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ERADICATE EXTREME POVERTY AND HUNGER

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POVERTY, NUTRITION AND MORTALITY: A COMPARATIVE PERSPECTIVE

EDITED BY
K. NAVANEETHAM
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G. CASELLI

COMMITTEE FOR INTERNATIONAL COOPERATION IN NATIONAL RESEARCH IN DEMOGRAPHY

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Edited by

Kannan **NAVANEETHAM**
Arunachalam **DHARMALINGAM**
Graziella **CASELLI**

CICRED
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in National Research in Demography

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Preface

The contemporary world continues to register substantial progress in economic growth, abundance in production of food grains, and profound breakthroughs in medical technology and knowledge on diseases and healthcare. These are no mean achievements and there are reasons to further them, as they play important role in both reducing poverty and hunger, and improving the health and nutritional status of the population. Despite this progress and achievement, a number of regressive aspects also continue to plague many parts of the world and blight the lives of men and women in various ways. The manifestation and intensity of these aspects varies between regions and between countries within regions. Poverty, hunger, malnutrition and mortality are so inexorably intertwined that they reinforce each other and hinder human development and economic growth. Understanding the relationship between poverty, nutrition and mortality is a complex one and this relationship vary according to the social, economic and cultural environment.

In order to further our knowledge on these important issues, a seminar titled "The Impact of Mortality as Both a Determinant and a Consequence of Poverty and Hunger: A Contribution to Achieving the First Millennium Development Goal (Eradicate Extreme Poverty and Hunger)" was held between February 23 and 25, 2005 in Trivandrum, India. The seminar was organised jointly by CICRED and the Centre for Development Studies (CDS) with financial support from UNFPA This book presents some of the papers offered at that conference with additional papers 'invited' in order to cover other regions and to fill the gap in certain issues. This volume covers Asia, the Pacific and Africa where nearly 90 percent of the world's hungry people live. About 2 out of 5 under-five deaths occur in Sub-Saharan Africa and almost half of the world's undernourished children live in South Asia.

The editors are grateful to Professor Christophe Z. Guilmoto, Director, CICRED who freely gave all the support, help and encouragement to organise the seminar. Without his keen involvement and enthusiastic support, we would not have seen this publication. We are also grateful to Professor Gavin Jones (CICRED and the Asia Research Institute), Professor Ian Pool (University of Waikato) and Professor K. Narayanan Nair

(Centre for Development Studies) for their wholehearted support and help in organising the seminar.

We would like to thank all the contributors to this volume and all the participants and discussants in the seminar for their support and cooperation. Space limitations prevented inclusion of all the papers presented at the seminar. Papers not included in this volume are available on the CICRED website.

We are grateful to Ms. Hartati Ayral, General Secretary at CICRED for ensuring the smooth running of the seminar and for managing the publication of this volume. Thanks are also due to Ms. Silvia Huix-Adamets for supervising the final layout and printing, and to Dr. Krishnakumar at the Centre for Development Studies for his assistance in the preparation of this book.

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Introduction

Kannan NAVANEETHAM, Arunachalam DHARMALINGAM, Graziella CASELLI

Poverty, hunger, malnutrition and mortality are regressive social phenomena that continue to plague the developing countries. This is despite them experiencing a substantial growth in income and food grain production and breakthroughs in medical technologies in the recent past. The manifestation and intensity of these aspects varies between regions and between countries within regions. Poverty, hunger, malnutrition and mortality are so inexorably intertwined that they reinforce each other and hinder human development and economic growth.

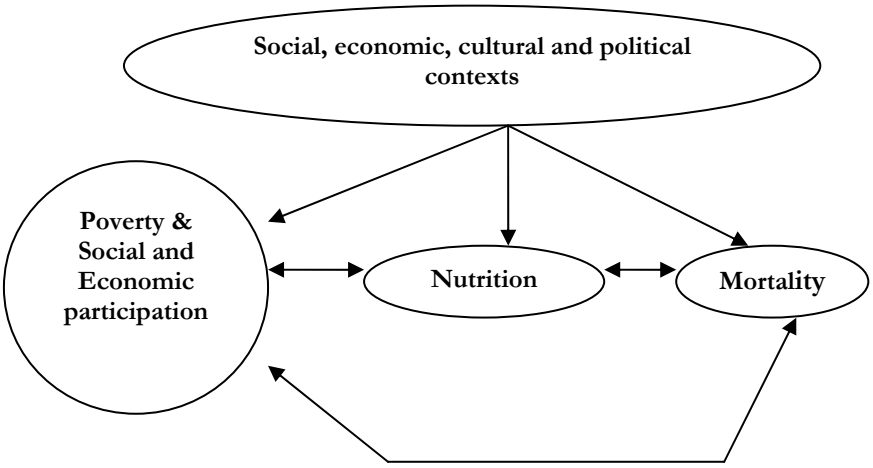
All governments and the leading development institutions have agreed to work towards eradicating extreme poverty and hunger–the first goal of the United Nations millennium declaration (United Nations, 2000). The declaration envisaged that by 2015 there be a 50 per cent reduction in the proportion of people living on less than $US1 dollar a day and a reduction by half the proportion of people who suffer from hunger. Poverty and Hunger, the foremost millennium development goals, are closely related. Achieving these first and foremost goals are also important determinants of other goals (4-7) such as achieving universal primary education, promoting gender equality and empowering women, reducing child mortality, improving maternal health, combating HIV/AIDS, malaria and other diseases and ensuring environmental sustainability (Wagstaff and Claeson, 2004).

1. Poverty, Nutrition and Health

Hunger, which is manifested by the prevalence of malnutrition, is an indication of a population's inability to provide the required intake and balance in diet for a healthy living. Income or consumption poverty is one

aspects of deprivation. Poverty is a multidimensional phenomenon. Education, health (including reproductive health) nutrition, water and sanitation, employment, and social and political participation are additional dimensions in the deprivation of capability and empowerment (Sen, 1999). Poverty limits access to food and basic services such as health and education which results in poor health and shorter life expectancy (SPACO, 2003). Poor health in turn leads to reduced human development and poverty, thereby completing the vicious circle of poverty, malnutrition, lack of human development, poor health and poverty (see Figure 1). Poverty influences health outcomes by limiting access to modern health facilities. Since poor households tend to spend a higher proportion of their income on food, the resources available for spending on health care is limited. By limiting access to food and health services, poverty tends to cause higher mortality and morbidity among the poor. The relatively high levels of mortality and morbidity among the poor leave many households without an income earner, thus exacerbating the problems associated with poverty.

Figure 1 A simplified framework for the poverty, nutrition and mortality nexus



Poverty is multi-dimensional, but it also provides the link between poverty, nutrition and health (Wagstaff and Claeson, 2004). Poverty and mortality are inseparable–one cannot consider poverty without addressing issues of health. Ill-health disproportionately affects the poor. According to WHO (1999), the likelihood of death before the 5th birthday is five times greater among the poor than among the non-poor. Similarly, the probability of

death between 15 and 59 years is about two and a half times higher. The determinants of higher ill-health among the poor are manifold and interrelated (Bloom and Canning, 2001). It is impossible to understand health without taking into account levels of nutrition and its attendant factors: malnutrition and extreme hunger; over-nutrition, obesity and diabetes; and the broader political-economic, environmental and agronomic questions of food and water security. The connectedness comes from the fact that hunger and malnutrition (whether mal-nutrition and low caloric intake or over-nutrition and obesity) are key determinants of ill-health and mortality.

Conversely, morbidity and mortality can lead to deprivation as a direct result of the disproportionate amount of resources spent on addressing chronic morbidity and the economic impacts of death and the rituals immediately following the death in the household (Chapter 9 in this volume). Hence, poor health and its considerable economic consequences are major obstacles to the eradication of poverty in poor rural areas and among disadvantaged population groups. Moreover, the significant costs of health care are met by out of pocket expenditure (private spending) which further adds to the impoverishment of the poor in the developing world (Wagstaff and Claeson, 2004).

The prevalence of chronic hunger and malnutrition is more widespread than acute hunger in developing countries. The hungry are found predominately in Asia, the Pacific and Sub Saharan Africa. These regions account for about 90 per cent of the people living in poverty and hunger. It was also estimated that 12 million babies are born with low birth weight each year, and that around 162 million pre-school children and almost a billion people of all ages were malnourished (Behrman *et al.*, 2004). A major consequence of this high prevalence of low birth weight is high mortality. Among the several maternal factors that have a strong bearing on birth weight, maternal nutrition is the most important determinant of low birth weight (Jejeebhoy and Rao, 1995; Scrimshaw, 1996; Osmani and Sen, 2003). The evidence suggests that birth weight is a function of the nutritional status of women, and that nutritional status depends on the quantity and quality food consumed and access to basic amenities which improves the nutrient absorption capacity of the body. Access to basic amenities might also relieve women and female children from the drudgery of domestic work, and help the later to attend school. Schooling has a positive impact on the survival of infants (Caldwell, 1986; Cleland and Van Ginneken 1988; Basu, 1997). For

this reason, there is a case for considering hunger and poverty to be an apposite indicator of poor health and nutritional status. The World Health Organisation estimated that malnutrition among children accounted for about 60 per cent of infant and child mortality (Behrman *et al.*, 2004).

On the other hand, changes in mortality levels and patterns can lead to increases in poverty and/or hunger. This is likely to vary depending on the prevailing economic, social and political contexts. Declines and increases in mortality can both lead to the worsening of poverty and/or hunger. For instance, as elderly women are especially vulnerable to poverty in many countries, an increase in the numbers of elderly people can lead to increased poverty. This occurs in the context of decreasing overall mortality. Although these interrelationships are highly relevant to all societies, it is particularly pertinent to the developing world where mortality has been declining rapidly, and consequently life expectancy has been increasing.

The young adults in the developing world are currently exposed to high risks of morbidity and mortality due to the pandemic of HIV/AIDS. Mortality resulting from this pandemic is very severe in the prime working ages and this can lead to an accentuation of ageing of the work-force. In sub-Saharan Africa, declines in life expectancy as a result of high HIV/AIDS prevalence has changed the age structure of many countries in the sub-region (Rau, 2003). The disease affects the most productive age group in the population (aged 15-49 years) to a much greater extent than other diseases (Haslwimmer, 1996). The countries with a relatively high prevalence of HIV/AIDS have experienced significant declines in the number of economically active adults, interrupting the chain of transfer of technical know-how from older adults towards the younger generation. This not only increases food insecurity but also means that the very young and the older people become responsible for food production. In view of the critical importance of youth to the economy of any nation, the devastating effects of disease that affects the young have dire consequences for the productive sectors of the economies (see chapter 3 in this volume).

The economic loss to AIDS-affected households is not limited only to the household economy of the infected person but also results in the meagre income having to be spent on medical care for the patient and eventually on to meet funeral expenses. Such expenses can seriously diminish household resources, which can affect household nutrition and the general

health of households. For most children, the loss of parents or guardians due to HIV/AIDS requires them to assume family responsibilities. Often these orphans have to fend for themselves and in most cases they cannot afford to undertake education. This state of affairs often has serious consequences on the survival chances of children and their future growth and development (Rau, 2003).

In sum, changes in the levels and patterns of mortality can lead to poverty, and conversely poverty and hunger can lead to changes in levels and patterns of nutrition and mortality. Are there lessons to be drawn from the experiences of continents and countries where poverty and hunger are strongly related to the changes in mortality levels and patterns? In the past most research in this field has been "univariate". Researchers have looked at mortality/health or at poverty. Some have examined the various dimensions of poverty and mortality. Only a few have examined the inter-linkages between the various dimensions of poverty, nutrition and health or mortality. To fill this gap, a seminar was organized jointly by the Committee for International Cooperation in National Research in Demography (CICRED) and the Centre for Development Studies (CDS) with financial support from the United Nations Population Fund (UNFPA) between February 23 and 25, 2005 in Thiruvananthapuram, India. This international seminar on "The Impact of Mortality as Both a Determinant and a Consequence of Poverty and Hunger: A Contribution to Achieving the First Millennium Development Goal (Eradicate Extreme Poverty and Hunger)" brought together several researchers from across the globe to discuss and debate these important issues. This book presents a collection of some of the papers presented at the seminar. We invited additional papers in order to cover other regions and to fill the gap in certain issues. This volume covers Asia, the Pacific and Africa.

2. Organisation of the Book

This volume is divided into five parts. The first part explores the theoretical understanding of the inter-linkages between poverty, nutrition and mortality by using empirical evidence from three regions: South Asia, the Pacific and West Africa. It is estimated that around 90 per cent of the people living in hunger are in these regions (Behrman *et al.*, 2004). In Chapter 2, entitled "*Poverty, Malnutrition and Mortality in South Asia: A Review of*

Evidence and Pathways", Sunny Jose, Arunachalam Dharmalingam, Kannan Navaneetham examine the emerging trends in mortality and malnutrition in South Asia and their association with poverty and hunger. In doing so, they seek answers to the question why the Indian subcontinent continues to have much higher levels of infant and under 5 mortality compared with other sub-regions in Asia. Infectious diseases, malnutrition and neonatal disorders combine to play a critical role in endowing the region with high death rates during infancy and childhood. At the same time, the adult population of the south Asian region is also witnessing an increase in disabilities and deaths from disease, both communicable and non-communicable.

The relatively high levels of child malnutrition, the prevalence of infectious diseases and the associated loss of lives are closely related to poverty and to deprived social and physical environment. What is more, these poor and malnourished children are bound to become victims of poverty and hunger, through their reduced educational, physiological and human capital development. Thus, poverty reduction is not only important in its own right, but it is also central to the reduction of child mortality and malnutrition and hence the huge economic and social costs arising there from. Equally clearly, it has emerged that gender inequality plays a critical role in leading to and reinforcing the burden of death and disability in the region. The neglect of maternal nutrition causes a high incidence of low birth weight babies, which in turn causes poor child nutrition, vulnerability to infection and child mortality. Foetal malnutrition increases the vulnerability to disabilities and deaths from chronic diseases in adulthood and old age. Addressing maternal malnutrition is therefore central to arresting and reversing the burden that looms large in the South Asian region.

The third chapter by Kesaia Seniloli is entitled "*Mortality, Poverty and Nutrition in the Pacific*". It reviews the patterns of morbidity and mortality in the countries of the Pacific and explores the relationship between morbidity and mortality on the one hand and poverty and nutrition on the other. This chapter notes the absence of reliable data with which to measure mortality and to assess the nutritional deficiencies in the Pacific Island countries is a problem. It urges the need to strengthen health and nutrition information systems in the region.

Fiji and those Polynesian countries with better provision of health care services and infrastructure have experienced declining mortality and longer

life expectancy. However, many of these countries experience both over- and under-nutrition. The Micronesian and Melanesian Island nations tend to have higher infant mortality and higher premature adult mortality. The paper stresses the importance of investing in health and addresses the issues of poverty and vulnerability which would in time translate into higher productivity, higher income and higher economic growth. This must be addressed by a multi-pronged approach: creating employment opportunities, improving health services and health infrastructure, and mounting an effective awareness programme on nutrition.

