
Self-employed	1.16	1.17	1.13	1.11	1.13	1.12
Access to Electricity						
Absent	1.48	1.49	1.45	1.48	1.70*	1.72*
CULTURAL VARIABLES						
Type of marital union						
Never married	na	na	na	na	na	na
Formerly married	na	na	na	na	na	na
Polygamous	1.23	1.20	1.26	1.26	1.28	1.29
INTERMEDIATE BEHAVIOURAL VARIABLES						
Age for solids						
Not given	7.04***	6.29***	7.06***	7.33***	7.15***	7.10***
0-3 months	1.17	1.13	1.13	1.13	1.14	1.15
Discussion of FP with partner						
Never	1.71***	1.93***	1.83***	1.82***	1.84***	1.88***
Once or twice	1.28	1.31	1.29	1.29	1.30	1.34
Number of marital unions						
More than once	1.46**	1.50**	1.68***	1.65***	1.66***	1.66***
Age for liquids						
Not given	1.44*	1.46*	1.47*	1.47*	1.48*	1.50*
0-3 months	1.35	1.26	1.28	1.28	1.26	1.27
Duration of breastfeeding						
0-6 months	0.42	0.41	0.38*	0.36*	0.38	0.38
7-18 months	1.72***	1.61***	1.53**	1.56**	1.56**	1.59**
PROXIMATE DETERMINANTS						
Subsequent birth interval						
<24 months		2.39***	2.37***	2.30***	2.31***	2.25***
36+ months		1.74**	1.76**	1.79**	1.80**	1.81**
Last births		0.68**	0.72*	0.69*	0.69*	0.68**
Age of mother at birth						
<18 years			1.61*	1.57*	1.58*	1.57*
18-24 years			1.13	1.12	1.13	1.11
35+ years			0.55*	0.58*	0.58*	0.58*
Mother currently pregnant						
Pregnant				1.44**	1.43**	1.38*
Household toilet facility						
No facility					0.75	0.80
Pit toilet					0.80	0.85
Preceding Child						
Dead						1.26
Model Chi-square (X^2)	114.8	170.2	178.7	183.8	185.4	191.1
Degree of freedom (df)	24	27	30	31	33	34

Even after excluding both household children size and household density from the models, province of residence and access to electricity continue to have considerable effect on child mortality risk. Unlike in Table 9.10, mother's type of marital union seizes to exert any significant influence on child mortality. Although Central Province shows the lowest child mortality risk compared to Lusaka Province, the continued influence on mortality from both province of residence and access to electricity strengthens the argument that they are a reflection of community-level infrastructural development. On the other hand, the two variables only show statistically significant effect on mortality risk once the proximate determinants are accounted for. Children from homes without electricity are 72 percent at increased risk of dying than their counterparts from homes with electricity.

As for the intermediate behavioural characteristics, and like the post-neonatal period, both discussion of family planning amongst spouses and the number of marital unions the mother has had have considerable influence on child mortality risk. Children whose parents never discuss family planning are at increased risk of dying. Most remarkable is the increased mortality risk amongst children whose mothers have had more than one marital union, once both household children size and household density are excluded from the model.

In the case of feeding behavioural characteristics, such as age at which children are introduced to solid feeds and the duration of breastfeeding, the estimates are possibly influenced by uncontrolled reverse causation.

Equally remarkable, however, is the increased influence on child mortality risk from age of mother at birth and mother's pregnancy status while the mortality risk associated with the survival status of the preceding sibling is reversed.

While children with less than two years and those with at least three years of subsequent birth intervals are at increased risk of dying compared to those with intervals between 24 and 35 months, there is increased influence from age of mother at birth as the child grows, and in contrast to the first month of life. Moreover, children born to mothers aged less than 18 years are 57 percent at higher risk of dying than children born to mothers aged between 25-34 years. In contrast, child survival chances are highest amongst mothers with at least 35 years of age further supporting earlier findings on Sub-Saharan Africa from studies that used the DHS data (Sullivan et al., 1994).

Another important observation concerns the continued excess mortality risk to children whose mothers were pregnant at the time of the survey even when the survivorship status of preceding child is controlled for. While this observation may possibly be attributed to reverse causation of mothers's attempts to replace dead children, it is also possible that it might explain some of the neglect that are associated with older children once mothers are aware of a new pregnancy.

9.6 OVERVIEW

Chapter Nine has demonstrated the insignificant role both household and individual-level socio-economic factors have in shaping child survival outcomes in Zambia.

During the first month of life, only mother's religious affiliation shows some influence on neonatal mortality risk with children of Protestant mothers having better survival chances than children of Catholic mothers. With the increasing age of the child, only community-level socio-economic characteristics such as access to electricity and to a lesser extent province of residence show considerable influence on later child survival outcomes. Most important is the fact that these two factors, and especially access to electricity, reflect the level of community infrastructural development of an area. Surprisingly none of the household and individual-level socio-economic characteristics, such as maternal education, has any meaningful influence on childhood mortality differentials as previously shown by earlier demographic studies. This is understandable for the Zambian situation where the deterioration of modern health and social services means that households that often benefit more from such services are the most affected. The fact that controlling for modernity factors such as discussion of family planning amongst spouses accounts for much of the influence of mother's education strengthens the argument that modern education shapes health-related knowledge and attitudes. In the absence of quality modern facilities, therefore, it is difficult to expect increased influence from modern maternal education.

One of the most important contributions of this study is in introducing explicitly the intermediate behavioural factors to explain the pathways through which socio-economic and cultural factors influence child survival. Particularly significant is the increased influence of behavioural characteristics with increasing age of the child. This is especially shown by the contribution of both feeding and reproductive behavioural characteristics. While many of the feeding factors are possibly influenced by reverse causation, Chapter Nine also shows increased mortality risk amongst children whose parents never discussed family planning. Moreover, children whose mothers have married more than once have excessive risk of dying compared to children whose mothers have only had one marital union.

Perhaps most remarkable is the influence bio-demographic factors have on mortality during the first year of life. Particularly important is the excessive mortality risk associated with multiple births during the neonatal period and declines with increasing age of the child. Also important is the excess mortality risk for male births especially during the first month of life, which might possibly explain the earlier observed excess omission of male births in Chapter Three. Excess male mortality for Sub-Saharan Africa is not unusual although the situation might have possibly been worsened by the deteriorating health service provision in Zambia. Chapter Nine also illustrates the use of the child's size at birth as reported by the mother as an alternative proxy for children's birth weight, information available only to about 40 percent of births in this sample.

Also important from this study is the performance of both preceding and subsequent birth intervals for which children born with less than two years of birth interval are at elevated risk of dying. While preceding birth intervals are especially influential during the first year of life, the contribution of subsequent birth intervals are particularly important after the first month of life. Linked to subsequent birth intervals is the significance of mother's pregnancy status which requires further investigation especially when reverse causation is controlled for. It is possible that mothers's discovery of a new pregnancy results in reduced care for the older sibling, a practice possibly driven by cultural beliefs.

Lastly is the significant contribution of home floor materials especially during the first month of life possibly indicating the presence of neonatal tetanus to children most likely to have been delivered in homes with earth or sand floor materials.

Overall, the study shows that the intermediate behavioural characteristics are important in explaining some of the influences socio-economic factors have on mortality risk. The effect of these behavioural factors on mortality risk increases with the increasing age of the child. On the other hand, bio-demographic factors have considerable influence on child survival outcomes especially during the first year of life, possibly reflecting the existing health service provision in Zambia. As for the child spacing pattern, subsequent birth intervals continue to exert considerable influence on older children who are possibly affected by their parents' recent reproductive situation.

CHAPTER TEN

FACTORS INFLUENCING CHILDREN'S HEALTH: ANALYSIS OF NUTRITIONAL STATUS

10.1 INTRODUCTION

Arising from the modified Mosley-Chen framework (Chapter One), this chapter has three main concerns: firstly, to explore explanations for the childhood mortality risk associated with certain socio-economic and cultural factors that are not accounted for by controlling for both intermediate behavioural and proximate variables; secondly, to assess the importance of information on child care practices and morbidity factors that are otherwise not collected on dead children, as is the case with many demographic surveys; and thirdly to assess the contribution of behavioural factors in explaining the pathways through which socio-economic and cultural factors influence growth faltering and increased susceptibility to infections and possibly death. There is sufficient evidence to show that children's nutritional status reflects infant and child feeding practices as well as recurrent and chronic infections (Mosley and Chen, 1984; Martorell and Ho, 1984; Mosley, 1989; Gaisie, Cross, Nsemukila, 1993; Kaite, Nestel, Rutstein, 1993). Moreover, infections are as important a cause of malnutrition as are the limited availability of food and related feeding practices (Cosminsky, Mhloyi, and Ewbank, 1993). Particularly important is the contribution of diarrhoeal diseases to growth retardation

(Martorell and Ho, 1984).

The major problem in measuring susceptibility by way of growth faltering, however, is the reverse causation between infection and malnutrition. Available evidence shows that moderately malnourished children may be more likely to develop severe infection because of deficiencies in immunocompetence (Martorell and Ho, 1984). However, more severe infections in turn result in a poorer nutritional status and a vicious cycle of effects may eventually bring on severe malnutrition and death (Martorell and Ho, 1984). This process is described by Mosley (1985) as the interaction of both social and biological synergies. These are the synergies that are significant in determining susceptibility that is equally influenced by social, behavioral and bio-demographic risks within the household environment.

10.2 CONSTRUCTION OF ADDITIONAL VARIABLES

10.2.1 Intermediate Behavioral Variables

a) Child Minder

Although child care is an important component in the child survival debate, Demographic and Health Surveys do not often address issues of who cared for the dead children, always assuming that the sole carer is the biological mother of that child. Instead, child care questions are only asked on surviving children born in the five years before the survey.

To explore the effect of child care on child survival through use of anthropometric measurements a question is asked in the Zambia

Demographic and Health Survey (ZDHS) on who usually takes care of the youngest child at home while mother is working. This question is used here to construct a child care variable namely "child minder".

As shown by Table 10.1, child minder is categorized into four groups as follows: **parents** (which includes both mother and father although there are only 25 cases of children cared for by fathers) making up 59 percent of the sample; **older children** making up almost 20 percent; **relatives** accounting for 17 percent and; **other carers** taking up less than 4 percent.

TABLE 10.1: DISTRIBUTION OF BIRTHS BY ADDITIONAL INTERMEDIATE BEHAVIORAL, BIO-DEMOGRAPHIC AND MORBIDITY FACTORS.

VARIABLE	NUMBER	PERCENTAGE
INTERMEDIATE BEHAVIORAL VARIABLES		
CHILD MINDER		
Others	117	3.5
Relatives	577	17.4
Older Children	661	19.9
Parents[1]	1959	59.1
BIO-DEMOGRAPHIC VARIABLES		
MOTHER'S BODY MASS		
<18.5	612	9.4
18.5-25.9	5108	78.6
26+	779	12.0
MORBIDITY[2] VARIABLES		
RESPIRATORY INFECTION (COUGH)		
Yes	2271	47.2
No	2542	52.8
MALARIA INFECTION (FEVER)		
Yes	2178	45.2
No	2644	54.8
DIARRHOEAL INFECTION		
Yes	1116	23.1
No	3707	76.9

Notes: 1. Includes only 25 cases of where father is child minder
2. Information on morbidity applies only to infections in the two weeks prior the survey.

Included among the "other" carers are neighbours, friends, servants or hired help and child care institutions. This child care variable is, therefore, an additional variable to the already defined intermediate behavioral variables representing certain family or household behavioral patterns or life styles. The category "parents" is used as reference.

10.2.2 Bio-demographic (Proximate) Variables

a) Mother's Body Mass

In many retrospective surveys such as the DHS, information is rarely collected on mother's health status. In the Zambian survey, mother's height and weight is collected from eligible women who have given birth to children in the five-year period before the survey. The aim is to obtain a picture of the nutritional status of women of reproductive age (Gaisie et al., 1993). It should be noted, however, that height and weight measurements are missing for about 2 percent of eligible women. Moreover, women who were pregnant at time of the survey and those who had delivered within the two months preceding the survey are excluded (Gaisie et al., 1993).

Although weight is predominantly a measure of current nutritional status and is often used as an indicator of overall health and nutritional status, height is a measure of past nutritional status as well as the genetic potential of the individual (Kaite, et al., 1993).

In this study, however, indices of body mass known as Body Mass Index (BMI) are adopted. Indices of body mass (also known as the

Quetelet Index) and defined as weight in kilograms divided by the square of the height in meters, is used to assess thinness or obesity. Although originally developed to diagnose obesity, the indices are also currently used in assessing chronic energy deficiency (Gaisie et al., 1993; Kaite et al., 1993). Whereas BMI is a self-contained ratio which does not require a reference table (being its main advantage), a cut-off point of 18.5 has been recommended for defining chronic energy deficiency. On the other hand, data on reference populations for women show the normal range for the BMI to fall between 21.5 and 23.1. Furthermore, women who are 20 percent overweight have BMI between 25.8 and 27.3 where as those who are severely overweight have BMI between 30.1 and 32.3 (Kaite et al., 1993). Data from the Zambia Demographic and Health Survey shows the mean BMI for Zambian women to be around 22.