The fourth chapter entitled "*Mortality: A Determinant and a Consequence of Poverty and Hunger in West Africa*" by Alieu Sarr studies the causal relationship between mortality, poverty and hunger in the West African region and their potential impact on the attainment of the first Millennium Development goal–eradicating extreme poverty and hunger. In particular the author uses published data for West African countries to document the trends, identify the potential consequences of these trends, and to deduce the causal relationships between mortality and poverty on the one hand, and mortality and hunger on the other. Further, the author investigates the consequences of the rapid rate of increase in HIV infection in West Africa and the consequences of the disease both in terms of its effects on agricultural output and the increased strain it places on health resources. Sarr shows that mortality is both a determinant and a consequence of poverty and hunger in West Africa. For the sub-region to overcome the problems related to mortality, poverty and hunger, it is essential that efforts be intensified towards improving the productivity of the agricultural sector and the quality of health care services to fight against HIV/AIDS. In terms of priorities, it is necessary to take on the challenges posed by the three problems at the same pace and time. This is because neglecting any of these problems or even under-investing in any them could negate the efforts aimed at solving the others.

The chapters in Part II illustrate the understanding of the linkages between poverty, hunger and mortality from a macro perspective. Chapter 5 "*Public Health and Mortality in China's Less Developed Rural Areas*" by Zhongwei Zhao and Chun Luo investigates health care and mortality in China's less developed rural areas–15 of the poorer counties. It also examines the determinants of health and their impact on health conditions using the data collected through China's 2003 National Health Services Survey (NHSS) and recent censuses. China has made impressive progress in lowering

mortality and poverty reduction in the last half century. However, socio-economic reforms have also brought about negative changes. The collapse of the Co-operative Medical System in many rural areas, the growing inequality in income distribution and the increasing cost of health services have prevented people, especially the poor, from receiving adequate health care. The mortality gap between advanced and less developed areas has widened in recent years. Among the people of China's less developed rural areas, living standards are low, the living environment is poor and the provision of health services is inadequate. Also, most people do not have any health care coverage and their knowledge of health and disease prevention is rather limited and all these factors had a considerable impact on population health defined in terms of morbidity and mortality patterns.

In the next chapter "*Generalised Deprivation and Infant Mortality in Rural India*", Dhairiyarayar Jayaraj examines the relationship between deprivation in access to infrastructure–an important determinant of women's health status, and the incidence of infant mortality in rural India. Jeyaraj constructs an index of 'generalised deprivation' of access to infrastructural facilities to explore the relationship between deprivation and infant mortality. The results show that the incidence of generalised deprivation has a negative impact on infant mortality, which suggests that there is a case for improving access to basic infrastructural facilities such as safe drinking water, public transport, healthcare facilities, clean fuel and electricity for lighting. This chapter also provides an account of the magnitude and spatial variability in the incidence of generalised deprivation in rural India. The spatial patterns in infant mortality and generalised deprivation show that rural population in north India suffers in both. Illiteracy, child labour, non-school attendance, poor nutritional status, and low expectation of life at birth appear to be high among India's northern states compared with the situation in the states in the south and suggest that deprivation in different spheres thrive together. This chapter concludes that the nexus between deprivation and poor health in different areas can be broken by investing in infrastructural facilities.

The trends in both poverty and mortality and the poverty-mortality link at the macro and micro levels in the Philippines are analysed by Josefina Cabigon in chapter 7. It is entitled "*Understanding the Relationship between Poverty and Mortality in the Philippines*". While improvement in poverty and mortality reduction is evident in the Philippines, the study found that at the household-individual level of analysis, a clear poverty-mortality linkage is

evident. The 1998 and 2003 National Demographic Health surveys revealed that infant and child mortality rates among the poor are two to three times higher than those of the rich. A similar pattern is observed in the rich-poor differential in both the urban and rural populations as well as among males and females. Skilled delivery attendance at child birth is also low among the poor; the rich are more likely to have skilled attendance at delivery. Utilisation of private facilities for delivery is also higher among the rich compared with the poor. All the other health indicators related to child, maternal and tuberculosis mortality reveal that the poor are always at a relative disadvantage.

Part III of this book deals with the contribution of micro level studies to the understanding of the poverty, nutrition and mortality nexus. Chapter 8 titled "*Poor but Healthy? The Paniyas*[1] *of Kerala*" by Delampady Narayana uses micro level data collected from a *Gram Panchayat*[2] in Kerala to illustrate how the self perception of illness and health mediate the poverty and health status linkages. The *Panchayat* studied is a multi-caste and multi tribe community and the differences between them and within the tribal groups are wide. Households with poor housing conditions, less education, and wage labour show poorer health status compared to those with good housing conditions who are well educated and are engaged in non-wage labour occupations. Further, hygiene practices and personal habits (e.g. not boiling drinking water) exacerbate the ill health effects of poverty. The study notes that the understanding of the health status from the measure of perception of illness is consistent with the understanding derived from objective measures of health for social groups, except for the *Paniyas*, a Scheduled Tribe Community. Against the general measures, poorer population groups do report worse health. This must be the case for the Paniyas as well but the Paniyas' perception of their health and illness seems not to reflect their reality. This is confirmed by the results from the clinical examination of chronic diseases which showed that the Paniyas experienced as much chronic disease and malnutrition as other social groups. But the Paniyas perceive themselves to be in better health. This study has brought out two

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[1] A tribal community living in Wayanad district, Kerala, India. The word 'Paniyans' means 'workers' as they were workers of non-tribes.

[2] A local self government unit at the village level in India.

important implications. First, while studying broad social groups, such as the Scheduled Tribes in India, researchers need to be sensitive to the highly heterogeneous nature of such groups and must therefore be extremely careful. Second, the reported measures of health need to be placed within the larger social context before drawing any policy conclusions.

Chapter 9 by Chrétien Ngouanet *et al.* is entitled "*Poverty and Mortality in the Rural Western Highlands of Cameroon: Perceptions and Realities*". It examines the link between poverty and mortality in the rural western highlands of Cameroon. This chapter also deals with concepts of poverty developed by organisations and researchers, and the approaches used in surveys in Cameroon. The authors argue that surveys conducted in Cameroon have largely ignored the social context within which poverty is assessed, especially in the case of the Western Highlands of Cameroon where the psychosocial priorities of the population have not been taken into consideration. This has lead to the over-estimation of poverty in the region. An examination of the statistics on the agricultural production of foods crops in this area, it seems paradoxical to conclude that the population of the Western Highlands is poor. The chapter highlights that the high mortality rate observed in the Western Highlands is not exclusively due to poverty but also to other local practices. A large part of the income earned is spent neither on food nor on health but on status-seeking activities (marriage, death, funerals), and the building of houses. The paper ends in concluding that mortality and morbidity rate observed in the Western Highlands is not primarily due to poverty but largely due to psychosocial causes. Health has become precarious, characterised by recourse to self medication, road-side drug vendors and traditional practitioners. Visits to the hospitals occur only when most patients are terminally sick, resulting in high mortality.

Chapter 10 entitled "*Poverty, HIV/AIDS and Mortality in Karnataka*", Pradeep Bhargava and Dayanand Sathial examine the relationship between poverty-linked HIV/AIDS (morbidity) and associated mortality using the data collected from a number of recent studies conducted at the micro level in Karnataka, a state in southern India. The study shows that seasonal labour migration, the traditional *Devadasi* system and other local factors linked to poverty facilitate the transmission of HIV/AIDS. Further, the authors argue that the HIV epidemic is likely to have serious repercussions for the future mortality in the study area, especially among the poor and

marginalised community in the absence of adequate preventive (Vaccine) and curative measures.

The chapters in part IV of this book looks at the determinants of child mortality and child malnutrition in different social settings. Chapter 11 by Ngianga-Bakwin Kandala is entitled "*Mapping Child Mortality Inequalities in Sub-Saharan Africa: Contextual Influences of Prenatal Environment*". It examines how the household and neighbourhood environments affect child survival in Sub-Saharan African countries (Malawi, Nigeria, Tanzania and Zambia). The study reveals that poor geographic location and household socio-economic status have a greater impact on child survival in Sub-Saharan African countries. Further, by using the Bayesian geo-additive modelling procedure, the study identified that there is a large amount of unexplained residual spatial effects that show a strong spatial structure even after controlling for the covariates. The regional variations in health care provision, environmental risks and cultural factors could be the reasons for the spatial variation in under-five mortality in the four countries

Rania Roushdy and Mark Montgomery analyse the effects of living standards and relative poverty on infant and child mortality in the urban areas of Egypt in chapter 12 entitled "*Poverty and Early Childhood Mortality: Household and Neighbourhood Effects in Urban Egypt*". To measure living standards, this chapter applied a multiple indicator multiple-cause (MIMIC) factor-analytic model to a set of proxy variables collected in the 2003 Interim Demographic and Health Survey for Egypt. It was found that living standards exert substantial influence, much more than that of *neighbourhood*, on early childhood chances of survival.

Chapter 13 entitled "*Child Malnutrition in Rural India*", Arunachalam Dharmalingam and Thangasamy Alesan focus on the importance of maternal education, household hygiene, and a child's birth weight on chronic malnutrition (stunting) in rural India. This chapter provides a detailed description of variations within rural India in the relationship between chronic malnutrition and maternal education, household hygiene and birth weight. The analysis showed that these factors indeed are significant predictors of chronic malnutrition for rural India as a whole. But more importantly, their significance varies substantially among the major states in rural India. This indicates that policy and programme prescriptions to address chronic malnutrition need to be context-specific.

The last part of book titled "*Mortality, Poverty and Hunger nexus: A Synthesis and Policy Implications*" Ian Pool *et al.* provide a synthesis of the issues covered in the book and suggest several policy considerations to achieve the millennium development goals.

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Part I

POVERTY, NUTRITION AND MORTALITY: KNOWLEDGE BASE ACROSS REGIONS

2

Poverty, Malnutrition and Mortality in South Asia: A Review of Evidence and Pathways

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1. Introduction

South Asia is home to nearly one-fourth of the world's population. Yet, nearly 97 per cent of South Asia's population dwells in just three countries: Bangladesh, India and Pakistan. The regional aggregate, influenced heavily by the sub-continent, is therefore likely to mask the wide variations that signify the region's diversity. Though South Asia is an immensely diverse region with varying economic, socio-cultural and political milieus, a number of factors common to most countries of the region enable us to make some broad generalisation.

South Asia is one of the regions which continues to register an increasing rate of growth in the economy, abundance in production of food grains, increasing access to basic social services and infrastructure, rising awareness and knowledge of diseases and growing access to primary and other health-care services (Bajpai, Sachs and Volavka, 2004; Sanchez and Swaminathan, 2004; MHHDC, 2005; Parikh, 2006). The region has therefore made significant strides in enhancing the well-being of women and men, and is inching closer to achieving some of the Millennium Development Goals.

Yet South Asia is also a region where a number of issues plague the lives of women and men unequally. Malnutrition of children and women–a manifestation of hunger–is endemic in the region, though there remain

islands of exception. The rising tide of non-communicable, chronic diseases associated typically with abundance, extends a lethal arm to the armoury of communicable diseases–emblematic of poverty–in taking a huge toll of life. The region is also a home to entrenched norms and discrimination against women, leading to their deprivation even in basic aspects of well-being. Hence, the region lags far behind, and is unlikely to achieve some of the Millennium Development Goals (Ghaffar, Reddy and Singhi, 2004; Zaidi, Awasthi and deSilva, 2004; MHHDC, 2005).

In this chapter, through the review of the existing evidence, we examine critically the emerging trends on mortality and malnutrition in South Asia and their association with poverty and hunger. Specifically, we seek to examine that how the higher levels of mortality and malnutrition prevalent in South Asia arise and how they lead to poverty and hunger. By so doing, we also try to identify the pathways underlying the association between poverty and mortality in South Asia.

The paper is organised as follows. In the next part, we present the emerging trends on aspects of mortality and malnutrition in South Asia. How mortality is both a cause and consequence of poverty and hunger is discussed in the third part. An attempt has also been made to suggest that the burden of disease and disability that debilitates the region is intertwined intricately with gender inequality. The concluding part discusses the implications that the findings may have for policy.

2. Mortality in South Asia: The Emerging Trend

2.1. Mortality of Children

Being alive or freedom from premature mortality–a capability quintessential to human life–is valuable not only in its own right, but is also central to the achievement of any other functioning (Sen, 1998). Child mortality could therefore be an ideal starting point for the present discussion. As is evident from Table 1, the levels of infant and under-5 mortality rates remain quite high in South Asia. Hence, they surpass not only most regions of the world, but also all the developing countries considered together. Only two regions have higher rates of infant and under-5 mortality than South Asia: Sub-Saharan Africa and Eastern and Southern Africa.

Nonetheless, the rate of mortality decline in South Asia seems to be relatively faster than most of these other regions. Is the rate of reduction adequate, given the relatively higher rate of economic growth in the region? It appears from the analysis of Bajpai, Sachs and Volavka (2004) that the rates of decline in infant and under-5 mortality in both India and Pakistan and under-5 mortality in Bangladesh remain rather slower than expected. Given the present pace of decline, South Asia is not likely to achieve the Millennium Development Goals set for the period 1990 to 2015 (that is, a reduction of two-thirds) until 2050 (MHHDC 2005:47).

Table 1 Infant and under-5 mortality across regions (per 1,000)

Regions	Infant mortality		Under-5 mortality	
	2000	2005	2000	2005
Latin America and Caribbean	30	26	36	31
East Asia and Pacific	34	26	44	33
Middle East and North Africa	49	43	62	54
Developing Countries	63	57	92	83
South Asia	73	63	100	84
Eastern and Southern Africa	97	93	153	146
Sub-Saharan Africa	105	101	176	169

Source: UNICEF, 2007

The substantial difference found between South Asia and Sub-Saharan Africa on child mortality rates shrinks when we consider the absolute number of child deaths. Sub-Saharan Africa contributed 41 per cent of global child deaths in 2000, and the share of South Asia was only marginally lower at 34 per cent. Thus, the marginal advantage in the child mortality rate is offset by the large population base of South Asia. What is more, four out of the ten countries with higher numbers of child deaths in 2000 were from South Asia. India had the largest number of child deaths (2,402,000), with Pakistan ranked fourth, and with Bangladesh and Afghanistan occupying seventh and eighth places respectively (Black, Morris and Bryce, 2003).

The region's higher rates of child mortality raise some important questions. Why does South Asia continue to have much higher levels of infant and under-5 mortality? Why does the region fail to make adequate progress in preventing the premature death of children, despite a reasonably higher rate of economic growth? Why is India unable to convert its consistently higher and increasing rate of growth to protecting the lives of its children?

As a prelude to addressing these questions, let us examine the primary determinants of child deaths in the region. Though child mortality is essentially a cumulative outcome of a number of discrete yet overlapping factors, two factors –in synergy with each other –make the region a repository of child death.

Preventable infections are a major cause of child mortality in South Asia. Of the overall burden of deaths related to infectious diseases in the region, around 60 per cent are among children aged under five years (Mathers, Lopez and Murray 2006:73). Though neo-natal and related causes account for 52 per cent of child deaths in South Asia in 2000, the contribution of two infectious diseases is almost as high. Pneumonia (23 per cent) and diarrhoea (23 per cent) are responsible for around 46 per cent of child deaths in the region (Morris, Black and Tomaskovic, 2003:1046). Again, the countries with the largest absolute numbers of deaths are mainly in South Asia, because of the large population in the region. India alone, for instance, contributes around 27 per cent of the global neo-natal deaths (Lawn *et al.* 2005:12).

Of the infectious diseases, pneumonia (or acute respiratory infections) prevails as the prominent one outstripping others. Pneumonia and related infections (mainly sepsis), for instance, accounted for about 34 per cent of child deaths in South Asia, which is six percentage points higher than 28 per cent in Sub-Saharan Africa, in 2004. However, while about 702,000 children died of pneumonia in South Asia in 2004, the corresponding figure for Sub-Saharan Africa (1,022,000) is much higher (UNICEF and WHO 2006:5-11). This underlies, inter alia, the relatively better accessibility to basic healthcare facilities in South Asia than in Sub-Saharan Africa, a point we will take up later.

Since neo-natal causes and two infectious diseases account for the lion's share of child deaths in South Asia, it may be useful to examine the annual number of deaths attributable to them in South Asian countries. As is clear from Table 2, which provides the information for five large countries of South Asia, infectious diseases take a heavy toll of children's lives in almost all of these countries. Sri Lanka, where the number of deaths caused annually by these diseases is much lower, remains an exception. Understandably, the most populous countries are the ones in which there are more deaths: India, Pakistan and Bangladesh. Contrary to what one might

expect, the number of deaths caused annually by neo-natal infections is relatively lower in these countries. This may be because neo-natal infections are major but only a part of the factors associated with neo-natal deaths.

Table 2 Infectious diseases and death of children in South Asian countries, 1996-2000

No. of annual deaths from	Bangladesh	India	Nepal	Pakistan	Sri Lanka
Acute respiratory infection	82,320	576,480	18,240	135,600	<1,000
Diarrhoea	82,320	576,480	18,240	135,600	<1,000
Neonatal infections	53,207	388,473	11,928	73,410	1,133

Source: Zaidi, Awasthi and deSilva 2004: 812

Malnutrition is yet another factor that plays a major role with infectious diseases. The synergy between malnutrition–the poor nutrition and deficiency of micronutrients, mainly Vitamin A and Zinc–and infections leading to elevated risks of mortality operates in two ways. First, malnutrition, which makes a child susceptible to infections and enhances their progression, is an underlying cause of the infection, and mortality arises there from. For instance, child malnutrition is responsible for more than 60 per cent of child deaths arising from diarrhoea, 52 per cent of deaths from pneumonia and 45 per cent of deaths from measles. On the whole, malnutrition is the underlying cause of, and hence is responsible for, about 53 per cent of all child deaths (Caulfield *et al.* 2004:195).

Second, infections make a child vulnerable to malnutrition and intensify it in a variety of reinforcing ways. Infection depresses the appetite and inhibits the absorption of nutrients. It alters the body's metabolism, so that less energy and fewer nutrients are available for growth. Hence, malnourished children will have reduced resistance to infections because of humeral and cell-mediated immunity, which make them susceptible to frequent and severe infections, particularly diarrhoeal and respiratory diseases (Ramalingaswami, Jonsson and Rohde, 1996; Scrimshaw, 1996). Thus, infections drain the nutritional reserve of the children, rendering them vulnerable to further infections that lead to their malnutrition. Hence, a look at the incidence of child under-nutrition across the regions becomes pertinent here.

Table 3 presents the prevalence of moderate under-nutrition–incidence of stunting, underweight and wasting–among children aged below five. It merits here a mention that even mild to moderate malnutrition is associated with an elevated risk of mortality (Pelletier, Frongillo and Habicht, 1993).

Levels of child under-nutrition, unlike mortality, remain the highest in South Asia. It appears that nearly 45 per cent of children are both stunted and moderately underweight (below 2 SD) in 2000. Only in wasting is the proportion relatively lower. This pattern is equally true for all the regions.

Table 3 Incidence of child malnutrition (moderate) across regions (%)

Regions	Stunting		Underweight		Wasting	
	1990	2000	1990	2000	1990	2000
East Asia and Pacific	33.8	16.6	21.8	13.8	5.0	3.0
Middle East and North Africa	25.0	19.1	12.9	10.2	5.2	4.3
Sub-Saharan Africa	39.3	40.5	29.3	29.0	7.3	7.8
South Asia	52.6	43.7	52.9	45.4	16.2	14.8

Source: Klasen, 2006:24.

Like child mortality, the rate of decline in child under-nutrition in South Asia seems to be relatively faster than that in Sub-Saharan Africa. But such decline is not sufficient to enable South Asia to outperform any of the regions. As we saw earlier, South Asia has relatively lower levels of child mortality than two African regions, namely Sub-Saharan Africa and Eastern and Southern Africa. The advantage of South Asia over these African regions appears to have declined in terms of under-nutrition. This reversal, then, brings South Asia the dubious distinction of being a region with the highest levels of child under-nutrition in the world.

2.2. Mortality of Adults

The region is also witnessing an increasing burden of disabilities and deaths among adults from diseases, both communicable and non-communicable. This includes morbidity and mortality of women and men due to old and emerging diseases on the one hand, and malnutrition and mortality of women due to factors specific to them on the other. Communicable diseases also wreak havoc among adults, as they do among children in South Asia, leading to growth in the extent of disabilities and deaths. Although TB and HIV/AIDS are increasingly affecting adults, both diseases also affect children, but to a lesser extent.

By and large, the prevalence rate of HIV/AIDS remains quite low in the South Asian region. But there are wide variations between countries within the region. While the prevalence rate is low in some of the smaller countries, such as Afghanistan, Bhutan, the Maldives and Sri Lanka, it is rising slowly in Nepal, Pakistan and India. Following South Africa, India

houses the second largest number of HIV/AIDS-infected people in the world (over 5.58 million in 2003), due to the sheer size of her population (Zaidi, Awasthi and deSilva, 2004).

Similarly, tuberculosis is widespread in most of the countries, with Afghanistan having the highest rate. Though the prevalence of tuberculosis is relatively lower in India, the presence of a large number of people with HIV/AIDS creates a conducive climate for a rapid spread of the disease. The overall prevalence rate of such communicable diseases, such as malaria, typhoid, dengue and hepatitis B and C, remains quite low in South Asia (Zaidi, Awasthi and deSilva, 2004). Yet, they continue to cause a huge and increasing burden of morbidity in recent years. As is clear from Table 4, four communicable diseases account for nearly 20 per cent of all adult deaths, of which deaths from tuberculosis alone constitute more than half. While tuberculosis and HIV/AIDS together account for more than 20 per cent of deaths of adult males in South Asia in 2001, the proportion was relatively lower (12 per cent) for adult women.

Table 4 Causes of adult (15-59 years) deaths in South Asia, 2001 (%)

Causes of deaths	Male	Female	Total
Infectious diseases			
Diarrhoeal disease	0.5	0.4	0.4
Respiratory infections	1.6	1.4	1.5
HIV/AIDS	8.6	3.0	6.2
Tuberculosis	11.5	9.3	10.6
Maternal-related causes			
Nutritional deficiencies	1.1	2.1	1.5
Maternal conditions	-	11.4	4.9
Non-communicable diseases			
Diabetes mellitus	1.4	1.4	1.4
Respiratory diseases	6.0	6.8	6.3
Cancer	6.4	9.3	7.7
Cardiovascular diseases	21.6	18.9	20.4

Source: Authors' calculation from Mathers, Lopez and Murray 2006:156-61.

Many new forms of non-communicable, chronic diseases join hands with these old torments in the South Asian region. Almost half of the disease burden in South Asia is caused by non-communicable diseases. Table 4, which also contains information on non-communicable diseases, shows that cardiovascular diseases, for instance, account for about 20 per cent of all adult deaths in the region. The percentage in 2001 was only marginally higher among men (22 per cent) than women (19 per cent). Though cancer causes nearly 8 per cent of all adult deaths in the region, it is

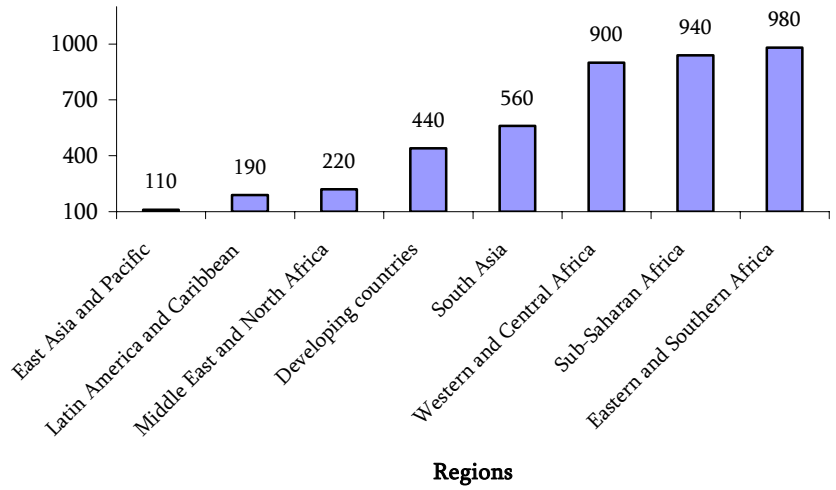
relatively higher among adult women than men. Diabetes was responsible for over 1 per cent of adult deaths in 2001.

In India, the largest country in South Asia, chronic diseases were responsible for an estimated 53 per cent of all deaths in 2005 (Reddy *et al.* 2005:1744). Of these, the share of cardiovascular diseases is around 29 per cent, followed by cancer and chronic respiratory diseases with 7 per cent each. Interestingly, while the proportion of cardiovascular disease has come down from 32 per cent of all deaths in India in 2000 to 29 per cent in 2005, the share of deaths resulting from diabetes has increased from 1 per cent of all deaths in India in 2000 to 2 per cent in 2005 (Ghaffar, Reddy and Singhi, 2004; Reddy *et al.*, 2005). Though diabetes contributes only 2 per cent of all deaths in India, that in itself is enough to have a higher number of people with diabetes than any other country in the world.

Equally, while non-communicable deaths constitute about 48 per cent of all deaths in the Maldives, deaths from stroke alone account for 11 per cent of all deaths here. Again, cancer contributes to around 6 per cent of all deaths in Sri Lanka, which is only marginally lower than the rate found in India (7 per cent). Cardiovascular diseases, which account for nearly 20 per cent of adult deaths, also debilitate Sri Lanka significantly. While one-third of Pakistanis aged above 45 years suffer from hypertension, the prevalence of diabetes is not low either. In fact, Pakistan is one of the top ten nations having higher number of people with diabetes (Ghaffar, Reddy and Singhi, 2004). Thus, the non-communicable, chronic diseases and the disability and mortality arising there from pose a serious challenge to the region, which is already burdened heavily with communicable diseases.

Table 4 also reveals that maternal-related factors account for over 11 per cent of deaths among adult women in South Asia in 2001. Since these factors relate to maternal mortality in one way or other, a look at the extent of maternal mortality in the region is of some relevance here. Though South Asia has a relatively lower maternal mortality ratio than most of the African regions, as is clear from Figure 1, it is not particularly low. With a maternal mortality ratio of 560 and with a higher lifetime risk of maternal death of 1 per 43 deliveries, the region fails miserably from preventing the loss of so many lives of women (UNICEF, 2007).

Figure 1 Maternal mortality ratio across regions, 2000 (per 100,000 live births)



Source: UNICEF 2006a

In fact, India is one of the two countries (besides Nigeria) that account for nearly one-third of all maternal deaths worldwide (Filippi *et al.*, 2006). While haemorrhage is the leading cause of maternal deaths in Africa and Asia, anaemia and obstructed labour each account for one-tenth of deaths in Asia (Khan *et al.*, 2006). Analysis suggests that given the present rate of decline in malnutrition and maternal mortality, the region is unlikely to meet the target set for 2015 by the Millennium Development Goals. The target was for a reduction in the maternal mortality ratio of three-quarters between 1990 and 2015 (MHHDC, 2004). That said, it is important to add that the decline in maternal mortality is more pronounced in some of the South Asian countries such as Sri Lanka.

The relatively higher maternal mortality ratio relates directly to maternal anaemia, which is endemic in the region. For instance, more than 48 per cent of pregnant women and 60 per cent of non-pregnant women in South Asia (excluding India) suffered from anaemia in one form or other in 2000. The corresponding percentages are much higher in India: nearly 72 and 71 per cent respectively (Mason *et al.*, 2005). Analysis suggests that the risk of maternal mortality tends to go up with an increase in the intensity of maternal anaemia: from mild to severe. Maternal anaemia alone accounts for over

7 per cent of maternal mortality in Asia in 1991 (Brabin, Hakimi and Pelletier, 2001).

3. Poverty and Mortality in South Asia: The Synergy

Child mortality is not simply a premature termination of life, but also implies the denial of the right of a person to live their full life. It thereby signifies the failure of the state or of governance (Sen, 1998). The higher levels of infant mortality should therefore be a cause for concern from a range of vantage points. Why do such excessively large numbers of children in South Asia die in infancy? As is apparent from the preceding discussion, infectious diseases, malnutrition and neo-natal disorders combine to play a fatal role in endowing the region with high rates of death in infancy and childhood.

It is fairly apparent that infectious diseases are associated with a combination of social and physical environment that characterise poverty. For instance, unhygienic living conditions, limited or lack of access to clean water, toilet facilities, immunisation and quality healthcare are some of the factors that make children vulnerable to infections (Black, Morris and Bryce, 2003). Similarly, malnutrition is also associated with a cluster of related, often coexistent, factors that together constitute what may be termed as the poverty syndrome (Gopalan 1992:18). More than poverty, neo-natal infections and disorders–responsible for more than 50 per cent of child deaths in South Asia–are an outcome largely of maternal malnutrition and mortality, which are associated closely with gender inequality (Matthews, 2002).

If poverty were the primary factor underlying the death of children, are the levels of mortality higher in poor regions and poor socio-economic groups? Indeed, nearly 99 per cent of childhood deaths occur in less-developed countries marked by lower income. Not only is under-5 mortality rate excessively high in low income countries, but it also registers a secular decline commensurate with increasing levels of income. For instance, the under-5 mortality rate among the richest households is only one-third of the rate found among the poorest households in India (Victora *et al.*, 2003).

As stated already, nearly 75 per cent of child deaths occur in two regions: 41 per cent in Sub-Saharan Africa and 34 per cent in South Asia (Black, Morris and Bryce, 2003). It is therefore only natural to find four

South Asian countries –India, Pakistan, Bangladesh and Afghanistan– among the top ten counties in terms of high child mortality. The large gaps in child mortality between poor and rich countries as well as between poor and rich households within these countries relate to the entrenched inequalities in income, and hence inequality in access to services and facilities that are essential for saving lives. In a sense, these excessive socio-economic gaps in child mortality are not simply inequalities, they are also a mark of inequity–inequalities that are unjust and unfair (Victora *et al.*, 2003:233).