For purposes of this study, however, mother's body mass is divided into three groups: <18.5, 18.5-25.9, and 26+. While <18.5 is intended to measure thinness, the 26+ category is to measure obesity. The category between 18.5 and 25.9 is used here as base reference. As earlier indicated in Table 10.1, 9 and 12 percent of the births in the sample are to mothers considered, here, as thin and as overweight, respectively.

10.2.3 Morbidity Variables

As information necessary to investigate the question of susceptibility to infection leading to growth faltering as discussed in the Mosley-Chen's infection/malnutrition dyad, data on morbidity are collected on children with fever, cough and diarrhoea in the two weeks before survey. As measurements for malaria and respiratory infections, mothers are asked to state whether their children have fever and cough in the preceding two weeks, respectively. In addition to fever and cough, mothers are also asked whether their children have diarrhoea in the two weeks prior survey.

About 47 and 45 percent of births in the sample have respiratory and malaria infections in the two weeks before survey, respectively. On the other hand, only 23 percent of these births have diarrhoea. In all these variables, children without infections are taken as the reference category.

10.3 MODEL ESTIMATION AND INFERENCE

Unlike previous chapters that have used childhood mortality as the dependent variable, children's underweight status is adopted here as the dependent variable. Like the mortality analysis, the individual child is taken as unit of analysis with a dichotomous dependent variable of whether the child is underweight or not.

To measure children's nutritional status, three indices of height-for-age, weight-for-height, and weight-for-age are often used. Based on a recommendation by the World Health Organization (WHO), the nutritional status of survey children is compared with an international reference population defined by the U.S. National Centre for Health Statistics (NCHS) and also accepted by the U.S Centre for Disease Control (CDC). These indices are expressed in standard deviation units known as *z*-scores from the median for the reference population. Children whose height-for-age *z*-score is below minus two standard deviation (-2SD) from the median of reference population are considered stunted or chronically undernourished. Often, stunting reflects the outcome of a failure to receive adequate nutrition over a long period of time, and is also affected by recurrent and chronic illness (Gaisie et al., 1993). On the other hand, weight-for-height describes current nutritional status of children. Children whose weight-for-height *z*-scores are below minus two standard deviations (-2SD) from the median of the reference population are considered wasted, and are acutely undernourished. Wasting, which may also reflect acute food shortages, represents the failure to receive adequate nutrition in the period immediately preceding the survey and may be the result of recent episodes of illness, causing loss of weight and the onset of under nutrition (Gaisie et al., 1993).

Ideally, wasting could have been used in this study to measure growth faltering. However, there are fewer cases of wasting (about 5 percent) in this sample, hence the need to look for alternative indicators of nutritional status.

Some studies have suggested that weight-for-height or stunting is the weakest predictor of mortality (Mosley and Chen, 1984). Therefore, since weight-for-age is a composite measure of height-for-age and weight-for-height and equally takes into account both acute and chronic under-nutrition, it is adopted here as an ideal nutritional measure for the study and also has enough working cases. Moreover, it measures both recent and past malnutrition. Children whose weight-for-age is below minus two standard deviations (-2SD) from the median of the reference population are classified as underweight.

In this study, therefore, children aged 2-59 months are selected to demonstrate the effect of socio-economic and cultural factors on childhood nutritional status using the dichotomous dependent variable of whether the child is underweight or not.

Since mothers to children aged less than one month are not measured, all neonatal cases are dropped from the analysis. Furthermore, the basic logistic regression model is adopted in estimating model parameters within the SPSS logistic procedure. Like the mortality analysis in previous chapters, and taking each predictor variables' theoretically low-risk level as reference, exponentiated values of the parameter estimates are computed as odds ratios and interpreted here as relative risks.

Even though a multiple linear regression model would have been ideal (for reasons of information loss) in measuring underweight (weight-for-age) as dependent variable, logistic regression offers a better option for simple reasons of ease of interpretations of relative odds and as a continued build up to earlier mortality models used in the previous chapters. In other words, the logistic regression model is used here to predict an outcome of a child being underweight.

For univariate analytical purposes, as demonstrated in section 10.4, the gross effects of socio-economic, cultural, behavioral, bio-demographic and morbidity variables on childhood nutritional status are estimated by fitting one-variable models in the logistic regression procedure. And to assess their net effect, the variables are sequentially fitted in the model. For both procedures, statistical significance of the estimated parameters is also assessed by use of p-values of model X^2.

10.4 UNIVARIATE ANALYSIS

10.4.1 Nutritional Differentials by Socio-economic and Cultural Factors

Table 10.2 presents the effects of socio-economic and cultural variables on children considered underweight aged 2-59 months. As with the case of mortality, childhood is divided into post-neonatal (2-11 months) and child (12-59 months). Among the community-level socio-economic variables include rural-urban residence, province of residence and access to electricity. According to the gross relative risk by rural-urban residence, children from the rural areas are over 3 times more likely to be underweight than their counterparts from the urban areas.
This inequality in nutritional status is reduced, however, with increasing age of the child. During late childhood, for example, children aged 12-59 months from the rural areas are 56 percent more likely to be undernourished than children in urban areas. One possible explanation for higher risk of being undernourished during the post-neonatal period is that many of the children are just being introduced to normal adult meals and are, therefore, exposed early to food contamination often leading to diarrhoeal infection. Diarrhoea, which has an immediate effect on energy balance, often tends to increase the risk of being underweight (Kaite et al., 1993).

As for province of residence, estimates can not be computed for the post-neonatal period since there are only few births. Instead, estimates are computed for children aged 12-59 months.

TABLE 10.2 EFFECTS OF SOCIO-ECONOMIC AND CULTURAL FACTORS ON CHILDHOOD NUTRITION: RESULTS OF LOGISTIC REGRESSION.

VARIABLE	POST-NEONATAL	CHILD
REGION OF RESIDENCE	[0.00]	[0.00]
Rural	3.17***	1.56***
Urban	1.00	1.00
PROVINCE OF RESIDENCE	na	[0.00]
Central	na	1.06
Copperbelt	na	1.08
Eastern	na	1.12
Luapula	na	2.79***
Lusaka	na	1.00
Northern	na	1.97***
North-Western	na	1.37*
Southern	na	0.94
Western	na	1.12
ACCESS TO ELECTRICITY	[0.01]	[0.00]
No	2.31**	1.95***
Yes	1.00	1.00
HOUSEHOLD CHILDREN SIZE	[0.09]	[0.55]
3+	0.70	1.07
2	1.26	0.97
1	1.00	1.00
MOTHER'S EDUCATION	[0.02]	[0.00]
No education	2.96**	2.03***
Primary	2.74**	1.69***
Secondary +	1.00	1.00
FATHER'S OCCUPATION	[0.00]	[0.00]
Never worked	1.91	1.69**
Agricultural self-employed	2.15**	1.62***
Blue collar	0.86	1.04
White collar	1.00	1.00
TYPE OF MARITAL UNION	[0.12]	[0.61]
Never married	0.33*	1.08
Formerly married	0.75	1.15
Polygamous	0.64	1.08
Monogamous	1.00	1.00

Although children in Southern Province are better nourished than children in Lusaka Province, those in Luapula and Northern Provinces are at highest risk of being undernourished. For instance, the children in Luapula and Northern Provinces are 179 and 97 percent, respectively, more likely to be underweight than children in Lusaka Province. The finding that underweight levels are highest in Bemba-speaking north-eastern Zambia might suggest linkage between feeding practices, ecological settings and nutritional status. It is also demonstrated from Table 10.2 that the risk of being underweight is lowest in the dominantly urban regions of Central, Copperbelt, Lusaka and Southern Provinces.

Like rural-urban residence, the risk of a child being underweight according to household access to electricity is reduced with increasing age of the child. Whereas children from homes without electricity are 131 percent more likely to be undernourished during the post-neonatal period, such children are 95 percent more likely to be underweight during the late childhood period. As earlier suggested with rural-urban residence, children from homes without electricity, like children residing in rural areas, are much more likely to be underweight.

Unlike the case of childhood mortality, the household number of children has little effect on the nutritional status of children. Moreover, there is no notable pattern emerging on the relationship between the number of children in a household and being under-weight.

Among the individual-level socio-economic variables selected for this analysis are mother's education and father's occupation. During the post-neonatal period, children of mothers with no formal education are almost 3 times more likely to be underweight, while those from mothers with primary education are 2.7 times at risk. As the child grows, however, the nutritional gap by maternal education is narrowed despite higher levels of statistical significance during the late childhood period. Even then, children of mothers with no formal education are more than twice at higher risk of being under-weight while children of primary educated mothers are at 69 percent higher risk, both groups compared to children of at least secondary educated mothers. Compared to mortality results, mother's education has a more significant effect on childhood nutritional status than on mortality, suggesting different pathways of influence. One possible explanation is that while mother's education might be effective in influencing children's feeding practices, it is not sufficiently effective in an environment where basic essential services such as modern health care are inadequate or simply unavailable to most children. It is also possible to speculate that the significance shown by the discussion of family planning amongst spouses in the mortality analysis might be reflecting situations that are linked to mother's exposure to modern ideas. However, it could also be said that mother's education might have little influence on certain causes of death such as malaria and possibly those that are HIV/AIDS related where there is poor provision of health services.

Lastly is the effect of mother's type of marital union on her children's nutritional status. Even though little underweight risk difference exists during the late childhood period between the four categories, children of never-married women are less likely to be malnourished. Moreover, children from both formerly-married women and those from polygynous unions are less likely to be underweight than children from monogamous unions. The lower risk of malnourishment amongst children from never-married mothers might be explained by confounding effects from other factors such as mother's education and occupation. Although it is equally possible that such children might come from professional never-married mothers, it is also likely that children of young and never-married mothers are sometimes cared for by their grand parents and other relatives, who might have higher socio-economic status than young mothers.

10.4.2 Nutritional Differentials by Intermediate Behavioral Factors.

Table 10.3 presents three sets of family, feeding and reproductive intermediate behavioral variables. Among the family behavioral variables are household density (i.e. persons per sleeping room) reflecting modes of living and child minding reflecting practices linked to overall child care.

During the post-neonatal period, there is an observed U-shaped pattern relating household persons per sleeping room and underweight, even though the effect is not statistically significant. Up to 4 persons per sleeping room, there is a notable inverse association between household density and underweight. Children from homes with less than 3 persons per sleeping room are at 37 percent higher risk of being under nourished than children from households with at least 5 persons per sleeping room. This pattern is similar to that observed from the mortality analysis during the first month of life. This, however, is not the case for children aged 12-59 months.

TABLE 10.3: EFFECT OF INTERMEDIATE BEHAVIORAL FACTORS ON CHILDHOOD NUTRITION: RESULTS OF LOGISTIC REGRESSION.

VARIABLE	POST-NEONATAL	CHILD
FAMILY VARIABLES		
HOUSEHOLD DENSITY	[0.69]	[0.01]
<3 persons/room	1.37	0.74**
3 persons/room	1.15	0.80**
4 persons/room	0.93	0.99
5+ persons/room	1.00	1.00
CHILD MINDER	[0.88]	[0.00]
Others	1.02	0.38***
Relatives	0.69	0.69***
Older Children	1.06	0.56***
Parents	1.00	1.00
FEEDING VARIABLES		
DURATION OF BREASTFEEDING	[0.00]	[0.00]
0-6 months	0.04***	0.30***
7-18 months	0.20***	1.02
19+ months	1.00	1.00
AGE FOR SOLIDS	[0.00]	[0.00]
Not given	0.27***	0.11**
0-3 months	0.43***	0.82**
4+ months	1.00	1.00
AGE FOR PLAIN WATER	[0.01]	[0.02]
Not given	0.00	0.68
0 months	1.18	1.25***
1+ months	1.00	1.00
REPRODUCTIVE VARIABLES		
DISCUSSION OF FP WITH PARTNER	[0.08]	[0.14]
Never	1.58	1.20*
Once or twice	0.88	1.17
More often	1.00	1.00
NUMBER OF MARITAL UNIONS	[0.15]	[0.11]
More than once	1.50	1.17
Once	1.00	1.00

During the late childhood period, household density is actually positively associated with underweight and statistically significant for children from homes with less than 4 persons per sleeping room.

Children from homes with less than 3 persons per sleeping room are 26 percent less likely to be undernourished than children from households with at least 5 persons. One possible suggestion to explain the pattern during this period is increased child competition for the limited resources with increasing age of the child. This is particularly true during the late childhood period when children are expected to participate in the normal adult meals.