Since under-nutrition is the underlying cause of more than 52 per cent of child deaths, it is important to reflect on the association between malnutrition and mortality. We have already seen that child malnutrition is higher in South Asia than in Sub-Saharan Africa. At the same time, child mortality levels are relatively lower in the former than the latter region. What is more, poverty levels are also lower in South Asia than in Sub-Saharan Africa (Klasen, 2006). If malnutrition were the underlying cause for the mortality of children, we would expect a relatively higher level of child mortality in South Asia than in Sub-Saharan Africa, given the high levels and number of malnourished children. However, the reverse is the case. What could explain this anomaly–a phenomenon referred to, by Ramalingaswami, Jonsson and Rohde (1996), as the *Asian Enigma*?

Two competing hypotheses are advanced to explain this anomaly. First, it has been argued that the higher incidence of malnutrition in South Asia is likely to a statistical artefact. That is, the use of US-based reference standards that are inappropriate to the South Asian region appears to generate misleading estimates on under-nutrition. Most importantly, it tends to over-estimate the incidence of under-nutrition– between 8 and 20 percentage points–in South Asia (Klasen, 2006:13). Similarly, a careful examination of the methodology employed by the FAO in estimating child under-nutrition suggests that FAO estimates are biased upwards and thereby over-estimate the incidence of child under-nutrition in South Asia (Svedberg, 2002).

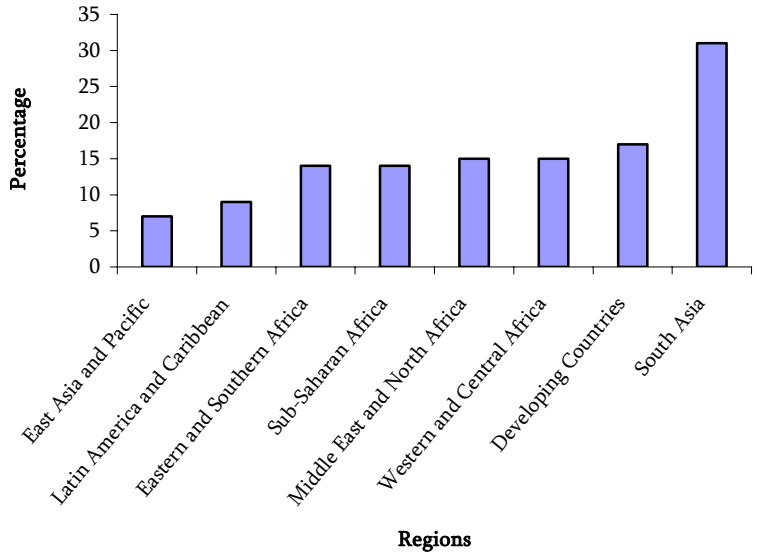
Notwithstanding the possibility of the over-estimation of child under-nutrition in South Asia, we would like to pose a question here. Should child malnutrition always and essentially result in child mortality? Or, alternatively, is it possible to intervene and break the cycle from reaching its rational end? It has been argued that South Asia has better access to modern healthcare,

and especially to life saving antibiotics. Also, South Asia has a larger number of private medical practitioners than Sub-Saharan Africa. Although these practitioners possibly can and do save more lives, they do relatively little to improve the nutrition situation (Ramalingaswamy, Jonsson and Rohde, 1996; Osmani and Bhargava, 1998). If this is true, then the enigma conveys that a higher incidence of malnutrition need not necessarily end up in an equally higher level of mortality, provided there is an increased access to healthcare services.

Equally, the coexistence of relatively lower levels of poverty with higher under-nutrition (even after correcting for the upward bias) suggests that the lower incidence of poverty does not necessarily imply equally lower experience of hunger in the region, since malnutrition signifies hunger and food insecurity. South Asian countries such as India, for instance, produce enough food to feed themselves. Yet, both the number and rate of under-nourished children are extremely high in India. What is more, even the higher and growing rate of aggregate growth in the economy that is the case with India, does not necessarily mean a significant decline in child under-nutrition (Svedberg, 2006). Though hunger is an outcome of many factors, it also impinges on the poor's failure to get that to which they are entitled (Sanchez and Swaminathan, 2004).

It emerges from Figure 2 that the incidence of babies with a low birth weight (below 2.5 kg) is much higher in South Asia (31 per cent) than Sub-Saharan Africa (14 per cent). Babies with low birth weight are not only born with a disadvantageous health outlook, but also have a greater propensity to suffer from malnutrition later. Detailed analysis reveals that the presence of a substantially large number of birth weight babies contributes significantly to the high levels of malnutrition found in the region. For instance, the higher number of low birth weight babies found in the region explains almost entirely the higher prevalence of stunting in South Asia (Osmani and Bhargava, 1998).

Figure 2 Incidence of low birth weight babies across the regions, 2000



Source: UNICEF, 2006b

The low birth weight reflects essentially the quality of maternal nutrition, because women who experience greater nutritional stress during pregnancy tend to bear low birth weight babies (Rasmussen, 2001). We have already mentioned that a substantially large proportion of pregnant women, as high as 48 per cent, suffer from anaemia in South Asia (excluding India). Given the much higher percentage of anaemia among pregnant women in India (over 70 per cent), inclusion of India would certainly give even much higher percentage than that found in 2000 in Sub-Saharan Africa (47 per cent) (Mason *et al.*, 2005). Viewed differently, through low birth weight, maternal malnutrition partly accounts for the high incidence of child malnutrition of South Asia.

The implications of maternal malnutrition extend beyond child malnutrition in South Asia. They are closely related to the emerging tide of chronic diseases, and thereby lend increasing importance to the 'foetal origin of adult disease' hypothesis, in South Asia. The hypothesis presumes that malnutrition during pregnancy forces the baby in utero to adapt to survive but with a permanent disadvantage at the later life (Barker, 1995). Specifically, foetal growth restriction due to maternal malnutrition leads,

inter alia, to low birth weight babies. The low birth weight not only predisposes poorer health in early childhood, but also endows the child with an inherent vulnerability to chronic degenerative diseases, including hypertension, heart disease, type II diabetes and some of the most serious forms of cancer in adulthood (Barker, 1995). There is some empirical evidence from India lending credence to the hypothesis (Stein *et al.*, 1996).

As we have already shown, the region is experiencing an increasing burden from diseases such as coronary heart disease, hypertension, cancer and diabetes. The roots of these diseases are obviously traceable to the poor nutritional status of women. If maternal malnutrition is such a crucial a factor causing such disabilities and deaths for both children and adults alike, what is primarily responsible for the increased assault on women's nutrition? We have already seen that malnutrition is largely an outcome of a cluster of factors that characterise poverty (Gopalan, 1992). Viewed in this way, women's malnutrition would signify both the manifestation and their unequal experience of poverty and associated hunger. However, analysis suggests that there is something regressive in the culture of the South Asian region that leads to the excessive neglect of maternal nutrition. This is in addition to the usual determinants of health and nutrition (Osmani and Bhargava, 1998; Osmani and Sen, 2003).

There is enough evidence to suggest that the socio-cultural norms prevalent in the most part of South Asia not only devalue women's well-being through a variety of reinforcing ways, but also discriminate against women even in crucial matters such as the allocation of healthcare and food (Agarwal, 1994). Apart from these socio-cultural factors, the demands made in the patriarchal societies of South Asia on the time and energies of women are excessive and unfair than in other regions of the world (Ramalingaswamy, Jonsson and Rohde, 1996). Therefore, addressing gender inequality is central to ensuring better health and nutrition for children and adults in the region (Osmani and Sen, 2003).

Thus, while part of the burden of diseases in the region comes from poverty, gender inequality contributes much of the rest. While lower respiratory infection, diarrhoeal diseases and tuberculosis–which are associated with poverty–cause around 17 per cent of burden of disease, the contribution of chronic diseases is not altogether low. Ischemic heart disease alone, for instance, accounted for over 6 per cent of total burden in the region in

2001. Gender inequality is likely to be the mediating factor not only for the chronic diseases, but equally for perinatal conditions, which are responsible for over 9 per cent of burden (Mathers, Lopez and Murray, 2006; pp. 91). In India, chronic diseases account for about 44 per cent of disability-adjusted life-years (DALYs) lost in 2005 (Reddy *et al.*, 2005).

Equally, the mortality and disability arising from poverty and gender inequality are themselves a cause of poverty. It is increasingly clear that much of the burden of non-communicable diseases occurs in the region during the productive mid-life period, and will therefore adversely affect workforce productivity and economic development (Ghaffar, Reddy and Singhi, 2004). Similarly, the estimated cost caused annually to the region by maternal anaemia is as high as $5 billion (Darnton-Hill *et al.*, 2005). The contribution of child malnutrition in reinforcing the poverty in the region is likely to be quite high.

Detailed estimates suggest that 27 per cent of children under five years in South Asia are living in poverty. This could be as many as 46 million. If we add the number of malnourished (stunted) children to the number of poor children, there were around 89 million disadvantaged children in South Asia, or 52 per cent, in 2004. (Grantham-McGregor *et al.*, 2007:65). These numbers are likely to come down, given the declines in fertility, poverty and malnutrition underway in the region. But beyond these staggering numbers are the economic and social implications of such disadvantage faced by the children for the regions. The disadvantaged children are destined not only to be less educated and have poorer cognitive functions than their peers, but are also more likely to be less productive economically (Grantham-McGregor *et al.*, 2007:67). Thus, malnutrition and mortality are not only the consequence of poverty, but equally its cause.

4. Concluding Remarks

The discussion from the preceding sections raises at least two aspects that have a bearing on policy. The relatively higher levels of malnutrition of children in combination with infections and the loss of lives arise there from are closely associated with poverty and the poignant social and physical environment it breeds. What is more, these poor and malnourished children are bound to become victims of poverty and hunger, through their reduced educational, physiological and economic development. Therefore, poverty

reduction is not only important on its own, but it is also central to the reduction of child mortality and malnutrition and hence the huge economic and social costs arising there from. This was envisaged in the Millennium Development Goals.

It is emerging equally clearly that gender inequality plays a critical role in leading to and reinforcing the burden of death and disability in the region. The neglect of maternal nutrition causes a high incidence of low birth weight, which in turn causes poor child nutrition, vulnerability to infection and child mortality, and the foetal malnutrition leads to increasing vulnerability to disabilities and deaths from chronic diseases at later stages on the other. Addressing maternal malnutrition is therefore central in arresting and reversing the burden that looms large in the South Asian region. The enormous economic and social gains associated with reduced maternal malnutrition call for increased policy intervention. Yet, it is equally a call for ending the lack of freedom associated with malnutrition, and the consequent indignity experienced by women.

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3

Mortality, Poverty and Nutrition in the Pacific[1]

Kesaia SENILOLI

1. Introduction

In mid-2004 the population of the Pacific region was estimated at 8.6 million (SPC, 2004). Pacific Island populations are small by world standards and population and development issues such as poverty and nutrition are of immense concern in these countries. Many people do not associate poverty and nutritional problems with the Pacific Island countries; they usually link them with sub-Saharan Africa or Asia. The Pacific reality, though, is different from the tourist picture post card. The Pacific Island countries have fragile ecosystems and economies and they are part of the 'ring of fire' vulnerable to natural disasters such as volcanoes and earthquakes as well as hurricanes, droughts and flooding. With the exception of Melanesia, agricultural land is limited. The atoll islands can support only local populations. They are remote and their resource base is limited. Indeed, poverty *is* an issue in the Pacific but its severity varies between countries and within countries.

The Pacific Island countries, though spoken of as some kind of homogeneous unit, do in fact display one of the most diverse social, economic and demographic profiles. These countries are undergoing various types of transitions, not least of a demographic and socioeconomic nature. The consequence is that they are characterized by vast differences in levels of economic development, which are reflected in anomalous differences in health development.

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The region contains countries at virtually all stages of the demographic, epidemiological and nutrition transitions. The epidemiological transition is the shift in mortality and disease patterns. It begins with the prevalence of infectious diseases associated with under nourishment and unsanitary conditions, and ends with the prevalence of non-communicable diseases. This era of transition has also brought about the nutrition transition involving a high prevalence of under-nutrition to one where dietary excesses contribute significantly to the predominance of non-communicable diseases. Accordingly, because Pacific countries are at different stages of socio-economic development there are differences *between* the sub-regions (Melanesia, Micronesia and Polynesia) and even *within* sub-regions, with regard to morbidity and mortality.

The aim of this paper is twofold. First it reviews the patterns of Pacific morbidity and mortality and causes that explain these patterns. Second, it aims to examine the links between morbidity and mortality and poverty and nutrition.

2. Matters of Data Quality

Mortality data used in this study were collected from various sources. Death registration in many Pacific Island countries is incomplete and in many cases data have been adjusted for under-enumeration or calculated by indirect methods using census data.

Cause of death is very difficult to establish. There are problems of discrepancies and errors in the diagnosis of diseases. This diagnosis can be obtained by the physician or it can be obtained by interviewing the bereaved relatives on symptoms experienced by the deceased before death. Identification of a disease as the cause of death therefore is laden with difficulties. Some countries in the Pacific are still using 'ill-defined and unknown' as a label for the cause of death (Lopez, 2002). Death certification assumes medical knowledge about the seriousness of the disease and its interconnectedness with other diseases. In Fiji, however, it also depends on the skill of the coder in classifying the cause on the basis of the information provided on the death certificate. The coder is often an officer with no medical training or even training in classifying diseases (Lopez, 2002). Causes of death therefore in Pacific Island countries must be treated with caution.

Moreover, under-registration of deaths in the Pacific is a long-term problem. McArthur (1967) estimated that 10–15 per cent of all deaths were unregistered. Taylor (1989) estimated that in the 1980s only 80 per cent of all deaths were registered. Even in the late 1990s, mortality statistics continued to be incomplete.

3. Infant and Child Mortality Rate

Gains in life expectancy in the Pacific region are one of the major achievements of the 20th century. Pacific Island countries have benefited from improved health technologies and public health measures. The share of declining infant and childhood mortality in these gains is significant. Nevertheless, high infant mortality persists, largely because of the prevalence of often preventable communicable diseases.

Table 1 shows the decline in the infant mortality rate (IMR) in most Pacific Island countries.

Table 1 Change in infant mortality rate, 1970–2000 (Per 1,000), and per capita GNI, 2001

Country	1970–80s	1995–2003	Per capita GNI $US
MELANESIA			
Fiji	23	22	2,150
Papua New Guinea	72	64	580
Solomon Islands	71	66	590
Vanuatu	94	27	1,050
MICRONESIA			
Federated States of Micronesia	51	40	2,150
Kiribati	82	44	830
Marshall Islands	61	37	2,190
Nauru	31	42	2,150
POLYNESIA			
Cook Islands	28	21	4,270
Samoa	33	19	1,490
Tonga	41	12	1,530
Tuvalu	43	35	1,260

Source: http://www.spc.int/demog (IMR).
http://adb.org/documents/books/key_indicators/2003 (GNI)

This decline is uneven across the region. Countries with lower levels of infant and mortality rates are Polynesian countries and Fiji. These countries have instituted public health measures to combat infectious diseases. For Fiji, the biggest decline, occurring in the early 1950s, can be attributed to a number of factors, including the significant increase in access to health services. The number of health centres, dispensaries and nursing stations

increased. The number of nurses also increased, and health personnel assisted in educating parents in the care of sick children. This also meant that any new medical programme such as the immunization programme could be delivered quickly. The decline in infant and child mortality can also be attributed to the Health Department's focus on maternal and child health (Roizen, 1996).

Other factors that have contributed to the decline in infant and childhood mortality are increasing urbanization and better transportation, making people better able to access medical care. Women also became better educated, resulting in favourable health seeking behaviour and improvement in standards of living. Change in standards of living can also be attributed to the entry of larger numbers of people into the cash economy. In recent years successful immunization programmes have contributed to reductions in infant mortality rates (Roizen, 1996).

The Micronesian countries have high infant mortality rates of about 40 per 1000. These countries are yet to provide adequate health care systems to control the spread of infectious diseases, especially among the under 5-year-olds. In Kiribati overcrowding, especially in the urban area, scarcity of clean water and poor sanitation contribute to a higher infant mortality rate (Seniloli, 2002).

While the infant mortality rate is improving in most Pacific Island countries, a rather worrying trend has been experienced in two countries, Nauru and the Solomon Islands. Not only did both these countries fail to maintain their IMR level; they actually experienced reversals in the trend. Further, the evidence suggests that relatively high incomes do not automatically contribute to lower mortality levels such as in the lowering of infant deaths and the improvement in life expectancy (Table 1).

Child mortality (Table 2) has declined in the last decade, 1990–2000. However, it is relatively high in Papua New Guinea, the Solomon Islands, Vanuatu and in the atoll states of Kiribati, Federated States of Micronesia and the Marshall Islands. The high child mortality levels in these countries are due mainly to respiratory diseases (particularly pneumonia), diarrhoea, malnutrition and peri-natal causes. Fiji and the Polynesian countries have achieved success in reducing child mortality.

4. Adult Mortality

In recent times, focus in the Pacific Island countries has been on premature deaths among adults. Premature adult mortality is defined as those at risk of death before age 60 among those who reach age 15 years (Table 2).

Table 2 Change in child (0-4) mortality rate (per 1,000 live births) 1990–2000 and in adult (15-59) mortality levels (per 1,000) in 2000

Country	Child mortality		Adult mortality
	1990	2000	2000
MELANESIA			
Fiji	29	25	187
Papua New Guinea	112	99	282
Solomon Islands	55	69	179
Vanuatu	74	58	217
MICRONESIA			
Federated States of Micronesia	na	60	202
Kiribati	na	77	232
Marshall Islands	na	44	328
Nauru	na	na	407
POLYNESIA			
Cook Islands	na	21	152
Samoa	58	22	219
Tonga	na	23	190
Tuvalu	na	55	263

Source: Adapted from Lopez, 2002, Table III.2

Table 3 Life expectancy at birth for both sexes, 1980–2000

Country	1980s	2000
MELANESIA		
Fiji	63.1	67.0
Papua New Guinea	49.6	54.5
Solomon Is	60.7	61.5
Vanuatu	55.0	67.5
MICRONESIA		
Federated States of Micronesia	58.0	67.0
Kiribati	53.1	64.0
Marshall Islands	60.0	67.5
Nauru	55.0	55.5
POLYNESIA		
Cook Islands	67.0	71.0
Samoa	62.6	73.0
Tonga	63.0	71.0
Tuvalu	59.0	63.0

Source: Bakker (1990: Column 2 of Table 111) (1980s data)
http://www.spc.int/demog/ (2000 data)

Premature adult mortality is high in Nauru, the Marshall Islands, Papua New Guinea and Tuvalu. The levels of adult mortality are higher than

expected given the levels of child mortality in the Marshall Islands, Samoa and Tuvalu (Lopez, 2002).

Life expectancy at birth has improved slowly in the region in the last two decades (Table 3). In 2000 the range was from 55 years to 73 years, reflecting the differences in levels of health development in the region. Nauru, with the highest diabetes rates in the world, has the lowest life expectancy at birth and made virtually no gain in the last two decades of the century.

5. Patterns of Morbidity and Mortality and the Epidemiological Transition

Most Pacific Island countries have experienced the mortality transition, which essentially describes a state of high mortality due to the incidence of infectious and parasitic diseases, followed by a state of low mortality, resulting from the successful control of communicable diseases. The mortality transition is associated with the epidemiological transition, which focuses on changes in disease patterns and causes of mortality. This is the shift from a pattern of high prevalence of infectious diseases to a high prevalence of chronic and degenerative diseases.

Table 4 shows the diseases recorded by the Pacific Island countries. It is obvious that in some cases the same conditions are classified differently and not according to the International Classification of Diseases (ICD) standard. Health data from the Pacific Island countries must be treated with caution.

In the Pacific Island countries, infectious diseases such as respiratory diseases tend to kill infants and people in their productive years. These diseases are receding in importance. Consequently, as we have seen, infant and child mortality is declining in most Pacific countries, though infant mortality is still relatively high in Papua New Guinea and the Solomon Islands (Tables 1 and 2). These two countries and parts of Vanuatu are in the malaria belt. Outbreaks of dengue fever occur in both Melanesia and Polynesia. Tuberculosis, lymphatic filariasis and yaws are still found in some of the Pacific Islands. There are frequent outbreaks of respiratory diseases and diarrhoea, and occasional outbreaks of cholera and typhoid. Hepatitis B is regularly found in a number of island countries

Many people suffer from diabetes mellitus, which all too often brings with it long-term complications such as diabetic eye disease, kidney damage, nerve damage, peripheral vascular disease, foot ulceration leading to amputation, heart disease and stroke (WHO, 2000). It is a costly disease as it occurs among the economically active age groups. It is costly to the health system and to the community (WHO, 2000). In Nauru, for instance, diabetes prevalence rates are above 20 per cent in the population. Heart diseases, cerebrovascular disease and cancer are now the major causes of mortality (Table 4). The Pacific Islands region follows to some extent the epidemiological transition, the general shift in mortality and disease patterns where the pandemics of infection are progressively being displaced by degenerative diseases. There has also been a shift in the average age of death from infancy, to childhood to adulthood and older ages.

The epidemiological transition was thought to be a one-way process, but it appears that the transition is more complex and that it evolves in diverse ways, with some diseases disappearing and others re-emerging, a result of demographic, socioeconomic, technological, cultural and environmental changes (Wahdan, 1996). In general, in the last stage of the epidemiological transition, people who reach 70 years or more suffer and die from non-communicable diseases. However, the Pacific Island countries deviate from this in that significant numbers of adults are dying prematurely between ages 35 and 65 years. They usually die from diabetes mellitus, coronary and vascular diseases and from the effects of obesity. That is to say, the Pacific Island countries are characterized by the early onset of non-communicable diseases.

Table 4 Leading causes of morbidity and mortality, (per 100,000)

Morbidity		Mortality	
MELANESIA			
Fiji (2001)			
Respiratory diseases	614	Diseases of the circulatory system	330
Circulatory diseases	501	Respiratory disease	50
Injury and poisoning	401	Infectious and parasitic diseases	46
Infectious and parasitic disease	364	Neoplasm	38
Genitourinary disease	321	Injury and poisoning	32
Papua New Guinea (2000)			
Normal deliveries	1083	Pneumonia	19
Pneumonia	610	Perinatal conditions	16
Malaria	589	Malaria	13
Perinatal conditions	165	Tuberculosis	10
Direct obstetric causes	160	Meningitis	8
		Heart and pulmonary conditions	6
*Solomon Is – morbidity 2001, mortality 1999**			
Acute respiratory diseases	36,383	Neoplasm	n.a
Malaria	30,610	Neonatal causes	n.a
Fever (syndromic)	28,768	Malaria	n.a
Skin diseases (excluding yaws)	8,603	Cardiovascular diseases	n.a
Ear infections	4,858	Respiratory diseases –pneumonia as the leading causes	n.a
Vanuatu (2003)			
Acute respiratory diseases	20,227	Asthma	11
Malaria	10,414	Stroke	9
Skin diseases	3,733	Heart failure	9
Worms	2,125	Diabetes mellitus	9
Diarrhoea	1,506	Malaria	7
MICRONESIA			
Federated States of Micronesia (2003)			
Pregnancy complications	2,775	Diseases of the circulatory system	116
Respiratory diseases	1,625	Neoplasms	57
Infections and parasites	1,167	Diseases of the respiratory system	55
Diseases of circulatory system	1,129	Endocrine/metabolic diseases	54
Endocrine/metabolic diseases	1,113	Infections and parasites	40
Kiribati (2002)			
Acute respiratory infections	179,483	Ill defined conditions	134
Diarrhoeal diseases	46,305	Diseases of the circulatory system	80
Eye diseases	17,582	Diseases of the digestive system	64
Skin conditions	4,619	Infectious and parasitic diseases	65
Injury and poisoning	2,392	Diseases of the respiratory system	9
Marshall Islands (1998)			
Gastroenteritis	1,614	Malnutrition	32
Scabies	1,603	Accidents (all types)	32
Influenza	1,595	Sepsis	27
Conjunctivitis	1,422	Pneumonia	19
Diarrhoea–adults	975	Cancer (all types)	19
Nauru			
Unclassified	2,503	Diabetes	160
Confinement-postpartum care	1,550	Respiratory infection/pneumonia	149
Newborn	1,439	Diseases of the circulatory system	119
Diabetes	715	Malignant neoplasm	80
Hypertension	715	Accidents	80

Table 4 Leading causes of morbidity and mortality, (per 100,000) *(Continued)*

Morbidity		Mortality	
POLYNESIA			
Cook Islands (2002)			
Injury and poisoning	2,130	Diseases of the circulatory system	103
Diseases of the circulatory system	1,690	Endocrine, nutritional & metabolic diseases	71
Diseases of the respiratory system	1,668	Neoplasms	82
External causes of morbidity	1,369	Ill defined conditions	54
Diseases of digestive system	940	Diseases of the respiratory system	43
Samoa (2000)			
Spontaneous vertex delivery	1,326	Diseases of the circulatory system	32
Pneumonia	560	Disease of the respiratory system	27
Injury, poisoning & other consequences	510	Conditions originating in the Perinatal period	19
Certain infections & parasitic diseases	426	Infectious and parasitic diseases	13
Disease of the digestive system	401	Endocrine, nutritional & metabolic diseases	12
Tonga			
Acute respiratory infection	20,437	Diseases of the circulatory system	190
Influenza	19,689	Neoplasm	77
Broncho pneumonia	1,911	Ill defined conditions	54
Diarrhoea (adults)	992	Disease of the respiratory system	50
Diarrhoea (children)	659	Endocrine, nutritional & metabolic diseases	28
Tuvalu (2000)			
Septic sores/wounds	22,407	Heart problem	220
Influenza	38,311	Third degree burn	115
Acute respiratory infection	30,854	Senility	105
Headache	24,087	Stillbirth	52
Cough	19,767	Diabetes	52

Note: * The leading causes of morbidity for Solomon Island are based on the information provided by Liaison officer of Solomon Island. Data on cause specific mortality are not available.
Source: http://www.wpro.who.int/

At times a reverse of the trend occurs, such as the emergence of new infections like HIV/AIDS and the re-emergence of infections previously controlled, such as tuberculosis, yaws and dengue fever. A few stages of the transition may occur in different groups but within the same population at the same time. The decline in infectious diseases may be slow or stalling in certain groups, while non-communicable diseases may affect other groups in the same population. Crude death rates in the Pacific are low by world standards because of the effects of the age structure. These rates obscure the major health problems. The islands exhibit a mixed pattern of morbidity and causes of mortality. Communicable diseases are still found in many of the Pacific communities because of the environmental problems they face such as unsanitary environments and population densities that are very high. This is the case in Betio in Kiribati and Ebeye in the Marshall Islands. At the same time, there is a sizable proportion suffering and dying from non-communicable diseases.

The double burden disease theory is very apparent in many Pacific countries (Table 4). All countries recorded both infectious and non-communicable diseases as amongst the five leading causes of morbidity and mortality. Most countries of the Pacific are struggling not only with old and new infectious disease epidemics but also with the emerging epidemics of chronic and communicable diseases such as heart disease, stroke, diabetes and cancer.

Most Pacific Island nations do not have the resources to cope with the 'double disease burden'. They cannot afford the enormous cost of technology and tertiary health care required for the diagnosis, treatment and management of these diseases. Nor do they have the infrastructure for disease surveillance and risk factor assessment.

6. Underlying Causes of Morbidity and Mortality Levels in the Pacific

Poverty is a difficult notion to conceptualize in the Pacific. Women of Melanesia term it as 'hardship'. Many deny that it is a relevant concept in the Pacific. This attitude has implications for data collection and data on poverty across the Pacific are lacking.

Many Pacific Island countries have struggled through generations to attain a reasonable standard of living from available resources. Others, on the other hand, are struggling just to survive. In general, Pacific cultures emphasize sharing and reciprocity. Nonetheless, in some communities, despite the support system, a sizeable proportion of people live in poverty

The World Bank has set the international poverty line at $1 for each person a day (World Bank, 2000). This covers a person's income or the amount of goods they consume. This is the minimum amount with which a person can meet his needs; a person whose income falls below this modest sum is considered to be living in poverty. Many, of course, have criticized this measure, as it does not take into account cost of living differentials within countries. It does not differentiate those trapped in permanent poverty from those who can easily move out of this situation. Further, the measure does not take into account goods from the subsistence sector.

A focus on income is not always helpful. Poverty is multidimensional and needs a broader definition. It requires different sets of indicators, such

as access to health services, availability of clean water, sanitation, life expectancy, maternal mortality rate and literacy levels. To measure poverty by a cut-off point above and below which lie sufficiency and poverty, without consideration of social variables other than income, is a good deal less than perfect. The poor are deprived of many things-services, resources, knowledge and opportunities. Economic growth is not a panacea to problems of poverty. Further, eradication of poverty is not only a matter of creating employment. Wages are also a critical issue. Close to half of those in full-time employment in Fiji, for instance, earn wages below the poverty line. These are the working poor.

Underpinning poverty are the fundamental issues of slow economic growth, high urban population growth rates and minimal employment opportunities. From the outset, the Pacific Island countries are small and do not enjoy economies of scale; they suffer from external shocks such as climatic events or market failures and have a narrow economic base. The economic performance of Pacific Island countries in 2002 was described as lack-lustre by UNESCAP (2003). GDP growth ranged from a low of- 5 to a high of 4.4 (UNESCAP, 2003).

The Solomon Islands suffered a 14 per cent contraction in its economy as a consequence of civil unrest in 1999–2000 (UNESCAP, 2003). Fiji also experienced political turmoil in 2000. Such events threaten lives and livelihoods. Moreover, they deter investment and reduce employment opportunities. As a result of Fiji's 2000 political coup, GDP contracted by 2.8 per cent, unemployment increased and emigration resulted in pronounced skills shortages (UNESCAP, 2003). The garment industry in Fiji, a major source of employment for the poor, was especially affected by the political problems of 2000. United Apparel, one of the larger garment companies, lost FJD200,000 in six weeks after the May coup. The industry lost FJD10 million a month. This meant that 14 of the 48 garment factories closed down (Storey, 2004). The departure of investors resulted in major social problems such as an increase in unemployment and its attendant social ills. About 8,000 jobs were lost (Storey, 2004). Those who lost their jobs were mostly the working poor.