As for child minding, it has little significant effect on childhood nutrition during the post-neonatal period. On the other hand, children aged 12-59 months cared for by individuals other than own parents are less likely to be undernourished. This is especially the case for those children cared for by child care institutions, friends, neighbours, etc., and is equally true for those children cared for by relatives and older children. There are three possible explanations for this pattern. Firstly, children who are cared for by institutions, friends and relatives are more likely to belong to high economic status households that can afford the cost of child care. Also likely are those households that can afford to keep poorer kin members to help with child minding. This is a particularly common practice among urban working professionals. In return these kin members are provided with support in the form of accommodation, food, clothing and sometimes expenses on education. Secondly, older children are more likely to have higher levels of formal education than their parents. This is especially the case among rural and subsistence farming communities. Thirdly, children who are cared for by their own mothers while working are less likely to receive adequate care. Such children, for example, are less likely to be given adequate feeding when required. This pattern is also likely to be influenced by seasonal activities especially that the survey was conducted during the rainy-cultivating season. For the subsistence farming communities, this is the season when most mothers are less likely to give adequate child care themselves. This is also true for those mothers working in urban food markets. On the other hand, mothers who are unable to afford someone to look after their children while they are at work are also most likely to come from poor households. This is possibly the case for the urban poor. Table 10.3 also presents the gross effect of feeding behavioral variables on nutritional status. These variables are the duration of breastfeeding, and the age at which children are introduced to both solid supplements and plain water. For the duration of breastfeeding, caution should be taken since most children in the sample are still being breastfed during much of the post-neonatal period. On the other hand, it is noted for children aged 12-59 months that those breastfed for shorter durations are less likely to be undernourished, and little difference is observed for supplementation of both solids and plain water. The lower levels of malnutrition among children breastfed for shorter durations of less than 7 months might reflect those children belonging to educated and working professional mothers. Although the category of children not given supplements of solids should be taken cautiously, since they are based on few surviving births, there are indications that children introduced to solids during the first 3 months of life are better nourished than those introduced after. This contradicts the notion that children introduced to solids early are at increased risk of diarrhoea contamination that might later lead to under nourishment (Kaite et al., 1993). Although children are being introduced early to solids, such a practice does not seem to worsen their nutritional status. In fact introducing children to solids early might be more rational in an environment characterised by both poor maternal nutrition and lactation in the absence of alternative food supplements.

In their study of child feeding practices in rural Zimbabwe, Cosminsky and colleagues (1993) attributed the early introduction of supplements to the mother's pragmatic attitudes, interacting with ceratin social, cultural, and economic factors that are important in influencing mother's child feeding decisions.

However, the opposite is true for age at which children are given plain water. Those children given plain water in the first month of life are more likely to be underweight. This is possibly due to the effect of diarrhoeal infection once children are given contaminated water. Even though giving young children plain water while being breastfed is less beneficial, it exposes children to early diarrhoeal contamination. This is probably one area that needs health education to mothers more than early supplementation of solids. Introducing children to plain water within the first month of life is almost universal in Zambia.

Lastly, Table 10.3 presents children's risk of being underweight by reproductive behavioral variables such as the discussion of family planning among spouses and the number of marital unions the mother has had. Children from spouses who never discuss family planning are 58 percent more likely to be underweight than children whose parents discuss family planning more often. Nevertheless, the effect of spouses discussing family planning is only statistically significant during the late childhood period and amongst children whose parents never discuss family planning. These children are 20 percent more likely to be undernourished than children from spouses discussing family planning more often. Although most of the children from parents who never discuss family planning may reflect influences of poorer households, the effect is only significant with increasing age of the child.

As expected, children of mothers who have married more than once are more likely to be underweight than children from mothers married once. Although not statistically significant, children to mothers who have had more than one marital unions are more likely to be underweight than their counterparts whose mothers have been involved in only one marital union.

10.4.3 Nutritional Differentials by Bio-demographic Variables

Table 10.4 presents the effect of selected bio-demographic variables on childhood nutrition.

Although estimates for the post-neonatal period are not computed, those for the late childhood period indicate that children with shorter birth intervals are less likely to be undernourished than children belonging to longer birth intervals. It is possible that such a pattern is a result of the selection effect where most of the children with shorter intervals have already died leaving healthy surviving children. Also possible is the fact that high socio-economic status households are often associated with shorter birth intervals.

TABLE 10.4: EFFECT OF PROXIMATE FACTORS ON CHILDHOOD NUTRITION: RESULTS OF LOGISTIC REGRESSION.

VARIABLE	POST-NEONATAL	CHILD
SUBSEQUENT BIRTH INTERVAL	na	[0.00]
<24 months	na	0.81
24-35 months	na	1.00
36+ months	na	0.99
Last births	na	1.37***
BIRTH TYPE	[0.15]	[0.00]
Multiple	2.07	2.11***
Single	1.00	1.00
MOTHER'S BODY MASS	[0.37]	[0.00]
<18.5	1.30	2.07***
18.5-25.9	1.00	1.00
26+	0.61	0.54***

Like in the mortality analysis, multiple births are much more likely to be undernourished than singleton births. During the late childhood period, for example, multiple births are more than twice likely to be underweight than singleton births. The fact that the risk of being malnourished increases significantly with increasing age of the child indicates some increase in competition for household resources to the surviving multiple births.

Also to emerge from this analysis is the remarkable relationship between childhood nutritional status and mother's body mass. Although not statistically significant during the post-neonatal period (possibly due to few births), the children's risk of being undernourished is inversely associated with mother's body mass. Expectedly, children from mothers considered underweight are more likely to be undernourished themselves than children from mothers perceived as otherwise. In fact, children from mothers considered overweight are almost 40 percent better nourished. Children born to mothers perceived as chronically malnourished are two times more likely to be undernourished whereas those from overweight mothers are better nourished. The result is most remarkable with increasing age of the child.

10.4.4 Nutritional Differentials by Morbidity Variables

Table 10.5 presents the effect of three selected infections namely respiratory, malaria and diarrhoea on children's nutritional status. The estimates from morbidity data are especially important in that they represent the idea of susceptibility within the infection-malnutrition dyad, as discussed by Mosley (1985). It is argued that growth faltering is a product of the interaction between infection and malnourishment and is vital in explaining the concept of susceptibility and mortality. Unfortunately, the effect of infections such as malaria and diarrhoea on childhood mortality can not be explored for dead children since data have been collected only on surviving children.

TABLE 10.5: EFFECT OF MORBIDITY FACTORS ON CHILDHOOD NUTRITION: RESULTS OF LOGISTIC REGRESSION.

VARIABLE	POST-NEONATAL	CHILD
RESPIRATORY INFECTION (COUGH)	[0.08]	[0.00]
Yes	1.50*	1.30***
No	1.00	1.00
MALARIA INFECTION (FEVER)	[0.00]	[0.00]
Yes	2.64***	1.54***
No	1.00	1.00
DIARRHOEAL INFECTION	[0.01]	[0.00]
Yes	1.97***	1.77***
No	1.00	1.00

During the post-neonatal period, children with a cough in the two weeks prior survey are at 50 percent higher risk of being underweight than children without a cough. Although this risk wanes with increasing age of the child, the effect on childhood underweight is remarkable. Similar patterns are also noted for malaria and diarrhoeal infections. Whereas children with fever (measuring malaria infection) are more than twice at risk of being undernourished during the post-neonatal period, they are only at 54 percent higher risk of malnutrition during the late childhood period. Again, the differential effect decreases in importance with increasing age of the child.

As for diarrhoea, for example, children aged 2-11 months who had the infection two weeks prior survey are 97 percent more likely to be malnourished than children with no diarrhoea. Even with increasing age of children, the effect remains remarkable among children with diarrhoea at 77 percent excess risk of being underweight. The substantial reduction in the risk of malnutrition as the child grows might suggest that children develop immunity to such infections despite the influence on nutritional status remaining remarkably strong.

10.5 MULTIVARIATE ANALYSIS

10.5.1 Introduction

In this multivariate section, and like in previous chapters on childhood mortality, the net effect of socio-economic and cultural variables on children's nutritional status is presented using logistic regression models while controlling for both intermediate behavioral and proximate (bio-demographic) variables.

For the childhood nutritional status analysis, however, additional controls for morbidity variables are taken. This is due to the survey design of the DHS surveys where information on infections is collected only on surviving children. Including morbidity variables in the analysis enables additional investigation of the pathways that otherwise is not possible during the mortality analysis. Moreover, the analysis adds an infection/malnutrition dimension to explaining the pathways through which socio-economic and cultural factors operate in influencing child growth and in particular growth faltering.

10.5.2 Nutritional Variations by Socio-economic, Cultural and Behavioral Factors.

Table 10.6 summarizes the net relative risk of children being under-weight by selected socio-economic, and cultural variables for children aged 1-59 months (combining both the post-neonatal and child period due to fewer births in the former) while controlling for behavioral variables. Where as Model 1 presents only the net effects of socio-economic and cultural variables, Model 8 controls for the effect of the intermediate behavioral variables. From Model 1, almost all selected socio-economic and cultural variables, except household number of children, have statistically significant effect on children's nutritional status. The model shows children from rural areas being more malnourished than children from the urban areas. Rural children are at 37 percent higher risk of being underweight than children from the urban areas. Although controlling for the behavioral variables generally amplifies the rural-urban effect, it reduces the estimated statistical significance. This is particularly the case when child minding is accounted for. Apart from suggesting that urban children are most associated with behavioral practices that tend to worsen children's nutritional status, children who are cared for by persons other than older children and relatives are at 34 percent higher risk of being underweight than children cared for by their own parents.

TABLE 10.6: RISK OF UNDERWEIGHT ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL FACTORS, AND INTERMEDIATE BEHAVIORAL FACTORS: RESULTS OF LOGISTIC REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8
<u>SOCIO-ECONOMIC VARIABLE</u>								
Region of Residence								
Rural	1.37**	1.38**	1.39**	1.38**	1.38**	1.37**	1.42**	1.42*
Province of Residence								
Central	0.72*	0.70*	0.70*	0.67**	0.69**	0.69*	0.68*	0.82
Copperbelt	1.22	1.24	1.25*	1.20	1.20	1.19	1.24	1.22
Eastern	0.66**	0.70*	0.70*	0.75	0.77	0.75	0.78	1.08
Luapula	1.59***	1.71***	1.70***	1.62***	1.66***	1.66***	1.72***	2.84***
Northern	1.19	1.27	1.27	1.21	1.20	1.20	1.29	1.48
North-Western	0.83	0.84	0.84	0.79	0.79	0.79	0.82	1.04
Southern	0.64***	0.62**	0.63***	0.67**	0.66**	0.66**	0.73*	0.80
Western	0.70*	0.71*	0.68*	0.65**	0.65**	0.66**	0.64**	0.78
Access to Electricity								
No	1.51***	1.50***	1.49***	1.51***	1.50***	1.49***	1.57***	1.61**
Household Children Size								
3+	1.06	1.09	1.09	1.09	1.03	1.03	0.98	1.10
2	1.03	0.96	0.96	0.97	0.94	0.94	0.93	1.16
Father's Occupation								
Never worked	1.30	1.36	1.38	1.41	1.40	1.40	1.36	1.24
Agricultural self-employed	1.26*	1.28**	1.28**	1.29**	1.26*	1.26*	1.17	1.32
Blue collar	1.03	1.03	1.03	1.04	1.03	1.02	1.04	1.33*
Mother's Education								
No education	1.51***	1.51***	1.51***	1.51***	1.51***	1.51***	1.62***	1.91***
Primary	1.37***	1.37***	1.37***	1.37***	1.38***	1.37***	1.53***	1.68***
<u>CULTURAL VARIABLE</u>								
Type of marital union								
Formerly married	1.25*	1.19	1.19	1.18	1.19	1.19	na	na
Polygamous	0.93	0.90	0.91	0.90	0.91	0.91	0.91	0.92
<u>INTERMEDIATE BEHAVIORAL VARIABLES</u>								
Duration of breastfeeding								
0-6 months		0.12***	0.15***	0.16***	0.16***	0.16***	0.17***	0.18***
7-18 months		0.96	0.96	0.95	0.95	0.95	0.91	0.98
Age for solids								
Not given			0.60	0.61	0.61	0.60	0.57	0.46
0-3 months			0.89	0.89	0.89	0.89	0.88	0.87
Age for plain water								
Not given				0.62	0.62	0.66	0.73	0.69
0 months				1.16	1.16	1.14	1.23*	1.06
Household density								
<3 persons/room					0.86	0.84	0.92	0.83
3 persons/room					0.86	0.86	0.83	0.74**
4 persons/room					1.05	1.06	1.08	0.86
Number of marital unions								
More than one						1.05	1.07	0.94
Discussion of FP with partner								
Never							0.93	0.92
Once or twice							1.04	0.95
Child minder								
Others								1.34
Relatives								0.81
Older children								0.71**
Model Chi-Square (X^2)	152.2	362.2	355.4	356.4	359.5	358.1	327.4	219.4
Degrees of freedom (df)	19	21	23	25	28	29	30	33

Children cared for by older children and other relatives are better nourished than children cared for by their own parents. This result might confirm earlier suggestions that busy mothers are less likely to give adequate care to their children.

The rural-urban effect observed earlier is further supported by the nutritional inequalities existing between the provinces of residence. Children in Luapula Province have highest levels of malnutrition whereas the children in Southern Province are better nourished. Children in Luapula Province are 59 percent more likely to be undernourished than children in Lusaka Province, while those in Southern Province are 36 percent less likely to be underweight. Controlling for behavioral variables explains for much of the significance associated with the province of residence, except for Luapula Province where underweight is elevated by almost 80 percent. This is especially true when child minding is accounted for. Including child minding actually explains remarkably the advantages associated with more urbanized provinces such as Lusaka. For example, controlling for child minding explains for the nutritional advantages associated with Central, Southern, and Western Provinces. For Eastern Province, however, the nutritional advantage is largely explained by feeding practices and child care. On the other hand, controlling for child minding amplifies the nutritional risks associated with Eastern and North-Western Provinces, respectively. This further suggests that children in Lusaka Province are most likely to be cared for by individuals other than relatives and own parents.