Similarly, the economy of the Solomon Islands headed towards total collapse as result of ethnic conflict in 1999–2003 (WHO, 2004). Decreased economic activity resulted in unpaid wages, poor maintenance of health

facilities, job redundancies and increased unemployment (WHO, 2004). This is reflected in the reversal of infant mortality levels to 66 and the rise in the prevalence of infectious diseases as the major causes of morbidity and mortality. Likewise, the other country described as part of the 'arc of instability' is Vanuatu, which since 1996 has also experienced political instability in the form of seven changes in government, one bloodless coup and a national state of emergency (FAO, 2003). This has discouraged overseas investment in the country.

Samoa's economy performed well in 2000–2001 but lost ground in 2002 (UNESCAP, 2003). Papua New Guinea and Vanuatu recorded contraction in GDP in 2002 (UNESCAP, 2003). Overall, the pattern of GDP growth had been low and uneven in the Pacific region. Because of the low growth in the economies of South Pacific countries, unemployment is a problem. This is aggravated by the reduction in fertility, which has resulted in increasing proportions in the working age group 15–64 years. This large proportion cannot all be absorbed into the labour market. A slow pace of economic growth in the region is constraining the ability of governments to increase budgetary allocations to health.

Another factor that can set a country's development back by years or even decades is natural disaster. Disasters affect the land and communities. The Pacific Island countries lie along weak areas of the Earth's crust, the so-called Ring of Fire, where the damaging effects of frequent earthquakes and volcanic activity attest to the accuracy of the sobriquet. The region also lies in the regular path of tropical cyclones and is subject to hurricanes and storms (FAO, 2001). Disasters mean the loss of past development gains and can arrest development and improvements, by shifting the focus to disaster management. Those who suffer most are the most vulnerable, the poorest households in the affected population. Disasters also have a major impact on food security and nutrition (FAO, 2001). The prevalence of malnutrition among the poor is likely to increase and these communities are usually at risk of infectious diseases during such periods of disruption. Further, it usually takes a long time for these communities to recover from the devastation.

Communities weighed down by a heavy burden of disease tend to face difficulties in making economic progress. The burden of diseases can hamper economic growth (WHO, 2001). It is therefore imperative, in the inter-

ests of promoting economic development and reducing poverty, to invest in health. The improvements in health would in turn translate into higher income and higher economic growth. Many believe that economic growth in developing countries would automatically result in the lowering of mortality, eventually to a level similar to that in developed countries. However, the disease burden itself in developing countries will slow economic growth and any convergence of mortality rates will take a long time.

7. Health System

Currently, many Pacific Island countries are reforming their health systems to make them more responsive to rapidly changing socio-economic and political settings. Stable and effective health care funding that ensures access to good quality health services for everyone is a goal for many countries in the region. In the Pacific, the level of funding from different sources-taxation, health insurance, private payments and external support-is low. The World Bank recommended spending is at least US$15 per person per year (Bayarsaikhan, 2003). Pacific Island countries fall below this. Previously, governments were solely responsible for providing and funding health care. Health spending among Pacific Island countries as percentage of GDP ranges from a low 2.5 per cent in Papua New Guinea to 10 per cent in Nauru, depending on the size of the economy and foreign assistance (Bayarsaikhan, 2003). Private payments are increasing. The former trust territories of the United States have been affected by reductions in US compact funding. As a consequence these countries have introduced user fees (Bayarsaikhan, 2003). A flat-rate schedule introduced in the Cook Islands has mainly affected the people with low incomes. Everywhere in the region, the low levels of government spending on health have increased inequity in the delivery of services (Bayarsaikhan, 2003).

Globalisation and the information revolution have meant that new medical technology can be quickly adopted by other countries in a very short span of time. Currently the escalation of health care expenditure associated with new medical technologies has meant that more resources are needed than what most governments can afford. Most Pacific Island countries do not have the resources to cope with non-communicable diseases: the diagnosis, treatment and management of these diseases are notoriously costly. In addition, offshore referral costs are excessively high in

most Pacific Island countries, where intra-national referrals from the outer dispersed islands to the main hospital are also a necessity. Offshore and local referrals are an expensive component of health care expenditure. For instance, offshore referral accounts for 20 per cent of the health expenditure in Micronesia; similarly, in Marshall Islands 14 per cent of total expenditure covers the treatment of diabetes and referrals (Bayarsaikhan, 2003). This high cost of referrals must be set against a background of low health care budgets.

The quality of health care that a government provides for its people is an indication of how the quality of the government's concern. Countries should do more to make current spending more equitable and effective. Despite improvements in the health of the peoples of the Pacific in the last 50 years, major gaps remain. Health improvements have not been shared equally and there are health inequalities both between and within countries in the region. Health systems need to be responsive to client needs, particularly when the clients are the poor or live in remote places. More investment in health means more lives saved from infectious diseases and nutritional deficiencies.

The health spending of the developing countries of the South Pacific is low and most public health systems are underfinanced. These inadequate levels of health spending, determined mainly by the national budget, are first and foremost a reflection of slow economic growth. This is made worse by poor budgeting, planning and management at all levels of the health system. The overall low health care financing worsens the overall insufficiency of resources. In some countries health spending is slanted towards hospitals and away from cost-effective public health programmes (Bayarsaikhan, 2003). Health personnel still face shortages of drugs and most hospitals and health centres are ill-equipped or have equipment that is not maintained. In Fiji, borrowing of equipment from other sections of the same hospital or from other hospitals is by no means unknown.

Lack of an appropriate policy and framework to guide health care financing arrangements has led to a decline in equity, quality and efficiency of health care systems. Despite their importance for the effective analysis of existing data, an essential basis for health policy and planning, health information systems remain weak. The improvement of health information systems will require a coordinated effort by several sectors. Capacity build-

ing in the health sector in these countries is constrained by emigration and inadequate health budgets. Underlying these issues are broader questions of leadership, commitment and governance. For instance, the loss of doctors and nurses from the region need to be tackled. Politicians respond by appealing to doctors' sense of patriotism and duty. This is not enough. The policy makers need to have the will to develop packages that health personnel will find attractive (Moulds, 2004).

The migration of doctors and nurses is part of the globalization of health care, but at the same time it compromises the delivery of health services. The shortage of health care personnel in richer countries has a significant impact on the flow of health workers from developing countries such as the Pacific Island countries. The Fiji School of Medicine continues to lose its good graduates, who migrate to fill the shortfall of doctors in Australia and New Zealand (Moulds, 2004). This is a drain on the Pacific Island countries' human resources because their investment in the human capital development will benefit the recipient (developed) country. The Ministry of Health in Fiji is facing a shortage of doctors and nurses. Between 1992 and 2004 some 50 per cent of the total stock of nurses has left the service (Narsey, 2004). The Pacific Island countries, even the larger ones, are small and have few senior posts in the health sector, so upward career mobility is limited. In addition, the greatest pull is the disparity in work conditions and remuneration.

The loss of doctors and nurses means a loss of skills and experience. People moving out are the ones with 10–20 years of experience. It takes time to recover. As a consequence, standards are falling: of necessity, untrained and informally trained personnel are used, absenteeism rises as a result of unrealistic work loads, and services provided to the public are reduced, quantitatively and qualitatively.

The condition of the health system affects the health of the community and of individuals within it. The health of the individual is inextricably linked to poverty. Health is the basis for job security. Ill health prevents people from working, affecting their productivity and lowering their income. It can also prevent them from earning an income at all, miring them in poverty. With the early onset of non-communicable diseases in the Pacific resulting in the early onset of disability and premature death of men, many families quickly find themselves in poverty. Death means a loss of

livelihood to the head of the family, plunging the family into poverty. The majority people do not have insurance against illness and have great difficulty borrowing money to deal with illnesses.

Good health, on the other hand, increases the capacity of children to learn at school. Health increases the capacity to grow intellectually, physically and emotionally. Health and education are the basis of human capital. Good health is critical in reducing poverty, facilitating economic growth and economic development. Many Western countries were able to achieve industrialization and economic development because there were other developments taking place in society, such as the breakthrough in public health, disease control and improved nutritional intake.

8. Health Infrastructure: Poor Environmental Living Conditions

Apart from the need for more investments in health services per se, there is also a need to ensure heavy investment in the health infrastructure, such as the provision of water supply, sanitation, garbage disposal, housing, education and agricultural improvement. Most of the illnesses associated with poverty are infectious diseases such as diarrhoeal diseases, malaria and tuberculosis. These diseases are associated with lack of income, lack of clean water and sanitation, lack of access to medical services, low levels of education and malnutrition. These have been aggravated by the process of urbanisation.

Increasing numbers of people are moving into towns in the Pacific. In Melanesia, the rate of urban growth is very high, about 6 per cent (ESCAP, 2003). The increasing urban populations contribute to poor living conditions everywhere. High populations in Pacific towns increase the threat of water-related diseases in the region, especially in squatter settlements. The high urban population is also pushing essential services such as clean water, adequate sanitation, waste disposal and transport to their capacities. Infrastructure is increasingly run-down and unable to handle rapid population growth in urban areas. There is evidence that lack of planning and investment are resulting in haphazard development and environmental degradation.

Safe water supply is unevenly distributed in Pacific Island countries. In atoll countries particularly, water sources are limited. Kiribati and Tuvalu

rely mainly on water sourced from wells, tanks and drums, and the shortage and poor quality of water contribute to the relatively high infant mortality in the atoll countries. Many of the region's countries indicate that coverage is high but the real problem is quality and reliability of water supply. A few countries face problems of mismanagement of the water supply system and this is seen in leakage because of lack of maintenance of the system.

Overall, the inadequate disposal of human waste is one serious environmental problem in the Pacific. There are very few sewage treatment plants in urban areas in the region and their coverage is very limited. Lack of reticulated sewage systems has resulted in an increase in numbers of septic tanks and in some urban areas, pit latrines. Many places, such as Honiara and South Tarawa, use ocean outfalls for sewage disposal (UNESCAP nd). Foreshore contamination is high, with deleterious effects on marine resources. In Marshall Islands there is surface pollution from septic tanks, pit latrines and household and domestic waste resulting in the contamination of the underlying water lens. High faecal coliform levels in lagoons (Fanga'uta in Tonga and beside South Tarawa) and sea (around Suva and Port Vila) are a public health concern (UNESCAP, nd).

Solid waste management is a problem, particularly in the atoll countries of the Pacific. The volume of solid waste is increasing with the adoption of a western life style but there are few programmes of solid waste reduction. The usual method of disposal is to dump at the seashore, estuaries, swamps or mangroves. This pollutes waterways, lagoons and water supply.

In Micronesia, most notably in the Republic of Marshall Islands and Kiribati, and particularly in Ebeye and Betio therein, the problems of land shortage and overcrowding result in the spread of infectious diseases. Inadequate sanitation causes outbreaks of gastro-intestinal diseases and hepatitis in both Kiribati and the Marshall Islands.

One of the results of urbanisation is the increase in the numbers of squatter settlements in Pacific towns. 1n 1995 10 per cent of Fiji's population lived in squatter settlements and by 2003 this had increased to 12 per cent. For Fiji, some of the contributing factors are: the expiring land leases, job losses, and the attraction of service sector employment. These squatter settlements are characterized by inadequate water and electricity supply, sanitation and garbage disposal. Housing conditions are extremely poor: dilapidated shelter and overcrowding predominate. The 1996 Fiji popula-

tion and housing census showed a high proportion of dwellings in squatter settlements that were inadequate structurally, without electricity and using pit toilets (Fiji Bureau of Statistics, 2002). These settlements are often located on marginal land near streams, mangroves or hilltops. Such are the deficiencies that affect the urban poor, especially their health and quality of life.

In Fiji, as in other Pacific Island countries, significant inequalities in housing provision continue to exist between regions and between the rural and urban sectors. Safe and adequate water supply is a basic human need but it is unevenly distributed. Adequate sanitation is also unevenly distributed. The poor are more likely to experience living conditions that contribute to poor health. The most prevalent diseases in the Pacific are those related to poor living conditions, such as respiratory diseases, gastro-intestinal diseases, mosquito-carried infections such as malaria and dengue fever, and those relating to poor nutrition.

9. Access to Health Centres: Rural Areas, Outer Islands

Most development in Pacific Island countries is concentrated in the main town, leaving the remote communities under-serviced and with fewer opportunities for development. The cost of servicing rural areas in rough terrains or the scattered islands that are lightly populated is costly. Professionals are also reluctant to locate outside the main centres. As a consequence, people in rural areas have fewer opportunities and services and their risk of falling into poverty is greater.

Many Pacific Island countries face a major challenge in providing health services to rural areas in the face of resource constraints and staff shortage. Many health centres are ill equipped. A few have had to be closed. 'Access', of course, implies more than the mere existence of health facilities. When a health facility does not have properly trained staff, opens irregularly, and suffers from shortage of supplies, then most of these rural and remote communities do not have access to health services. Health services are usually very rudimentary in outer atolls, as in the Marshall Islands and Kiribati. The Melanesian islands are large and have a difficult terrain. Hence everyone is not within easy reach of a medical centre. Many Pacific Island countries do not have the resources to provide services to the very remote areas and outer islands and poor people in these places do not have the

means to access medical facilities. Very serious and complicated cases are referred to the bigger hospital in the main centre. Most people outside urban areas have less access to health care and are less likely to have health insurance coverage.

The urban dwellers are better served than their rural counterparts. Despite this, in Fiji there is shortage of nurses and doctors because of migration. This continues to burden and compromise the delivery of health services. It is clear from discussions with senior health personnel in the main hospital that the health sector is losing skill and experience and that it will take years to recover. The workload has increased and the quality of care has slipped. The poor are the ones who feel the effects of this. The well-to-do go to doctors in private practice, or to the private hospital or go overseas for treatment. They are also more likely to have medical insurance cover.

10. Food Security and Nutrition

Pacific Island nations face food and water security challenges. Increasingly, the food supply situation is characterized by a heavy dependence on overseas food imports. The atoll nations of the Pacific are particularly vulnerable to food and water insecurity.

Climate change and sea-level rise threaten food and water security in many island nations. Tuvalu is particularly vulnerable to sea-level rise. Climate change affects marine food sources. Coral bleaching caused by rising ocean temperatures affects artisanal coastal fishing (www.foe.org.au).

The frequency and severity of natural disasters such as cyclones and droughts also affects food security in the region. Cyclone Heta destroyed the agricultural sector and the infrastructure in Niue last year. Droughts have been experienced in Papua New Guinea and Marshall Islands. Saltwater intrusion reduces land use in Tuvalu. Disasters often highlight conditions of food scarcity (www.foe.org.au).

Many countries of the Pacific have only a low level of self-sufficiency in terms of local food production. Countries therefore have to import food in order to meet food demands. Globalization has enhanced access to non-traditional foods. Fiji, for instance, imports more than half (57 per cent) of the country's food requirements.

Access to sufficient and nutritionally adequate and safe food for all people at all times is internationally recognized as a basic human right. Nutrition is a major determinant of morbidity and mortality. Improved nutrition results in improved health, which in turn contributes to increased human capital and labour productivity. Hunger and malnutrition are problems faced by different countries, especially the poor in these countries. Malnutrition affects all ages. From conception to birth, intrauterine nutrition affects foetal development. Nutrition also affects physical and mental development from birth and throughout life and affects the development of non-communicable diseases in the later years of life.