Similar results are observed when access to electricity is considered. Children from homes without electricity are at 51 percent higher risk of being underweight than children from homes with electricity. Although controlling for behavioral variables has little effect in explaining the inequalities in nutritional status, including both the discussion of family planning amongst spouses and child minding elevates the risk of being underweight. This suggests once more that children from homes with electricity are more likely to be looked after by individuals other than their parents. Model 1 also summarizes children's nutritional status by father's occupation. Children of never-worked fathers and those from agricultural self-employed fathers are at 30 and 26 percent higher risk of malnutrition, respectively, than children from fathers in white collar employment. Nevertheless, only among children of agricultural self-employed fathers is the effect statistically significant. Although controlling for behavioral variables accounts for some of the risks associated with children of never-worked fathers, it elevates the risk substantially for children of both agricultural self-employed and blue collar workers.

Particularly important is when child minding is controlled for. Including child minding elevates the risk of being underweight for children from agricultural self-employed and blue collar workers by 88 and 725 percent, respectively, and hence making the effect of blue collar employment statistically significant at 10 percent. The result suggests that children of fathers in white collar employment are associated with child care practices that tend to worsen their nutritional status relative to children from comparatively poorer occupational categories.

Most remarkable, however, is the effect maternal education has on children's nutritional status, contrary to earlier findings on childhood mortality. Children of mothers with no formal education and those with primary education are at 51 and 37 percent higher risk of malnutrition, respectively, than children of mothers with at least secondary education. Controlling for behavioral variables actually worsens the nutritional status of children from mothers with lower levels of formal education. This suggests that children from mothers with at least secondary education are associated with behavioral practices that worsen children's nutritional status. Controlling for behavioral variables elevates the risk associated with children from mothers with no formal education and those with primary education by 78 and 84 percent, respectively. Ironically, this suggests that children from mothers with at least secondary education and most associated with modernity are linked to practices that worsen children's nutritional status. Also important is the finding that links children's nutritional status and their mother's marital circumstances. It is noted that children of formerly married mothers are more likely to be undernourished than children from married mothers. The risk is only explained when behavioral variables such as the duration of breastfeeding are accounted for. Controlling for the duration of breastfeeding accounts for 24 percent of the malnutrition risk associated with children of formerly married mothers.

Overall, therefore, controlling for the intermediate behavioral variables has a tendency to amplify nutritional risk associated with the selected socio-economic variables while accounting for some of the effects linked to marital instability. Although it is understood that children from unstable marital unions are also most likely to face both social and economic hardships, this study also suggests that children who otherwise are supposed to have better nutritional status are in fact associated with behavioural practices that tend to worsen children's malnutrition levels.

10.5.3 Major Determinants of Children's Nutritional Status

Table 10.7 presents the net effects of socio-economic, cultural and behavioral variables on children's nutritional status, controlling for both bio-demographic and morbidity variables. Like other earlier models, the analysis considers children aged 2-59 months. Model 9, however, attempts to demonstrate the net effect of these selected variables once the analysis is restricted to children aged 12-59 months. This is partly to assess the influence of breastfeeding once children aged less than 12 months are removed from the analysis. From Model 1, children from rural areas are at 42 percent higher risk of malnutrition than children from urban areas. Controlling for both bio-demographic and morbidity variables does little to explain the regional differences despite accounting for 14 percent of the risk associated with children from the rural areas. It should be noted, however, that controlling for mother's body mass accounts for the significance associated with the rural-urban influence. On the other hand, restricting the Models to children aged 12-59 months, as illustrated by Model 9, accounts for 44 percent of the risk of being underweight for rural children. This reflects the importance of children's age in explaining variations in their nutritional status.

TABLE 10.7: RISK OF UNDERWEIGHT ASSOCIATED WITH SELECTED MAIN SOCIO-ECONOMIC AND CULTURAL FACTORS, INTERMEDIATE BEHAVIORAL FACTORS, PROXIMATE DETERMINANTS AND MORBIDITY FACTORS: RESULTS OF LOGISTIC REGRESSION.

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8	MODEL 9[a]
SOCIO-ECONOMIC VARIABLE									
Region of Residence									
Rural	1.42*	1.43*	1.41*	1.35	1.36	1.35	1.36	1.36	1.20
Province of Residence									
Central	0.82	0.83	0.84	0.85	0.86	0.87	0.87	0.87	1.07
Copperbelt	1.22	1.23	1.22	1.17	1.18	1.18	1.16	1.16	1.33
Eastern	1.08	1.08	1.09	1.04	1.04	1.03	0.99	0.99	1.05
Luapula	2.84***	2.91***	2.92***	2.70***	2.71***	2.70***	2.60***	2.58***	3.60***
Northern	1.48	1.53	1.53	1.49	1.49	1.49	1.43	1.36	1.39
North-Western	1.04	1.05	1.04	1.01	1.01	1.01	0.98	0.98	1.13
Southern	0.80	0.79	0.80	0.78	0.77	0.77	0.75	0.74	0.77
Western	0.78	0.78	0.78	0.71	0.70	0.70	0.67	0.67	0.65
Access to Electricity									
No	1.61**	1.61**	1.60**	1.45*	1.46*	1.45*	1.41*	1.36	1.44*
Household Children Size									
3+	1.10	1.24	1.21	1.23	1.23	1.23	1.22	1.19	1.31
2	1.16	1.26	1.27	1.26	1.26	1.26	1.25	1.22	1.21
Father's Occupation									
Never worked	1.24	1.25	1.25	1.27	1.27	1.34	1.28	1.25	1.28
Agricultural self-employed	1.32	1.33	1.32	1.30	1.30	1.30	1.28	1.26	1.37
Blue collar	1.33*	1.34*	1.32	1.30	1.30	1.30	1.28	1.25	1.27
Mother's Education									
No education	1.91***	1.93***	1.93***	1.89***	1.89***	1.88***	1.85***	1.88***	2.11***
Primary	1.68***	1.68***	1.69***	1.65***	1.65***	1.64***	1.62**	1.61**	1.63**
CULTURAL VARIABLE									
Type of marital union									
Formerly married	na	na	na	na	na	na	na	na	na
Polygamous	0.92	0.91	0.92	0.92	0.92	0.93	0.92	0.93	0.90
INTERMEDIATE BEHAVIORAL VARIABLES									
Duration of breastfeeding									
0-6 months	0.18***	0.16***	0.17***	0.17***	0.17***	0.17***	0.17***	0.17***	0.41
7-18 months	0.98	0.96	0.97	0.95	0.95	0.95	0.95	0.92	0.97
Age for solids									
Not given	0.46	0.44*	0.43*	0.43*	0.43*	0.44*	0.45	0.49	0.31
0-4 months	0.87	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.89
Age for plain water									
Not given	0.69	0.72	0.74	0.86	0.87	0.86	0.90	0.92	1.09
0 months	1.06	1.05	1.05	1.02	1.02	1.02	1.02	1.03	1.00
Household density									
<3 persons room	0.83	0.83	0.82	0.80	0.80	0.80	0.80	0.77	0.71*
3 persons/room	0.74**	0.75*	0.75*	0.77*	0.78*	0.77*	0.78	0.75*	0.67**
4 persons/room	0.86	0.86	0.86	0.86	0.87	0.86	0.87	0.86	0.84
Number of marital unions									
More than one	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.92	0.94
Discussion of FP with partner									
Never	0.92	0.91	0.91	0.90	0.90	0.90	0.90	0.90	0.86
Once or twice	0.95	0.94	0.94	0.90	0.89	0.89	0.90	0.90	0.95
Child minder									
Others	1.34	1.36	1.33	1.17	1.18	1.17	1.16	1.19	1.00
Relatives	0.81	0.80	0.80	0.82	0.82	0.82	0.81	0.82	0.78
Older children	0.71**	0.70**	0.69**	0.73**	0.71**	0.71**	0.72**	0.73**	0.70**

<u>PROXIMATE VARIABLES</u>									
Subsequent birth interval									
<24 months		0.92	0.91	0.87	0.87	0.87	0.88	0.89	1.01
36+ months		1.00	1.00	1.00	1.00	1.01	1.01	1.03	0.92
Last births		1.29*	1.28*	1.27*	1.27*	1.25	1.21	1.14	1.29*
Birth type									
Multiple			1.59	1.64	1.67*	1.68*	1.70*	1.73*	1.89*
Mother's body mass									
<18.5				1.42**	1.42**	1.41**	1.41**	1.39*	1.61**
26+				0.54***	0.54***	0.54***	0.55***	0.55***	0.55***
Sex of child									
Male					1.10	1.10	1.10	1.07	1.03
<u>MORBIDITY VARIABLES</u>									
Respiratory infection (cough)									
Yes						1.06	0.99	0.97	1.00
Malaria infection (fever)									
Yes							1.25*	1.18	1.15
Diarrhoeal infection									
Yes								1.63***	1.64***
Model Chi-Square (X^2)	219.4	224.6	226.9	241.1	241.9	241.3	244.5	258.3	180.9
Degrees of freedom (df)	33	36	37	39	40	41	42	43	43

Notes: 1. Model 9 is for children aged 12-59 months.

Moreover, the result reflects varying feeding practices among children between rural and urban areas at different stages during childhood. On the other hand, the result might as well reflect the different socio-economic and environmental situations existing in both rural and urban areas.

As for the province of residence, nutritional inequalities continue even after controlling for the proximate variables. The nutritional status of children is worst in Luapula Province, where children are almost 3 times more likely to be underweight than children in Lusaka Province. Although the overall control for both bio-demographic and morbidity variables accounts for only 14 percent of the underweight risk to children in Luapula Province, much of the risk between the two provinces remains unexplained. Moreover, restricting the analysis to children aged 12-59 months, as demonstrated by Model 9, worsens the nutritional status of children from nearly all the provinces of Zambia. Particularly remarkable is the worsened nutritional status of children in Luapula Province where such children are 3.6 times more likely to be undernourished than children from Lusaka.

Since many children become less dependent on the breast after the first year of life and that breastfeeding has a cushioning effect on under-weight, the nutritional status of children becomes increasingly influenced by socio-economic factors linked to each region.

Consistent with earlier findings, children from homes with no electricity are more than 60 percent at higher risk of being undernourished than their counterparts from homes with electricity. However, controlling for bio-demographic and morbidity variables explains the advantage access to electricity gives. This is particularly the case when mother's body mass and diarrhoeal infection are controlled for. On the other hand, restricting the analysis to older children elevates the risk of being undernourished by 22 percent improving the statistical significance at 10 percent level. It is possible here that presence of electricity is acting as a proxy for household well-being. The increase in risk of being undernourished at older ages is further evidence of the increased influence household socio-economic environment has with increasing age of children. The significance controlling for bio-demographic and morbidity variables has on nutritional status of children by father's occupation supports the idea of increased socio-economic and possibly cultural pressure on older children.

Most remarkable is the effect of maternal education on children's nutritional status. Although the control for both bio-demographic and morbidity variables account for some of the risk associated with lower levels of formal education, much of the effect remains unexplained. Moreover, restricting the analysis to older children worsens the nutritional status of children from mothers with little formal education. Children of mothers with no formal education have their underweight levels elevated by 26 percent suggesting increasing influence of maternal education with increasing age of children. This pattern is not only restricted to children's nutritional status, but to their mortality patterns, too, except for the fact that the influence of maternal education on childhood mortality is explained by the association with modernity. As for children's nutritional status, however, the maternal effect remains unexplained.

10.6 OVERVIEW

Overall, the effect of provincial residence (especially Luapula) and maternal education remain unexplained even after controlling for intermediate behavioral, bio-demographic and morbidity variables. The intermediate variables, whose influence remain unexplained even when both the bio-demographic and morbidity variables are controlled for include the duration of breastfeeding, household density, and child minding. However, the importance associated with the duration of breastfeeding is partly explained once the analysis is restricted to older children, hence reflecting breastfeeding's cushioning effect on childhood nutrition.

As for the bio-demographic variables, multiple births and mother's body mass continue to have some strong influence on children's nutritional status even when other factors are controlled for. For example, multiple births are 73 percent more likely to be underweight than singleton births, suggesting sibling competition in households with multiple births. On the other hand, children whose mothers are themselves underweight are 39 percent more likely to be undernourished, with the situation worsening once the analysis is restricted to older children aged 12-59 months. In contrast, children whose mothers are considered overweight are more likely to be better nourished.

Although both the subsequent birth intervals and the sex of the child have strong effect on childhood mortality, they seem to have little overall effect on children's nutritional status. This further suggests that nutritional inequalities between the sexes are less likely to result from discriminatory child feeding practices.

One important contribution of this analysis is in demonstrating the effect diarrhoeal infection has on general growth faltering in children. Unlike respiratory and malaria infections, children with diarrhoea in the two weeks prior survey are at 63 percent higher risk of malnutrition than children without diarrhoea. Equally important is the influence of diarrhoeal infection in explaining the risk associated with other selected socio-economic factors such as access to electricity. Although the absence of significant influence from malaria and respiratory infections on nutritional status could be attributed to possible misreporting of diagnoses by mothers and the extent to which fever and cough reflect such infections, the effect of diarrhoea on overall childhood growth is well known (Mosley and Chen, 1984; Madise, 1995).

CHAPTER ELEVEN

JUSTIFYING THE ESSENCE OF BEHAVIOURAL MODELS: SUMMARY OF FINDINGS AND CONCLUSION

11.1 INTRODUCTION

Given the consistent childhood mortality increase in Zambia over the last two decades, this study set out to achieve three main objectives. The first has been to analyze childhood mortality trends with the aim of identifying specific age groups that have contributed most to the overall childhood mortality increase. Highlighting of mortality patterns by region of residence has also been particularly important here. By limiting the analysis to the five years before the ZDHS (1987-91) and to children aged under five, the second objective was to ascertain how socio-economic and cultural factors interact with both intermediate behavioural and bio-medical correlates in shaping the observed patterns of childhood mortality and general well-being. The third objective was to assess the extent to which Demographic and Health Survey data enable identification and analysis of socio-cultural and behavioural factors and their influence on child survival.

11.2 SETTING OF A CONCEPTUAL FRAMEWORK

As was argued in Chapter One, the Mosley-Chen model is based on the premise that all social and economic determinants of child mortality necessarily operate through a common set of biological mechanisms, or proximate determinants, to exert impact on mortality. The key to the model is the identification of a set of proximate determinants, or intermediate variables, that directly influence the risk of morbidity and mortality.

MOSLEY-CHEN FRAMEWORK (1984)

Operation of the Five Groups of Proximate Determinants on the Health Dynamics of a Population.

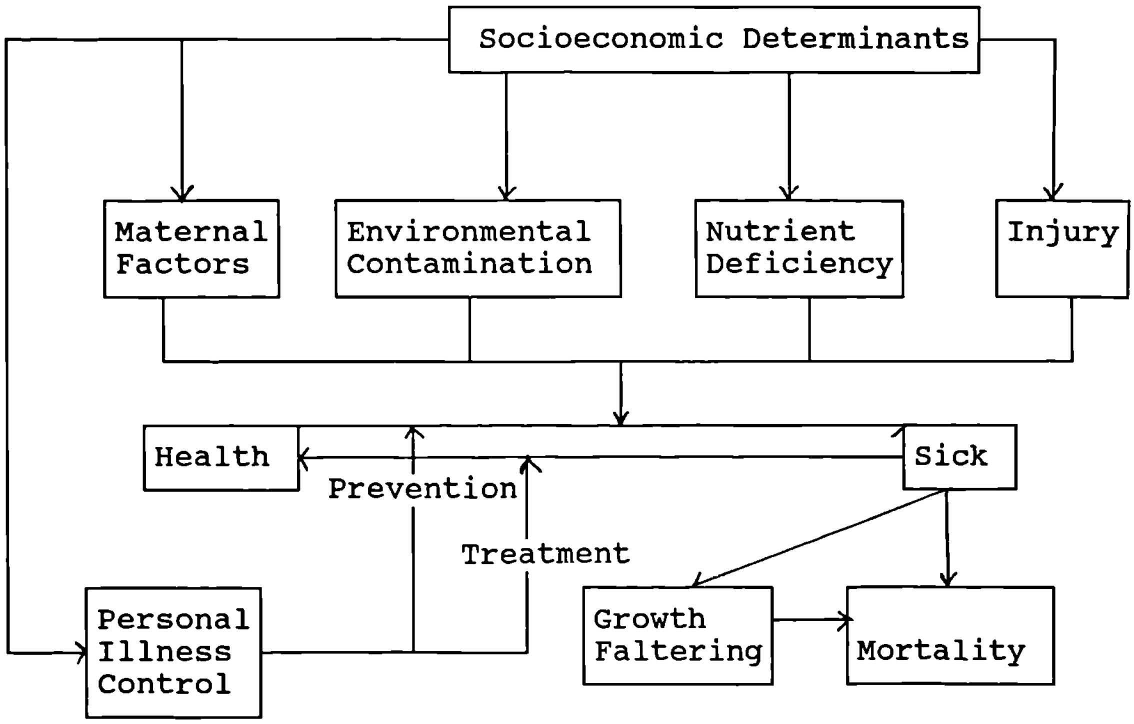


FIGURE 11.1

This study has incorporated three main modifications to the Mosley-Chen model, within the broader context of child care and general welfare. First, the relative importance of cultural factors within the socio-economic determinants block has been re-emphasised to avoid situations such as those observed in many cross-national studies where analytical designs make almost impossible allowance for factors such as religion, ethnicity, and region (Chapter Six).

MODIFIED CHILD-SURVIVAL FRAMEWORK

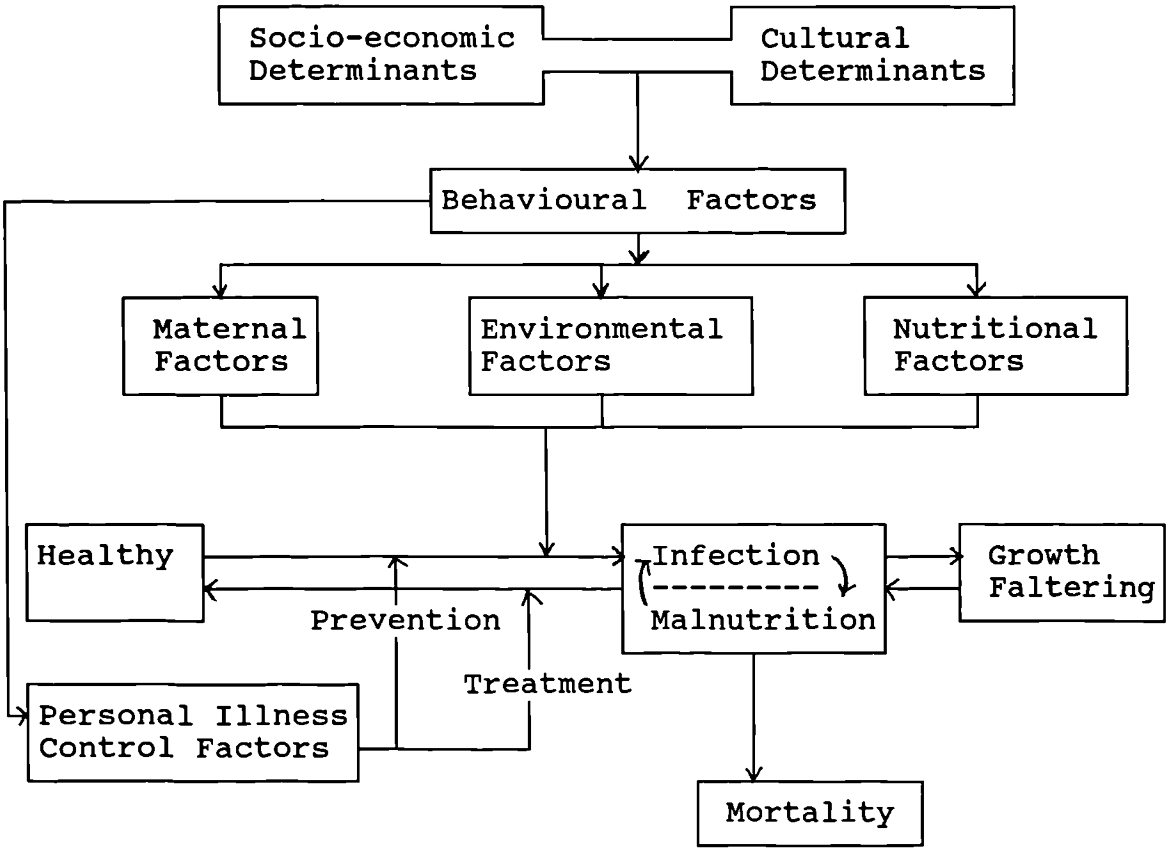


FIGURE 11.2

Second and most important, is the explicit introduction of an intermediate behavioural model into the framework and within the broader context of child care (Chapter Seven). Although Mosley and Chen discuss the significance of health behaviours such as breastfeeding, weaning and supplementation as intermediate variables, many of these variables end up as independent socio-economic and less often as behavioural variables. This makes observation of effect mediation between socio-economic and cultural factors and the proximate variables more difficult. Third a malnutrition-infection model has been incorperated to enable analysis of child care (for which data are collected only on living children) (Chapter Ten). Anthropometric data are here used to measure what Mosley and Chen call "growth faltering" (or degree of physical deterioration which results from infection and nutrient deficiency). Weight-for-age (or underweight) is therefore used as an index for general child health and growth. The choice of weight-for-age is based on prospective studies showing a consistent increase of death risk with lower weight-for-age. Moreover, this model emphasises the importance of age variation in the analysis of major determinants of child survival. Since results from various studies show how the importance of some determinants varies according to the age of the child, the analysis divided childhood into neonatal (<1 month), post-neonatal (1-11 months) and child (12-59 months) age categories.

11.3 MAIN FINDINGS

a) Childhood Mortality Levels and Trends

All three sources of data explored confirm a general decline in under-five mortality rate from around 192 per 1000 births in early 1970s to about 150 per 1000 births by the beginning of the 1980s. Towards the mid-1980s, under-five mortality started to rise. When broken down into different age categories, it becomes even more clear that infant mortality (1q0) had started to rise by as early as the mid 1970s in rural areas while increase in child mortality (4q1) for both rural and urban areas did not start until the first half of the 1980s. One possible reason for an early rise in mortality in rural as opposed to urban areas is the general government neglect of remote rural areas. Moreover, government often subsidised urban living conditions at the expense of rural areas. The increase in infant mortality, however, can be attributed largely to increases in post-neonatal mortality since neonatal mortality remained stable until the mid-1980s. Although the survey data show a clear general pattern of higher mortality in rural than urban areas, the rural-urban gap in regional infant mortality, for example, narrowed from about 90 percent during the 1970s to around 35 percent by the beginning of the 1990s. This narrowing of the gap during the mid-1980s results from a substantial rise in urban infant mortality, by about 55 percent as opposed to 10 percent for rural mortality. Moreover, the additional increase in general childhood mortality in both the rural and urban areas during this period may have possibly been worsened by the higher incidence of HIV/AIDS in urban areas.

As for provincial mortality levels, under-five mortality estimates for 1973 from the 1980 census ranged from 125 per 1000 in Copperbelt to 242 per 1000 in Luapula. About ten years later, estimates from the 1990 census show under-five mortality to have ranged from 126 in the Copperbelt to 229 in Eastern Province. Four provinces of Central, Copperbelt, Northern and Western experienced some increase in mortality during the intercensal period.

On the other hand, the 1992 ZDHS survey data show the directly derived under-five mortality rate to have ranged from 117 per 1000 births in Lusaka to 214 per 1000 births in Luapula provinces. However, during the five-year period of 1987-91, on which this study later concentrates, infant mortality was estimated at 104 per 1000 with neonatal and post-neonatal mortality accounting for 43 and 57 percent, respectively. Similar proportions were also noted at regional level.

b) Factors Influencing Child Survival

One of the objectives of this study has been to identify key community-, household- and individual-level socio-economic factors with significant influence on overall child survival during the first five years of life.

Results of this study, however, show little influence from all the selected socio-economic factors during the first month of life while the effect of community-level socio-economic factors emerged with increasing age of the child. Particularly significant is the effect of access to electricity after the first month of life reflecting possible differences in infrastructural development between communities. Although access to electricity has been introduced in this study as a community-level variable, it may also possibly reflect the socio-economic environment existing at the household-level.

This study also joins earlier studies that have indicated the weaker association between child survival and maternal education in Sub-Saharan Africa (Hobcraft et al., 1984; Ahonsi, 1992; Hobcraft, 1993). Moreover, the study also supports evidence from other studies to suggest that neonatal mortality is generally less sensitive to maternal education than mortality during later childhood (Bicego and Boerma, 1991; Hobcraft, 1993). Most important, however, is the fact that while earlier studies managed to control for bio-demographic factors which largely comprise family formation patterns, few have controlled for both intermediate behavioural and bio-demographic factors. In fact controlling for behavioural factors such as spousal discussion of family planning accounts for the significant effect of maternal education on child survival during both the post-neonatal and child periods. Although some studies have linked the discussion of family planning amongst spouses to modernity issues such as women's status and social identification in the form of engagement with modern institutions, there has been little success in identifying the mechanisms through which spousal discussion of family planning impacts on child survival outcomes. If Cleland's suggestion (Cleland, 1990) of maternal education having pronounced effect on the propensity to use modern medical facilities is to be adopted here, then it means that the weaker performance of mother's education on childhood mortality in Zambia results from weaker health infrastructures which have inhibited the ability of educated mothers to take advantage of their health knowledge and beliefs. This is most likely the case in Zambia where modern health care provision has dramatically deteriorated in the face of extreme economic hardships as earlier discussed in Chapter Two.