The peoples of the Pacific do suffer from malnutrition. Malnutrition early in life, followed by inappropriate diets and physical inactivity in childhood and adult life, increases vulnerability to chronic diseases. A group within a population will have some form of malnutrition. Malnutrition includes a number of nutrient related disorders, deficiencies and conditions. These include such conditions as intrauterine growth retardation, iodine deficiency disorders and iron deficiency. It covers both under nutrition and over nutrition (WHO, 1998).

Malnutrition is responsible for higher rates of death, especially, in some Pacific Island countries, among children. Pacific Island children suffer when they do not eat the right kinds of foods or the right amount, as a result of inadequate care. Diets do not contain whole grains, fibber, fruits and vegetables. As noted already, the Pacific Island countries are characterized by heavy dependence on overseas food imports. In Kiribati and Tuvalu dependence on imported food and the absence of fresh vegetables from the diet result in some degree of malnutrition. Micronutrient deficiencies such as Vitamin A and iodine deficiencies and anaemia are problems of varying severity across the Pacific. Iodine deficiency disorders (IDD) is a problem in Fiji and Papua New Guinea (FAO, 2003). Malnutrition in children, a consequence of inadequate dietary intake, is a concern. In Papua New Guinea infants under one year have a high prevalence of underweight and wasting, and half of children under 4 years suffer from wasting and stunting. This mainly affects children in urban areas. Vanuatu and Fiji also have high prevalence of underweight and wasting in children under 5 years (Saito, 1995; Carlot-Tary *et al.*, 2000)

Urbanization and globalization have contributed to more and more, Pacific people moving away from their traditional diets. They have replaced nutritional local foods like breadfruit, banana, yam and taro with white rice, bread and now more recently, instant noodles. Dietary changes are part of a cycle of changes in people's tastes. Imported food stuffs of doubtful nutritional value, such as mutton flaps, turkey tails and canned foods are also being consumed much more. There has been a shift away from traditional foods toward high energy density, high fat and low fibre diets resulting in over-nutrition and obesity-the other face of malnutrition. The level of obesity within Pacific Island countries is extremely high (Gill, 2001) as also is the increase in weight-related morbidity (such as diabetes and cardiovascular diseases) and mortality. There are many cases, too, of overweight children in the region. These children are more likely to have high blood pressure or heart disease. Diabetes is beginning to afflict children and puts them at risk of a number of disorders such as blindness, nerve damage, kidney failure and cardiovascular diseases (International Food Policy Research Institute Forum, 2004).

Malnourishment among adults also occurs. In Fiji, iron deficiency is a problem among women of childbearing age. Malnutrition incapacitates people, resulting in low productivity, which in turn affects the economy. Mothers who are malnourished give birth to underweight babies whose health and growth are affected throughout their lives. In addition, children who are under- and malnourished cannot fight off diseases or infection. They also cannot concentrate at school resulting in their inability to escape from their situation of poverty.

Human history is characterized by a series of changes in diet and nutritional status and the pace of change has quickened over the last three decades. These changes occur at the same time as demographic, epidemiological and socioeconomic changes. Large shifts have occurred in dietary and physical activity and inactivity patterns. These changes are causing overweight, obesity, diabetes, high blood pressure, cardiovascular disease including stroke, and cancer. These changes are also reflected in changes in average stature and body composition.

Following the rapid economic and social change, modernization and urbanization, the pace of nutrition transition has accelerated in the Pacific Island countries. With modernization, urbanization and the entry into the

monetary economy and as income increases, diets change to ones with higher energy fat intakes, increased consumption of animal fats, sugars and salt, and processed foods and lower intake of dietary fibber in fruit and vegetables. Obesity emerges in these shifting conditions. In the many cultures of the Pacific, obesity is viewed as beautiful. However, obesity makes people prone to non-communicable diseases, which in turn reduces productivity.

Most Pacific Island nations exhibit a mixed pattern of nutrition, of under-nutrition and over-nutrition. The pattern of nutrition deviates from the nutritional transition process. The nutritional transition in the Pacific is not a unidirectional process. This is the twin burden of malnutrition that Pacific Island countries now face, of over-nutrition and under-nutrition existing side by side in the same population.

With development and modernisation come behavioural changes in lifestyle, and changes in social behaviour and social values systems. The socioeconomic changes have also brought about new types of employment that do not expend a lot of energy. Labour mechanisation and automation, including watching television and other sedentary activities, have low energy expenditure. Indeed, inactivity and new dietary patterns have contributed to the prevalence of risk factors leading to obesity, diabetes, high blood pressure, cardiovascular diseases including stroke, and cancer.

Urbanization has brought about changes in lifestyle, especially social behaviour and value systems. It has brought about changes in the pattern of diseases. There is evidence of early and more sexual activity among young people in the region. There is also evidence of multiple partnering among young people. This is reflected in the rapid spread of sexually transmitted infections such as gonorrhoea, syphilis, herpes, hepatitis B and HIV.

11. Conclusion

The availability of reliable mortality data in the Pacific Island countries is a problem. The vital registration systems are the main source of data on causes of death. It is important that mortality data be both accurate and reliable, since they continue to be very important for epidemiological and demographic research and in the formulation public policy. Many countries in the region do not have complete registration of deaths and in many cases

the causes of death are coded by a non-medical person. There is a need for health ministries in the region to employ a health person to code the causes of death, which must be certified according to the current International Statistical Classification of Diseases. Countries need to ensure that medical certification of cause of death is applied in vital registration systems. In addition, campaigns must focus on informing the public that it is mandatory to report and register all deaths. There is also a need to strengthen health information systems in the region. This is required to improve the capacity to analyze existing data that are useful for health policy and planning more effectively.

In addition, most countries in the region have no data on nutrition (http://www.sps.int/demog). No nutrition surveys have been carried out in the Pacific Island countries except in Fiji and many therefore do not have data on micro-nutrient deficiencies. Data on childhood malnutrition and micronutrient deficiencies (especially Vitamin A, zinc and iron deficiency) could assist in policy formulation and planning. Lack of research to date has meant that policy makers do not have the kind of information they need to evaluate the threat of increasing obesity and the rise of related chronic diseases.

The qualitative aspects of poverty are often mirrored in the levels of morbidity and mortality of a country. Indeed, the Pacific Island countries have made much progress in the last 50 years in lowering mortality and improving life expectancy. It is important therefore to maintain the momentum. However, even to do that is not easy because the slow economic growth of countries in the region constrains their ability to increase budgetary allocations to health. This affects the delivery of health services, as is reflected in the shortage and distribution of qualified staff, and technical guidance, programme management and supervision are weak. There is shortage of drugs and other medical supplies. Medical equipment is not well maintained. Access is a problem because the government does not have the resources to provide health care services to the poor in remote communities and the poor in turn do not have the resources to use the services. The governments need to increase their health care budget and to use resources more equitably and more effectively.

Poverty is indeed associated with lower health quality. Certain groups in the different countries of the Pacific are still battling infectious diseases.

The reasons are well-known–poverty, low incomes, food insecurity, poor housing, low levels of education of mothers and poor health infrastructure, namely water supply, sanitation and solid waste management. These factors increase the risk of ill-health. There is a great need for heavy investment in health infrastructure, in the provision of water supply, sanitation, solid waste management and improved housing. Public health infrastructure needs to be extended to all areas that do not benefit from these facilities.

With urbanization, modernization and globalization the Pacific people have shifted away from their nutritious and traditional diet to one of high energy density, high fat and sugars and low fibber content. This has given rise to over-nutrition, problems of overweight, obesity and the related illnesses of cardiovascular diseases, hypertension, diabetes and cancer. Moreover, studies have shown that infants who were undernourished while still in the womb and then are born small and have a greater risk of developing abdominal obesity and related morbidity as adults. The existence of a double burden of over-nutrition and under-nutrition poses a challenge for intervention. Disability or premature death from non-communicable diseases can plunge a family into poverty. Illness and death further impoverishes the poor. The cost of diagnosing and managing obesity and the related diseases is high. If action is not taken, this group of diseases will inundate the health services of Pacific Island countries at a time when they are still addressing infectious diseases and against a background of low economic growth. Awareness programmes need to be in place to improve nutrition during pregnancy. If non-communicable diseases are to be effectively addressed in the region, awareness and outreach programmes need to target everyone, to prevent weight gain and to encourage a healthy lifestyle in adults and children. This must be the focus of public health campaigns.

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4

Mortality: A Determinant and a Consequence of Poverty and Hunger in West Africa

Alieu SARR

1. Introduction

At a United Nations summit convened in New York in September 2000, 147 heads of state and government met to examine measures to achieve a more equitable and rapid path to sustainable development for all peoples of the world. During this summit, leaders of the world recognized the dangers posed by disparities between rich and poor nations and resolved to institute measures to reduce those disparities. Representatives at the summit unanimously adopted the Millennium Declaration. The Declaration called for the international community to take a number of actions necessary to achieve certain fundamental goals with respect to global peace, security and sustainable human development for all peoples, including the environment, human rights and governance. To attain the objective of reducing human misery and promoting social development, the international community agreed on a set of indicators to measure achievements in human development. To track development, the following goals were set: Eradicate extreme poverty and hunger, provide universal primary education, promote gender equality, reduce child mortality, improve maternal mortality, combat HIV/AIDS, malaria and other diseases, ensure environmental sustainability and foster global partnerships for Development. The latter goal is considered essential for the attainment of the set goals.

In this Chapter, an attempt is made to study the causal relationship between mortality, poverty and hunger and their potential impact on the attainment of the first Millennium Development goal, 'eradicating extreme poverty and hunger', in the West African sub-region. Available data on

poverty, hunger and mortality would be reviewed with the aim of establishing the interrelations between mortality, poverty and hunger.

1.1. Profile of Sub-Region

The West African sub-region comprises seventeen countries with a population of about 250 million with just under half living in Nigeria. The sub-region consists predominantly of low-income countries with gross national incomes per capita ranging from US$130 in Sierra Leone to US$1,330 in Cape Verde in 2000 (see Table 1). Recent estimates put the average per capita income of West Africa at US$309 compared to an average for Sub-Saharan Africa of US$470. West Africa is one of the poorest regions of the world with over 55 per cent of its population living on less than US$1 a day. The region's economic growth has been estimated at 2.5 per cent in the recent past while population has been growing at an annual rate of 2.2 per cent. It is estimated that the economy needs to grow at the rate of 6-7 per cent a year for the region to meet the goal of cutting poverty in half by 2015 (World Bank, 2004).

Table 1 Growth performance in the West African Sub-Region

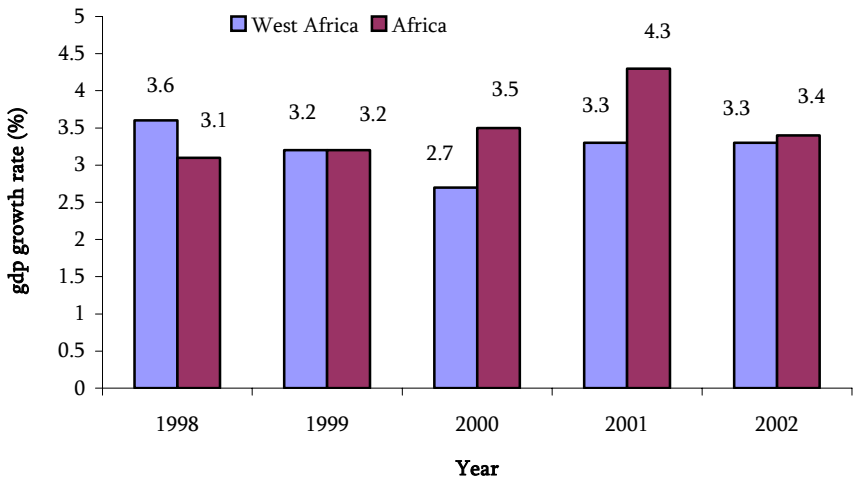
Country	GNI per capita (US$)		GDP growth rate	
	1990	2000	1980-90	1990-99
Benin	360	380	2.5	4.7
Burkina Faso	290	230	3.6	3.8
Cape Verde	980	1330	n.a	n.a
Cameroon	970	570	3.4	1.3
Ivory Coast	780	660	0.7	3.7
Gambia	320	330	n.a.	n.a.
Ghana	390	350	3.0	4.3
Guinea	460	450	n.a.	4.2
Guinea Bissau	220	180	n.a.	n.a.
Mali	270	240	0.8	3.6
Niger	310	180	-0.1	2.5
Nigeria	270	260	1.6	2.4
Senegal	720	500	3.1	3.2
Sierra Leone	260	130	n.a.	n.a.
Togo	430	300	1.7	1.5

Source: World Bank, *Attacking Poverty*, World Development Report 2000/2001

Figure 1 shows that the sub-region registered only marginal improvements in the growth rate of its overall economy. It can be observed that compared to growth rates registered by the African continent as a whole, West Africa trails behind. This marginal gain in economic growth can be attributed to the poor performance of the agricultural sector over the years

as measured by unfavourable terms of trade and low productivity orchestrated by low rainfall on the one hand and pest infestation on the other.

Figure 1 GDP growth in West Africa and Africa (per cent)



Note: Data are weighted by country GDP relative to African GDP
Data for 2001 is based on estimates whilst that of 2002 is projected.
Source: Economic Commission for Africa

Most economies in the sub-region are dependent on agriculture in terms of its contribution to the economy and employment opportunities. Except in Cape Verde, Cameroon and Ivory Coast, more than half of the workforce is employed in the agriculture sector (African Development Bank, 2001). Although the sector may be the single largest employer, there is an imbalance between the sector's contribution to employment and its contribution to the economy. For example in Burkina Faso, it is estimated that approximately 84 per cent of the workforce are employed in agriculture whilst the sector only contributes 35 per cent of GDP. This disparity mirrors low levels of agricultural output in most West African countries.

Agricultural production in the sub-region has been erratic for many years. Since the drought years of the 1970s and 1980s, the sub-region has been experiencing erratic rainfall patterns which have had negative effects on output. In general, the region has not been able to grow enough food for

the rapidly growing population, a problem compounded by the increased rural to urban migration caused by dwindling rural income due to years of persistent drought and pest infestation. Food security in the region has been threatened even more by the influx of large swarms of desert locust, which have devoured thousands of hectares of farmland leaving millions of farmers without food, and livestock without fodder.

In terms of the Human Development Index of the UNDP, West African countries rank amongst the bottom 25 per cent of countries. A review of the human development ranking of the sub-region over the past decade reveals only marginal improvements for the region.

Apart from natural constraints to economic growth which affect the agricultural sector in West Africa, the sub-region is faced with a problem of civil strife and conflict, which has impeded development. The sub-region accounts for more than 70 per cent of military coups in the world. Over the past 15 years, nine of the 15 members of ECOWAS have experienced some form of instability ranging from high intensity civil wars to violence during elections (The World Bank Group, 2004). In 2003 it was estimated that 65 per cent of West Africa's population lived in countries severely affected by conflict. This conflict situation in the sub-region has had dire consequences in terms of human, material and economic costs. It is difficult to quantify the human cost of conflicts in the sub-region but these could include; loss of life, destruction of property, diversion of resources from investment, promotion of capital flight, disruption of economic transactions, and channelling scarce government resources away from public services to military expenditure. According to Omar Kabbaj (2005) these are consequences of instability in the African continent, which exemplify the economic and social costs of the many wars and conflicts ravaging the African continent. The conflict situation in West Africa further explains the abysmal performance of the economies of countries of the sub-region.