In contrast, however, socio-economic factors have considerable influence on children's nutritional status. Especially important are province of residence, access to electricity and mother's education. Children of mothers with no formal education are more than twice at higher risk of being undernourished compared to children of mothers with at least secondary education. These findings suggest that while socio-economic factors have little influence once a child becomes ill in situations lacking adequate health care facilities, the economic status of the household strongly constrains the decisions on children's well being. Perhaps most important is that this study supports Bicego and Boerma's observation (Bicego and Boerma, 1991) that increased acute and chronic undernutrition are likely biological stepping stones on the path between lacking formal education and poor survival chances. Furthermore, it strengthens the argument that analysis of children's nutritional status might provide necessary links to the pathways through which household socio-economic environment impacts upon child survival chances.

With regards to the socio-cultural shaping of childhood mortality, only mother's religious affiliation has significant influence on children's survival chances. This is especially the case during the first month of life where children of Protestant mothers have better survival chances than children born to Catholic mothers.

Although controlling for modernity and proximate bio-medical factors does little to explain the influence of mother's religious affiliation, it is suspected here that certain religious beliefs, especially amongst Catholic mothers might inhibit their propensity to use certain health services linked to contraceptive use. On the other hand, the overall weak performance of cultural variables also raises some fundamental questions as to whether surveys such as the DHS can adequately investigate socio-cultural issues. For example, questions of what constitutes a cultural variable and how cultural "christianity" can be in the Zambian context where almost 97 percent of births are classified christian, are important. These are some of the questions such surveys are ill-equipped to investigate.

Perhaps one of the major contributions of this study is in explicitly introducing intermediate behavioural factors into the child survival analysis. Most important are behaviours that are linked to feeding, health care and reproductive practices. During the first month of life, two important behavioural covariates emerged as having impact on neonatal mortality. Particularly significant is the strong inverse association between duration of sexual abstinence and neonatal mortality risk. On the other hand, estimates of behaviours such as duration of sexual abstinence must be taken with caution since such behaviours could be changed because of the occurrence of a child death. This is also applicable to many other feeding behaviours such as the duration of breastfeeding. The second important factor having some influence on neonatal mortality, but less sensitive during later childhood periods is the excess mortality risk of children who are not biological siblings of the household head. Although not as prominent as other household behavioural factors, intra-household mortality inequalities have received little attention in Sub-Saharan Africa despite the recognised influence of the extended family system. Most important among the behavioural factors is the influence emerging from both the discussion of family planning among spouses and the number of marital unions mothers have had. The increased influence of these behavioural factors with increasing age of the child is remarkable. During the child period, for example, children whose parents never discuss family planning are 88 percent at higher risk of dying than their contemporaries whose parents discussed family planning more often. While discussion of family planning has been linked to modernity issues and has been found in this study to account for much of the effect from maternal education, little attention has been given to exploring the mechanisms through which it impacts on child survival. Even though there is a suggestion that its influence might be associated with the utilisation of modern medical facilities and possibly is the case in Zambia where family planning services are largely provided by public health institutions, the variable's weak influence during the neonatal period is puzzling. It is puzzling because the neonatal period is found to be more sensitive to health care provision. Since discussion of family planning between spouses becomes most influential in this study during both the post-neonatal and child periods, peharps Caldwell's argument (Caldwell, 1979) of the modernity link is important here and should be extended to other modern facilities that are closely associated with mortality risk after the first month of life.

Similarly puzzling is the increased influence of mother's number of marital unions on children's survival outcomes with increased age of the child. Children whose mothers have been involved in more than one marital union are 66 percent at elevated risk of dying compared to children whose mothers have had only one marital union. Although this observation might be attributed to the socio-economic situations surrounding children in unstable unions, even the control for both socio-economic and proximate bio-demographic factors does little to explain the mortality risk associated with children of mothers supposedly in unstable marital unions. In contrast, the analysis of children's nutritional status shows little influence from both behavioural factors namely discussion of family planning among spouses and the number of marital unions the mother has been involved in.

Like earlier demographic studies, this study highlights the significant impact of proximate bio-demographic and micro-environmental factors on mortality during the first month of life. Overall, however, the influence of proximate determinants of childhood mortality risk decreases with increasing age of the child, although this pattern may not necessarily be the case for child spacing patterns such as subsequent birth intervals.

One of the most important observations is the excessive mortality risk to male births and to multiple births. Although male excess deaths have been noted earlier for other Sub-Saharan African countries within the DHS programme, it is possible that the deterioration in health service provision in Zambia has worsened the risk of dying for male and multiple births. This is equally the case for children born with small birth weights. Moreover, the use of size of child at birth as perceived by the mother performs well in this study as a proxy for low birth weight, information often unavailable for about 50 percent of births, many of them delivered outside medical institutions.

As for the family formation factors of birth spacing, mother's age at birth and children's parity, only the preceding birth interval has considerable influence on neonatal mortality and continues to exert impact during the post-neonatal period. Children born less than two years after a preceding birth are more than twice at increased risk of dying than children born after two or three years. Although preceding birth intervals have been linked to maternal health, foetal growth and low birth weight as the most probable set of causal mechanisms, the increased influence of the subsequent birth intervals as constituting later childhood spacing pattern is probably linked more to child care practices. In fact the use and observed importance of mother's pregnancy status in this study further supports the suggestion that in traditional Sub-Saharan Africa, there is possible neglect of older siblings once mothers are aware of a new pregnancy. The fact that mother's pregnancy status continues to exert influence on mortality risk during later childhood periods even after controlling for the survival status of preceding siblings is reassuring. However, this should not divert attention from possible reverse causation between mother's recent pregnancy (and birth spacing) and attempts to replace a dead child.

Most important among the micro-environmental proximate factors is the considerable impact home floor material exerts on neonatal mortality risk. Children from homes with earth or sand floor materials are nearly twice at higher risk of dying during the first month of life than children from homes with cement or tile floors. Even though this is particularly important since it points to possible exposure and susceptibility of young births (especially those delivered from such homes) to the tetanus pathogens, the continued influence of household floor materials even after controlling for tetanus vaccinations raises important questions. First is the question of the effectiveness of such vaccinations without taking into account practices associated with the treatment of the umbilical cord during home deliveries. Second is the suspicion that unobserved factors indirectly linked to home floor materials are possibly influencing neonatal mortality risk. While administering tetanus toxoid to expectant mothers might reduce incidence of neonatal tetanus, mothers must be educated on issues of hygienic deliveries especially in Zambia where more than half of pregnancies are delivered from home and in most cases by relatives rather than by traditional birth attendants.

Even though many proximate determinants showed considerable influence on children's mortality outcomes, they showed little impact on children's nutritional status except in the case of multiple births that are otherwise possibly associated with competition for resources and mother's attention. On the other hand, mother's health status in terms of her nutritional well being at the time of the survey is strongly associated with children's nutritional outcomes. Children of chronically malnourished mothers are more than 60 percent of being undernourished themselves than children of mothers considered better nourished. Like mother's age at birth in the mortality analysis, these two bio-demographic characteristics are most likely associated with the socio-economic environment surrounding children's households. More important also is the observation that mothers aged more than 35 years are associated with lower mortality risk further suggesting that older mothers are possibly more economically stable than younger mothers. They are also most likely to have experienced previous births.

Finally and for reasons of integrating morbidity factors into the child survival framework, only diarrhoeal infection had considerable impact on children's nutritional status.

Children with diarrhoea in the two weeks prior to survey were 63 percent more likely to be underweight than children without the infection, even when other factors were controlled for. These results support earlier studies that have documented the link between children's growth pattern and diarrhoeal infection (Mosley and Chen, 1984; Martorell and Ho, 1984; Madise, 1995).

Unlike with mortality, child spacing factors such as subsequent birth intervals had minimal influence on children's nutritional status. This is rather surprising since the disruption of breastfeeding and earlier *introduction of an abruptly weaned* child to normal adult meals take place when mothers become aware of a new pregnancy.

11.4 IMPLICATIONS FOR THEORY

At a conceptual level, this study has demonstrated the power of an adapted Mosley-Chen framework in identifying mechanisms through which socio-economic and cultural factors influence general child well-being and survival. Most important, however, is the significance associated with introducing intermediate behavioural factors to further explain certain socio-economic and cultural childhood mortality differentials. Although studies that have adapted the Mosley-Chen framework (such as Bicego and Boerma's (1991)) controlled for the proximate determinants, they never adjusted for both cultural and especially intermediate behavioural factors perhaps because they dealt with cross-national investigations. Many cross-national studies such as Hobcraft et al. (1984) and even national studies (Ahonsi, 1992) that never accounted for behavioural influences, but controlled for the proximate bio-demographic determinants found the effect of socio-economic factors to increase with the increasing age of the child. The introduction of a behavioural model in this study shows that much of the influence of socio-economic factors that increased with children's age is in fact attributed to behavioural influence as illustrated by Table 11.1.

TABLE 11.1 THE INFLUENCE OF SOCIO-ECONOMIC, CULTURAL, BEHAVIOURAL AND BIO-MEDICAL FACTORS ON CHILDHOOD MORTALITY.

MORTALITY	**MAJOR DETERMINANTS**				**TOTAL EFFECT**
	SOCIO-ECONOMIC	CULTURAL	BEHAVIORAL	BIO-MEDICAL	
NEONATAL	0.4%	4.0%	21.7%	73.9%	100%
POST-NEONATAL	7.1%	0.7%	31.9%	60.3%	100%
CHILD	10.0%	1.3%	47.5%	41.2%	100%

NOTES: Percent contributions of variables on mortality are estimated from the Wald statistics, (i.e. the square of the ratio of the coefficient to its standard error).

Although the actual numbers in Table 11.1 should be interpreted with caution, a pattern of increased behavioural influence with increasing age of the child is clearly shown. The second major contribution of this study is to demonstrate that using the same adapted model at different age groups within the five year period brings out important variations in influence from different determinants of child survival, whilst at best in the original Mosley-Chen model only passing reference is made to the importance of sub-dividing the first five years of life. This is especially demonstrated during the post-neonatal period when a child moves from a stage largely influenced by existing health care services and proximate bio-demographic factors to later childhood periods dominated by both behavioural factors and the socio-economic environment surrounding the household. Perhaps more studies are required in developing conceptual frameworks using data originally designed to investigate behavioural patterns and practices, as Cosminsky, Mhloyi and Ewbank (1993) have earlier demonstrated in a recent study in Zimbabwe.

The final main theoretical contribution of this thesis is the integration of an infection/malnutrition model in the analysis of children's well being. Although Bicego and Boerma (1991) drew important findings from the use of a morbidity and growth faltering module in their analysis of child health status, they did not control for mother's own well being. The importance of mother's health status, as shown here, may possibly prove vital in future analysis of children's health status and especially in mortality analyses where mother's own health is hardly accounted for. This also raises the fundamental problem of mother's own health information that is hardly collected in survey designs such as the DHS for the purpose of childhood mortality analysis. Nevertheless, the collection of mother's anthropometric data in recent DHS programmes is an important step in the right direction.

11.5 IMPLICATIONS FOR POLICY AND FUTURE RESEARCH

The observed importance of bio-demographic and micro-environmental factors with associated high risk births, and the weaker influence of both household- and individual-level socio-economic factors on child survival outcomes clearly have policy implications.
The most important policy option should be the provision of improved access to better quality health and social services for three major reasons. Firstly, improved health care infrastructures would enhance the ability of educated mothers in using their health-related knowledge to improve child survival chances. This should, however, be done in the broader context of Zambia's economic reforms since real earnings for most employees have been reduced dramatically. Secondly, provision of improved quality health services has the possibility of improving the survival chances of multiple births, male births and those children born with low birth weight. Especially important are considerations for maternal health status such as her nutritional levels which have implications for mortality risk especially amongst low weight births. Thirdly, improving health care provision would possibly assist in managing diarrhoeal morbidity

risk which has implications for children's nutritional status, not forgetting improvements in home hygiene and management of less serious cases of diarrhoea through simple technologies such as oral rehydration therapy.

Related to the health service infrastructural provision is the importance of health education on managing pregnancy outcomes and most especially ensuring hygienic delivery. This is vital since more than half of births in Zambia are delivered from homes and more often by relatives than traditional birth attendants.

Even though preceding birth intervals are strongly associated with maternal health, foetal growth and low birth weight and even though these probable causal mechanisms might be helped with the provision of quality health care during the first month of life, the mechanisms of child care practices and beliefs surrounding subsequent birth intervals are not fully understood and require detailed investigation. For both situations, however, improving women's access to family planning use for child spacing purposes looks attractive as a policy option to achieving lower childhood mortality. Moreover and in addition to child care mechanisms, community and household behavioural mechanisms surrounding child spacing and new pregnancies need to be adequately investigated. Particularly important here are studies to investigate traditional practices that are associated with child care patterns for older siblings who are immediately followed by a new pregnancy.

With child care variables having significant influence on children's nutritional status and the higher risk of underweight amongst children cared for by mothers than those cared for by relatives, the study suggests a need for the collection child care information not only for the living children, but also for those who died. Perhaps demographers should go further than documenting the effect of maternal education alone and it is time formal education of other carers in the communities of Sub-Saharan Africa was investigated.

As for the influence of the discussion of family planning among spouses and its role in accounting for some of the maternal educational effects on mortality outcome, there is need to establish the mechanisms through which such a variable exerts impact on child survival. Particularly important is the investigation of the linkage between spousal discussion of family planning, women's status and overall utilisation of health services. Perhaps such an exercise might possibly unlock the mechanisms through which mother's own education affects childhood mortality outcome.

Also important is the understanding of the mechanisms through which marital instability influences child mortality risk in Zambia since children's nutritional status does not seem to be a vital lead to such risk, as illustrated in this study.

One other important aspect of this study which supports earlier similar demographic findings is the significance of age variations in influencing patterns of mortality risk. On the basis of this study, the most susceptible period to child survival outcomes is during the post-neonatal when children are largely influenced by all tiers of influence from socio-economic and cultural through intermediate behavioural, proximate bio-demographic and morbidity tiers, leading to either growth faltering or mortality.

Finally, for any meaningful discussion of the pathways through which socio-economic and cultural factors influence child survival, intermediate behavioural models must find a place in the various child survival conceptual frameworks. This has been shown to be particularly important for Zambia and may well be the case for Sub-Saharan Africa in general.

BIBLIOGRAPHY

Aaby Peter (1992) Overcrowding and Intensive Exposure: Major Determinants of Variations in Measles Mortality in Africa. In Etienne van de Walle, Gilles Pison and Mpembele Sala-Diakanda, eds. **Mortality and Society in Sub-Saharan Africa.** Clarendon Press, Oxford.

Ahonsi, B.A. (1992) **Factors Affecting Infant and Child Mortality in Ondo State, Nigeria.** Unpublished Ph.D Thesis, University of London, London.

Ahonsi, B.A (1995) Age Variations in the Proximate Determinants of Child Mortality in South-West Nigeria. **Journal of Biosocial Science** (1995) 27, 19-30.

Arnold, Fred. (1990) Assessment of the Quality of Birth History Data in the Demographic and Health Surveys. In IRD/Macro Inc., **An Assessment of DHS-I Data Quality.** DHS Methodological Reports, No.1. Columbia, Maryland.

Barbieri, M. (1991) The Socio-economic and Cultural Context of Infant and Child Mortality in Sub-Saharan Africa. In IRD/Macro Inc., **Demographic and Health Survey World Conference Proceedings**, Vol 1. Columbia, Maryland.

Belm, H. (1979) Socio-economic Determinants of Mortality in Latin America. In **Proceedings of the Meeting on Socio-economic Determinants and Consequences of Mortality.** Mexico City, June 1979.

Behm, H. (1991) An Analytical Framework. In United Nations, **Child Mortality in Developing Countries: Socio-economic Differentials, Trends and Implications.** United Nations, New

York.

Bellamy, C. (1996) **The State of the World's Children 1996.** UNICEF and Oxford University Press.

Bicego, G. and Boerma, J. (1991) Maternal Education and Child Survival: A Comparative Analysis of DHS Data. **Demographic and Health Survey World Conference**, August 5-7. Columbia, Maryland.

Bicego, G. and Boerma, T. (1994) Demographic Aspects of the Quality of Data on Births in the Demographic and Health Surveys. In Macro Inc., **An Assessment of the Quality of Health Data in the DHS-I Surveys**. DHS Methodological Reports No.2. Calverton, Maryland.

Blacker, J. (1979) **Mortality in Tropical Africa: the Demographer's Viewpoint.** Paper presented to the Conference on Medical Aspects of African Demography, Peterhouse, Cambridge, September 1979.

Blacker, J. (1991) Infant and Child Mortality: Development, Environment and Custom. In Feachem, R., Jamison, D., eds. **Disease and Mortality in Sub-Saharan Africa.** World Bank, New York.

Bledsoe, C. (1990) Differential Care of Children of Previous Unions within Mende Households in Sierra Leone. In J.C. Caldwell, S. Findley, P. Caldwell, G. Santow, W. Cosford, J. Braid and D. Broers-Freeman, eds. **What We Know About Health Transition: The Cultural, Social and Behavioural Determinants of Health.** Health Transition Series No. 2. (Vol. II). Australian National University, Canberra.

Boerma, T. and Bicego, G (1991) Preceding Birth Interval and Child Survival: Searching for Pathways of Influence. In IRD/Macro Inc., **Demographic and Health Surveys World Conference Proceedings**, Vol. 2. Columbia, Maryland.

Brass, W (1975) **Methods for Estimating Fertility and Mortality from Limited and Defective Data.** Carolina Population Center, Laboratories for Population Statistics, Chapel Hill.

Burdette, M.M. (1988) **Zambia: Between Two Worlds.** Westview Press, London.

Caldwell, J.C. (1979) Education as a Factor in Mortality Decline: An Examination of Nigerian Data. **Population Studies**, 33 (3): 395-413.

Caldwell, J.C. (1990) Cultural and Social Factors Influencing Mortality Levels in Developing Countries. **ANNALS**, AAPSS, 510, July 1990.

Caldwell, J.C. and Caldwell, P. (1991) What Have We Learnt About the Cultural, Social and Behavioural Determinants of Health? From Selected Readings to the First Health Transition Workshop. **Health Transition Review**, Vol. 1 (1): 3-19.

Cantrell, P. (1974) Is there a Standard Pattern of Tropical Mortality. In P. Cantrell, et al. (eds.) **Population in African Development**. IUSSP, Leige.

Cantrelle, P. and Locoh, T. (1990) Cultural and Social Factors Related to Health in West Africa. In J.C. Caldwell, S. Findley, P . Caldwell, G. Santow, W. Cosford, J. Braid and D. Broers-Freeman, eds. **What We Know About Health**

Transition: The Cultural, Social and Behavioural Determinants of Health. Health Transition Series No. 2. (Vol.I). Australian National University, Canberra.

Carrier, N. and Hobcraft, J. (1971) **Demographic Estimation for Developing Societies.** Population Investigation Committee, London.

Carvalho, J and Wood, C. (1978) Mortality, Income Distribution and Rural-Urban Residence in Brazil. **Population Development Review** 4: 405-420.

Casterline, J.B. (1987) The Collection and Analysis of Community Data. In Cleland, J. and Scott, C. eds., **The World Fertility Survey: An Assessment.** Oxford University Press, Oxford.

Clark, S., Colson, E., Lee, J., Scudder, T. (1995) Ten Thousand Tonga: A Longitudinal Anthropological Study from Southern Zambia, 1956-1991. **Population Studies,** 49 (1995): 91-109.

Cleland, J. (1990) Maternal Education and Child Survival: Further Evidence and explanations. In J.C. Caldwell, S.Findley, P. Caldwell, G. Santow, W. Cosford, J. Braid and D. Broers-Freeman, eds. **What We Know About Health Transition: The Cultural, Social and Behavioural Determinants of Health.** Health Transition Series No. 2. (Vol. I). Australian National University, Canberra.

Cleland, J. and van Ginneken, J. (1989) Maternal Schooling and Childhood Mortality. **Journal of Biosocial Science,** (supplement 10): 13-34.

Cleland, J., Bicego, G., Fegan, G. (1992) Socio-economic Inequalities in Childhood Mortality: The 1970s to the 1980s.

Health Transition Review, Vol.2 No. 1, 1-18.

Cleland, J.G. and Sathar, Z.A. (1984) The Effect of Birth Spacing on Childhood Mortality in Pakistan. **Population Studies**, 38: 401-418.

Cochrane, S and Farid S. (1989) Fertility in Sub-Saharan Africa: Analysis and Explanation. **World Bank Discussion Papers**, No. 43. The World Bank, Washington DC.

Contoh, A., David, P.H., and Bauni, E.K. (1990) Environmental Risk Factors of Childhood Mortality in Liberia: Evidence and Policy Implications. In Hill, A.G., ed., **Determinants of Health and Mortality in Africa**. Demographic and Health Surveys Further Analysis Series, Number 10, April, 1990.

Cosminsky, S., Mhloyi, M., and Ewbank, D. (1993) Child Feeding Practices in a Rural Area of Zimbabwe. **Social Science and Medicine**, Vol.36 (7): 937-947.

CSO (1985) 1980 Population and Housing Census of Zambia, Analytical Report Vol.IV. **Fertility and Mortality Levels and Trends**. Central Statistical Office, Lusaka.

CSO (1985) **1980 Census of Population and Housing: Fertility Tables**, Vol.3. Central Statistical Office, Lusaka.

CSO (1985) **Major Findings and Conclusions: 1980 Population and Housing Census of Zambia** (Analytical Report, Volume III). Central Statistics Office, Lusaka.

CSO (1991) **Women and Men in Zambia: Facts and Figures.**

CSO (1992) **Country Profile 1992**. Central Statistical Office, Lusaka.

CSO (1993) **Social Dimensions of Adjustment: Priority Survey I 1991 Report**. Central Statistical Office, Lusaka.

CSO (1994) **National Census of Agriculture (1990/92)**, Census Report Part I. Central Statistics Office, Lusaka.

CSO (1995) **1990 Census of Population, Housing and Agriculture**. Volume 10, Zambia Analytical Report. Central Statistics Office, Lusaka.

CSO/Macro Inc. (1995) **Zimbabwe Demographic and Health Survey 1994**. Calverton, Maryland: Central Statistical Office and Macro International Inc.

Curtis, S.L., Diamond, I. and McDonald, J. (1993) Birth Interval and Family Effects on Postneonatal Mortality in Brazil. **Demography**, 30 (1):33-43.

Curtis, S.L. (1995) Assessment of the Quality of Data Used for Direct Estimation of Infant and Child Mortality in DHS-II Surveys. **Occasional Papers No.3**. Calverton, Maryland.

Curtis, S.L. and Steele, F. (1996) Variations in Familial Neonatal Mortality Risks in Four Countries. **J.Biosoc.Sci.** 28: 141-159.

Das Gupta, Monica (1990) Death Clustering, Mother's Education and the Determinants of Child Mortality in Rural Punjab, India. In J.C. Caldwell, S.Findley, P. Caldwell, G. Santow, W. Cosford, J. Braid and D. Broers-Freeman, eds. **What We Know About Health Transition: The Cultural, Social and Behavioural Determinants of Health**. Health Transition Series No. 2. (Vol. I). Australian National University, Canberra.

Da Vanzo Julie (1984) A Household Survey of Child Mortality Determinants in Malaysia. **Population and Development Review** 10 (Supplement on Child Survival): 3-23.

Davies, D.H. ed. (1972) **Zambia in Maps.** University of London Press, London.

Davis, K. and Blake, J. (1956) Social Structure and Fertility: An Analytic Framework. **Economic Development and Cultural Change** 4: 211-235.

De Sweemer, C. (1984) The Influence of Child Spacing on Child Survival. **Population Studies**, 38: 47-72.

Dyson, T. (1982) Infant and Child Mortality in Developing Countries. In R.K. Chandra ed., **Critical Reviews in Tropical Medicine**. Plenum, New York.

Frank, O. and Dakuyo, M. (1985) Child Survival in Sub-Saharan Africa: Structural Means and Individual Capacity - A Case Study in Burkina Faso. **Center for Policy Studies Working Papers** No. 122. The Population Council, New York.

Frenk, J., Bobadilla, J.L., Stern, C., Frejka, T. and Lozano, R (1991) Elements for a Theory of the Health Transition. **Health Transition Review** 1,1: 21-38.

Gaisie, S.K. (1975) Levels and Patterns of Infant and Child Mortality in Ghana. **Demography**, Vol.12, No. 1: 21-34.

Gaisie, S.K. (1990) Culture and Health in Sub-Saharan Africa. **Health Transition Series**, Vol.1,. ANU, Canberra.

Gaisie, K., Cross, A.R., Nsemukila, G. (1993) **Zambia Demographic and Health Survey 1992.** University of Zambia and Macro Inc. Columbia, Maryland.

Goldman, N., Rutstein, S.O., Singh, S. (1985) Assessment of the Quality of Data in 41 WFS Surveys: A Comparative Approach. **WFS Comparative Studies** No. 44. International Statistical Institute, Voorburg.

Gray, R.H. (1981) Birth Intervals, Post-partum Sexual Abstinence and Child Health. In H.J. Page and R. Lesthaeghe, eds., **Child Spacing in Tropical Africa: Traditions and Change.** Academy Press, New York.

Gray, R.H. (1989) The Integration of Demographic and Epidemiological Approaches to Studies of Health in Developing Countries. In Ruzicka, L., Wunsch, G., Kane, P. **Differential Mortality, Methodological Issues and Biosocial Factors.** Clarendon Press, Oxford.

GRZ (1988) **Contraceptive Prevalence Survey 1988.** Ministry of Health, Lusaka. Draft.

GRZ (1990) Major Health Trends, 1978-1988. **Bulletin of Health Statistics.** Ministry of Health, Lusaka.

GRZ (1992) **National Health Policies and Strategies (Health Reforms).** Ministry of Health, Lusaka.

GRZ/UNICEF (1993) **National Programme of Action for Children in Zambia.** UNICEF, Lusaka.

GRZ/UNICEF (1995 Draft) **Prospects for Sustainable Human Development in Zambia: More choices for Our Children.** UNICEF, Lusaka.

Guo Guang (1993) Use of Sibling Data to Estimate Family Mortality Effects in Guatemala. **Demography** 30 (1):15-32.

Gwatkin, D.R. (1980) Indications of Change in Developing Country Mortality Trends: The End of an Era? **Population and Development Review.** 6, 4: 615-644.

Hill, A. (1985) The Demography of Zambia. **PHN Technical Note,** No. 85-9. Population, Health and Nutrition. World Bank, Washington DC.

Hill, Althea (1991) Infant and Child Mortality: Levels, Trends and Data Deficiencies. In Richard Feachem and Dean Jamison, eds. **Disease and Mortality in Sub-Saharan Africa.** World Bank, New York.

Hill, Althea (1993) Trends in Childhood Mortality. In Foote, K., Hill, K., Martin, L., eds. **Demographic Change in Sub-Saharan Africa.** National Academy Press, Washington DC.

Hill, K. and Pebley, A. (1989) Child Mortality in the Developing World. **Population and Development Review** 15, 4.

Hill, K. et al., eds. (1993) **Demographic Effects of Economic Reversals in Sub-Saharan Africa.** National Academy Press, Washington DC.

Hobcraft, J.N., McDonald, J.W., and Rutstein, S.O. (1983) Child-Spacing Effects on Infant and Early Child Mortality. **Population Index** 49 (4): 585-618.

Hobcraft, J., McDonald, J. and Rutstein, S. (1984) Socio-economic Factors in Infant and Child Mortality: A Crossnational Comparison. **Population Studies** 38, 2: 193-223.

Hobcraft, J.N., McDonald, J.W., and Rutstein, S.O. (1985) Demographic Determinants of Infant and Early Child Mortality: A Comparative Analysis. **Population Studies** 39: 363-385.

Hobcraft, J.N. (1991) Child-spacing and Child Mortality. In IRD/Macro Inc., **Demographic and Health Surveys World Conference**, August 5-7, 1991, Washington DC.

Hobcraft, J. (1993) Women's Education, Child Welfare and Child Survival: A Review of the Evidence. **Health Transition Review**, Vol.3, No.2, October, 1993.

Hosmer, D. and Lemeshow, S. (1989) **Applied Logistic Regression.** John Wiley, New York.

Institute for Resource Development (IRD) (1987) **Demographic and Health Surveys Data Processing Manual.** IRD, Columbia, Maryland.

Institute for Resource Development (1990) **Assessment of DHS-I Data Quality.** DHS Methodological Reports, No.1. IRD/Macro Systems inc., Columbia, Maryland.

Kahn, H.A. and Sempos, C.T. (1989) **Statistical Methods in Epidemiology.** Oxford University Press, New York.

Kaite, C.D., Nestel, P., and Rutstein, S.O. (1993) Nutrition and Health Status of Infants and Young Children in Zambia: Findings from the 1992 Zambia Demographic and Health Survey. **Africa Nutrition.** USAID, Macro Inc., and IMPACT, Calverton, Maryland.

Kalipeni, E. (1993) Determinants of Infant Mortality in Malawi: A Spatial Perspective. **Social Science and Medicine,** Vol. 37 (2): 183-198.

Lynch, K.A. and Greenhouse, J.B. (1994) Risk Factors for Infant Mortality in Nineteenth-Century Sweden. **Population Studies** 48: 117-133.

Madise Nyovani (1995) **Nutrition and Feeding Practices of Young Children in Malawi.** Paper presented at the British Society for Population Studies Annual Conference, 30 August-1 September, 1995. Brighton.

Martorell, R. and Ho, T.J., (1984) Malnutrition, Morbidity and Mortality. **Population and Development Review** 10 (Supplement on Child Survival): 49-68.

Meekers, D. (1992) The Process of Marriage in African Societies: A Multiple Indicator Approach. **Population and Development Review,** 18 (1): 61-78.

Mensch, B., Lentzner, H. and Preston, S. (1985) **Socio-economic Differentials in Child Mortality in Developing Countries,** United Nations, Department of International Economic and Social Affairs, New York.

Millard, A.V. (1994) A Causal Model of High Rates of Child Mortality. **Social Science and Medicine,** 38, 2:253-268

Miller, J.E., Trussell, J., Pebley, A.R. and Vaughan, B. (1992) Birth Spacing and Child Mortality in Bangladesh and the Philippines. **Demography,** 29 (2): 305-318.

Mosley, H.W. and Chen, L.C. (1984) An Analytical Framework for the Study of Child Survival in Developing Countries. **Population and Development Review,** 10 (Supplement on Child Survival): 25-45.

Mosley, H.W. (1984) Child Survival: Research and Policy. **Population and Development Review** 10 (Supplement on Child Survival): 3-23.

Mosley, H.W. (1985) Will Primary Health Care Reduce Infant and Child Mortality? In Vallin,J., Lopez,A., eds. **Health Policy, Social Policy and Mortality Prospects.** Ordina, Liege. 103-137.

Mturi, A. and Curtis, S.L. (1995) The Determinants of Infant and Child Mortality in Tanzania. **Health Policy and Planning,** 10 (4): 384-394.

NCPD/Macro Inc. (1994) **Kenya Demographic and Health Survey 1993.** Calverton, Maryland: NCPD, CBS, MI.

Norusis/SPSS Inc., (1993) **SPSS for Windows Advanced Statistics Release 6.0**. Marija J. Norusis/SPSS Inc., Chicago.

Nsemukila, G. (1989) **Population Growth and Food Production in Zambia**. B.A. Dissertation, University of Zambia, Lusaka.

Nsemukila, G.B.B. (1991) **Child Survival and Fertility in Sub-Saharan Africa: A Review of the Relationship**. MSc. Thesis, London School of Economics, London.

Nsemukila, G. (1994) **Maternal and Childhood Mortality in Zambia: Determinants and Trends, 1965-1992**. UNICEF Monograph, 1, 1994. UNICEF, Lusaka.

Obungu, W., Kizito, P.M. and Bicego, G. (1994) Trends, Age Patterns, and Determinants of Early Childhood Mortality in Kenya. **DHS Further Analysis Studies 12**. Macro International Inc., Calverton, Maryland.

Ohadike, P. (1971) Aspects of Domesticity and Family Relationship: A Survey Study of the Family Household in Zambia. **Journal of Asian and African Studies**, Vol. VI No. 3-4: 191-204.

Palloni, A. (1981) Mortality in Latin America: Emerging Patterns. **Population and Development Review** 1, 4: 623-649.

Palloni, A. (1989) Effects of Inter-birth Intervals on Infant and Early Childhood Mortality. In Lado Ruzicka, Guillaume Wunsch, Penny Kane, **Differential Mortality, Methodological Issues and Biosocial Factors**. Clarendon Press, Oxford.

Pebley Anne, R. (1984) Intervention Projects and the Study of Socio-economic Determinants of Mortality. **Population and Development Review**, 10 (Supplement on Child Survival): 281-305.

Potter, J.E. (1977) Problems in Using Birth History Analysis to Estimate Trends in Fertility. **Population Studies** 31, 2: 335-64.

Roberts, A. (1976) **A History of Zambia.** Heinemann, London.

Rutstein, S.O. (1984) Infant and Child Mortality: Levels, Trends, and Demographic Differentials. **WFS Comparative Studies** No.43. International Statistical Institute, Voorburg.

Rutstein, S.O. (1985) Assessment of the Quality of WFS Data for Direct Estimation of Child Mortality. In Assessment of the Quality of Data in 41 WFS Surveys: A Comparative Approach, by Noreen Goldman, Shea Oscar Rutstein, and Susheela Singh. **WFS Comparative Studies** No.44. International Statistical Institute, Voorburg.

Rutstein, S.O. and Bicego, G. (1990) Assessment of the Quality of Data Used to Ascertain Eligibility and Age in the Demographic and Health Surveys. In IRD, **An Assessment of DHS-I Data Quality**. DHS Methodological Reports No. 1. IRD/Macro Systems, Inc. Columbia, Maryland.

Ruzicka, L. and Hansluwka, H. (1982) Mortality Transition in South and East Asia: Technology Confronts Poverty. **Population and Development Review** 8, 30: 567-588.

Ruzicka, L. (1983) Mortality Transition in the Third World Countries: Issues for Research. **IUSSP Newsletter** 17: 60-82.

Ruzicka, L. (1989) Problems and Issues in the Study of Mortality Differentials. In Ruzicka, L. et al eds., **Differential Mortality: Methodological Issues and Biosocial Factors**. Claredon Press, Oxford.

Seshamani, V. (1992) The Economic Policies of Zambia in the 1980s: Towards Structural Transformation with a Human Focus? In Cornia, G.A., van der Hoever, R., Mkandawire, T., eds. **Africa's Recovery in the 1990s; From Stagnation and Adjustment to Human Development.** UNICEF, New York.

Simson, H. (1985) **Zambia: A Country Study.** Scandinavian Institute of African Studies, Uppsala.

Somoza, J.L (1980) Illustrative Analysis: Infant and Child Mortality in Columbia. **WFS Scientific Reports** No.38. International Statistical Institute, Voorburg.

Sullivan, J.M. (1972) Models for the Estimation of the Probability of Dying Between Birth and Exact Ages of Early Childhood. **Population Studies**, Vol. XXVI, No. 1: 79-97.

Sullivan, J. (1991) The Pace of Decline in Under-Five Mortality: Evidence from the DHS Surveys. In IRD/Macro Inc., **Demographic and Health Surveys World Conference**, August 5-7, 1991, Washington DC.

Sullivan, J., Rutstein, S.O. and Bicego, G. (1990) Assessment of the Quality of Data Used for the Direct Estimation of Infant and Child Mortality in the Demographic and Health Surveys. In IRD, **An Assessment of DHS-I Data Quality.** DHS Methodological Reports No. 1. IRD/Macro Systems, Inc. Columbia, Maryland.

Sullivan, J., Rutstein, S.O. and Bicego, G. (1994) Infant and Child Mortality. **DHS Comparative Studies** No. 15, Macro International Inc, Calverton.

Tabutin, D. and Akoto, E. (1992) Socio-economic and Cultural Differentials in the Mortality of Sub-Saharan

Africa. In Etienne van de Walle, Gilles Pison and Mpembele Sala-Diakanda, eds., **Mortality and Society in Sub-Saharan Africa.** Claredon Press, Oxford.

Trussell, J.T. (1975) A Re-estimation of the Multiplying Factors for the Brass Technique for Determining Childhood Survivorship rates. **Population Studies**, Vol. XXIX, No.1: 97-108.

Trussell, J. and Hammerslough, C. (1983) A Hazards-Model Analysis of the Covariates of Infant and Child Mortality in Sri Lanka. **Demography**, 20 (1): 1-26.

UNECA/CSO, (1982) **Interrelationships Among Infant and Childhood Mortality, Socioeconomic Factors and Fertility in Zambia: A Case Study of Lusaka and Keembe.** UNECA, Addis Ababa.

United Nations, (1982) **Levels and Trends of Mortality since 1950.** United Nations, New York.

United Nations, (1983) **Manual X: Indirect Techniques for Demographic Estimation.** Population Studies, No. 81. United Nations, New York.

United Nations, (1988) **Mortality of Children Under Age 5:** World Estimates and Projections, 1950-2025. Population Studies, No. 105. United Nations, New York.

United Nations, (1988) **Mortpak-lite.** The United Nations Software Package for Mortality Measurement. ST/ESA/SER.A/104, United Nations, New York.

United Nations (1988a) **World Population Trends and Policies: 1987 Monitoring Report.** Population Studies No. 103, United Nations, New York.

United Nations (1988b) **Mortality of Children Under Age 5: World Estimates and Projections, 1950-2025**. Population Studies No. 105, United Nations, New York.

United Nations (1990) **World Population Monitoring 1989.** Population Studies No. 113, United Nations, New York.

United Nations (1991) **Child Mortality in Developing Countries: Socio-economic Differentials, Trends and Implications.** United Nations, New York.

United Nations (1993) **World Population Prospects: The 1992 Revision.** United Nations, New York.

Vallin, J. (1992) Theories of Mortality Decline and the African Situation. In Etienne van de Walle, Giles Pison and Mpembele Sala-Diakanda, eds., **Mortality and Society in Sub-Saharan Africa.** Clarendon Press, Oxford.

Venkatacharya, K. (1991) Kenya. In United Nations, **Child Mortality in Developing Countries: Socio-economic Differentials, Trends and Implications**. United Nations, New York.

Ware, H. (1984) Effects of Maternal Education, Women's Roles and Child Care on Child Mortality. **Population and Development Review** 10 (Supplement on Child Survival): 191-210.

Wenlock, R.W. (1979) Social Factors, Nutrition and Child Mortality in Rural Subsistence Economy. **Ecology of Food and Nutrition**, Vol. 8: 227-240.

Woods, R.I. and Woodward, J.H., eds, **Urban Disease and Mortality in Nineteenth-Century England.** Batsford, London.

World Bank (1994) **Zambia Poverty Assessment**, Volume 1 Main Report. World Bank, Washington DC.