2. Theoretical Perspectives on Linkages between Mortality, Poverty and Hunger

For a better understanding of the impact of mortality both as a determinant and a consequence of poverty and hunger in West Africa, an attempt will be made to examine the linkages between these factors and the

influence they might have on each other. Issues to be addressed in this section relate to mortality, poverty, hunger/nutrition and HIV/AIDS.

2.1. Mortality

High mortality rates observed in developing countries for many years and the resultant low life expectancies has created remarkable differences in the age structure between developed and developing countries. In developing countries this has created a relatively young population whilst in developed countries, there is the problem of aging, which in some countries is beginning to affect labour supply and put pressure on social services. In many countries in sub-Saharan Africa, gains made in extending life expectancy over the years through improvements in health services is being negated by the high prevalence of HIV/AIDS. It is estimated that average life expectancy in sub-Saharan Africa is now 47 years when it would have been 62 years without AIDS. Studies have shown that in Botswana life expectancy at birth has dropped to a level not seen in the country since 1950. Many countries in southern Africa will see life expectancies fall to about 30 years, levels not seen since the end of the 19th Century (Stanecki, 2002)).

In sub-Saharan Africa declines in life expectancy as a result of high HIV/AIDS prevalence has influenced changes in the age structure of many countries in the sub-region. The disease affects the most productive age group in the population, largely affecting the population aged 15-49 years, a fact which is unique to HIV/AIDS in comparison with other diseases (Haslwimmer, 1996). In view of the important input of the youthful population to the economy of any nation, the devastating effects of the disease on the youth of sub-Saharan Africa has dire consequences on the productive sectors of the economies of many countries. Mortality may, therefore, be both a consequence and a cause of poverty.

2.2. Poverty

Research has shown that poverty is a multi-dimensional phenomenon, which can be measured in terms of income and expenditure levels but can also be perceived in terms of individuals' social interactions and state of mental well-being (Oduro and Aryee, 2003). A population falling below a poverty line of US$2 per person per day is considered to be moderately poor whilst one falling below a US$1 per person per day is considered to be

extremely poor. The causal relationship between poverty and hunger on the one hand and between poverty and mortality on the other is not as simple as it may appear.

The problems of poverty and hunger are closely associated. According to the International Fund for Agricultural development (IFAD, 1995) the differences between the two are largely definitional. Hunger, which is manifested by the prevalence of malnutrition, is largely an indication of a population's inability to provide the requisite balanced diet for healthy living. Although other factors such as low literacy levels, high population growth rates, environmental degradation and rural-urban migration can be underlying causes of malnutrition, poverty exacerbates it. Poverty limits accessibility to food and basic services like health and education (SPACO, 2003). It is worth noting that poverty is in turn aggravated by malnutrition, hence creating a vicious circle of poverty and malnutrition.

In view of increasing medical costs globally, it has been observed that poverty influences use of modern health facilities, hence poverty's influence on health outcomes. Since poor households tend to spend a higher proportion of their income on basic needs such as food, their expenditure on health is limited. The limiting effects of poverty on access to food and health services tend to cause high mortality among the poor. In turn, high mortality among the poor causes these communities to be without much needed income earners and aggravates the problems associated with poverty.

2.3. Hunger/Nutrition

Malnutrition or inadequate nutrition takes many forms. Sometimes it is the result of a lack of adequate food intake or in other times it is caused by a lack of essential vitamins. Malnutrition could be in the form of protein-energy malnutrition, iron deficiency anaemia, vitamin A deficiency, iodine deficiency and zinc deficiency, to name just a few. Malnutrition has been found to be the cause of increased vulnerability to serious and chronic illness, mental retardation, physical disability, diminished educational and economic prospects and early death (USAID, 2002). Although the effects of malnutrition are often not seen in the short term, the impact is often irreversible: the "silent emergency" (Lwanga and Piwoz, 2000).

A major challenge posed by malnutrition, which has attracted much attention in the recent past, has been the impact of nutrition deficiency on people living with HIV/AIDS. HIV has been found to compromise the nutritional status of infected persons, which then increases their susceptibility to other infections whilst malnutrition exacerbates the effects of HIV by further weakening the immune system. Improved nutritional intake is therefore essential in order to prolong the lives of people living with HIV/AIDS, which have financial implications for their families. This implies that in countries with a high prevalence of HIV/AIDS, additional costs incurred in meeting the nutritional needs of people living with the virus and the loss of the economic input of such persons could drastically reduce household income levels.

Research has found malnutrition to be economically costly to communities and countries in general. Because the effects of nutritional deficiencies are cumulative, when they occur among children, such deficiencies lead to child deaths, increased health costs to families and governments, decreased mental capacity, and lower future productivity which eventually impedes the development of nations (Lwanga and Piwoz, 2000). Among farming communities, heavy workloads borne by women often reduces the food intake of children and women hence worsening their nutritional status. Increased susceptibility of the malnourished child to infection also implies that the chronically malnourished child is often sick and bedridden and in need of care. This often means that the child's mother or another adult will have to withdraw from work to care for the child. In most African societies, where women play a pivotal role in food production, this causes a loss of farm labour and imposes a negative impact on food production. Malnutrition among adults has similar effects on agricultural production.

2.4. HIV/AIDS

HIV/AIDS have been found to be the leading cause of death in sub-Saharan Africa (UNAIDS, 2004). Since the beginning of the epidemic, over 15 million Africans have died of the disease and it is estimated that 2.3 million adults and children have died of AIDS in sub-Saharan Africa. When AIDS was first diagnosed in the 1980s, the disease was viewed more as a medical than an economic or social challenge. With increasing numbers of cases around the globe the social and economic problems posed by the disease became more apparent. Although HIV/AIDS is a "chief underlying

cause" of child death, particularly in sub-Saharan Africa, inadequate pre-natal and health care delivery cause the greatest proportion of preventable deaths. HIV/AIDS has been a major contributing factor to persistently high levels of morbidity and mortality in the sub-region.

In Sub-Saharan Africa where the disease is more prevalent, the majority of the population is not part of a fully operating medical care system. Households with a person living with HIV/AIDS are also more likely to spend more money on medical bills. In addition to increased medical bills the sick require care and their contribution to household income is also curtailed. Costs relating to traditional medical treatment and expenses on purchasing special foods for the patient must also be met. Cash income and labour are partly diverted to cope with and compensate for the effect of HIV/AIDS. This reduces the labour input for both farm and non-farm activities. The resultant cuts to household income and expenditure on funerals of those dying of the disease tends to increase household poverty levels. At the national level, HIV/AIDS places additional pressure on health budgets. UNAIDS estimates that in sub-Saharan Africa the annual direct medical costs of AIDS (excluding anti-retroviral therapy) is about US$30 per capita compared with the overall public health spending of less than US$10 for most African countries. Scarce national and household resources are spent on the care of people living with HIV/AIDS. Resources that could be spent on preventable diseases and food are now spent on the disease, either for the provision of medical services or on campaigns to stem the spread of the disease. This has implications for both poverty levels and for adult and child mortality.

3. Methodology

A study of this nature requires a closer look at the state of mortality, poverty and hunger in West Africa. It is essential to study the causal relations between each of the factors. It may not be sufficient to restrict the scope of research on these three factors alone. It might also be necessary to broaden research to examine other factors which could influence the relationship. For example, the existence of war and civil strife has been seen as an impediment to the attainment of food security in many parts of sub-Saharan Africa. Changes in the land tenure system have had an impact in some communities on access to land and consequently have influenced

agricultural production and food security. Environmental factors have also been an integral part of initiatives aimed at improving food security. All these factors require closer examination, but these factors have not been considered in detail here due to the limited scope of this chapter.

In this chapter, an attempt has been made to review existing published data for West African countries with a view to documenting trends, identifying potential consequences of these trends and deducing from the available data what causal relationships exist between mortality and poverty on the one hand and mortality and hunger on the other. In the process, the influence of mitigating factors would also be examined and inferences drawn based on the available evidence. In view of the rapid rate of increase in HIV infection in West Africa and the consequences of the disease both in terms of its effects on agricultural output and its increased strain on health resource, data on HIV/AIDS would also be reviewed.

4. Mortality, Poverty and Hunger in West Africa

4.1. Mortality

As has been experienced elsewhere, mortality levels in all West African countries declined considerably over the past two decades. This is largely attributable to improvements in health services in general, and improvements in water and sanitation. Despite considerable gains in terms of improved mortality conditions, levels of mortality in West Africa and sub-Saharan Africa, in general, remain among the highest in the world. According to the UNICEF report (2004) child mortality in many developing countries remain shockingly high, particularly in sub-Saharan Africa. Such high levels of mortality would make it difficult for these countries to meet the Millennium Development Goal (MDG) of reducing child deaths by two-thirds before 2015. To achieve this goal, countries need to record an annual decrease in child deaths of 4.4 per cent. The UNICEF report concludes that such levels of mortality reduction may not be attained since child mortality in 18 countries in sub-Saharan Africa has either remained the same or become worse.

Like other countries in Africa, West Africa has also enjoyed considerable improvements in infant and child survival over the years. Data on infant mortality presented in Table 2 indicates significant reductions in

mortality amongst infants in all West African countries. Oduro and Aryee (2003) however observed that the gains are marginal in view of the fact that in a number of countries in 2000, the infant mortality rate was higher than the average of 102 deaths per 1,000 live births observed for developing countries as a whole. According to the available data, infant mortality levels are highest for Sierra Leone, Niger, Guinea Bissau, Mali, Gambia and Guinea.

Table 2 Infant mortality in West Africa (per 1,000 live births), 1990 and 2000

Country	Infant Mortality Rate	
	1990	2000
Benin	99.2	83.8
Burkina Faso	109.8	91.8
Cape Verde	68.0	52.4
Cameroon	89.8	82.2
Ivory Coast	97.2	84.2
Gambia	138.0	119.0
Ghana	79.4	64.8
Guinea	139.4	118.0
Guinea Bissau	145.0	125.0
Liberia	142.8	91.8
Mali	139.0	124.0
Niger	147.6	130.0
Nigeria	100.6	82.6
Senegal	71.2	59.0
Sierra Leone	190.2	153.6
Togo	93.4	78.2

Source: African Development Bank, 2001

There are indications that gains made in child survival in some countries have been lost for one reason or the other. In Burkina Faso for example, an increase in child mortality was observed between 1993 and 1999, from 205.5 to 219.5 deaths per 1,000 live births. It has been reported that child mortality has increased in Ivory Coast by 1.1 per cent. Five West African countries have been listed among the ten countries with the highest mortality rates in the world in 2002. Of these countries Sierra Leone with the greatest number of child deaths globally registered a child mortality rate of 285 per 1,000 live births. Next on the list were Niger (with 265 deaths), and Liberia, Mali, Guinea-Bissau and Burkina Faso with 205 deaths per 1,000 live births, respectively (UNICEF, 2004).

In all the West African countries differentials have been observed in the levels of mortality across socio-economic groups. In The Gambia, for example, infant child mortality was higher in rural compared to urban areas.

Similarly, mortality among children declined as the educational attainment (formal education) of mothers increased (Sarr, 2000). In Guinea, it was reported that whereas the infant mortality rate for Conakry in 1999 was 74 deaths per 1,000 live births, the rates for other urban areas and the rural areas were 79 deaths and 116 deaths respectively. It has also been observed that children of the rich are more likely to survive than those of the poor. In Burkina Faso, for example, child mortality among populations in the poorest quintiles was estimated at 223.9 deaths per 1,000 live births compared to 199.2 deaths per 1,000 live births among the less poor population in 1993 (Odura and Aryee, 2003).

Differentials in mortality between urban and rural areas can be attributed to numerous factors, which range from differences in socio-economic characteristics of populations, variations in disease prevalence among regions and demographic and environmental factors, which may affect survival. Access to and affordability of health services can also immensely contribute to geographic variations in child survival.

High mortality rates in the West African sub-region as in the rest of sub-Saharan Africa have been attributed to a number of factors. Among the factors contributing to current high levels of under-five mortality are: HIV/AIDS, inadequate pre-natal health care, including lack of "skilled help" during childbirth and infectious and parasitic diseases such as diarrhoea, respiratory track infections, malaria and measles. Other factors identified are malnutrition, unsafe water supply, poor sanitation and armed conflict. According to UNICEF (2004) HIV/AIDS accounts for eight per cent of child deaths in sub-Saharan Africa. The problem of AIDS on child survival is compounded by the fact that children who lose their parents due to the pandemic have limited chances of survival. The UNICEF Regional Director in Eastern and Southern Africa was quoted as having told journalists ahead of the launch of 'Progress for Children' that; "The looming crisis of AIDS is going to make it a daunting task for sub-Saharan Africa to meet the target of reducing child mortality within the required period ".

Another challenge faced by West African countries in reducing child mortality is the persistent conflict environment that prevails in the sub-region. In Ivory Coast for example, since the military coup of 1999, the country has been experiencing civil conflict which has had a negative impact on child survival. Similarly, in Sierra Leone civil conflict has reduced

chances of child survival. The Jola population who are mainly found in the conflict-ridden region of Southern Senegal (Casamance) experienced significantly lower child survival rates than the national average. Although civil strife might have a direct impact on child survival in the sub-region, the indirect effects might be more pronounced. Strife in a number of West African countries has resulted in massive population movements with negative consequences for the welfare of both children and their parents.

At the macro-level civil conflicts have devastated economies of several countries. According to the World Bank (2004), the strife in Ivory Coast had severe economic consequences for the six members of the West Africa Economic and Monetary Union (WAEMU): economic growth rate fell from 3.7 per cent to 1.2 per cent in 2003. In 1999, it was estimated that $800 million that could have been used for development was instead diverted into conflict (World Bank Website, 2004). Monies that should have been spent on developing the social sectors, such as improving service delivery in the health sector and investment in food production were spent on fuelling civil conflict with devastating consequences for the population.

Mortality levels in West Africa are extremely high. Despite improvements in health services, achievements in mortality reduction have been limited due to the continuous existence of infectious diseases and civil strife in a number of countries. Without concerted efforts to combat disease and civil strife in the sub-region, the desired levels of mortality reduction may not be attained in the near future.

4.2. Poverty

In West Africa, low per capita income levels are indicative of high levels of poverty in the sub-region. The evidence to be reviewed in this section of the paper is based on poverty levels derived from national poverty lines set by individual countries. Some countries adopted the international standard definition of poverty – expenditure of less than US$1 per day whilst others have set their poverty line based on the cost of a food basket providing 2,700 calories. Most of the data reviewed here have been obtained from poverty studies conducted in West African countries in the course of the preparation of national Poverty Reduction Strategy Papers.

Poverty levels in the West African sub-region are generally high. Although some countries recorded a decline in the phenomenon in the past,

poverty has actually increased in other countries. Available data show that in Ghana the proportion of the population categorized as poor was 51.7 per cent in 1991/92 declining to 39.5 in 1998/99. Similarly, in Ivory Coast the proportion of the population below the poverty line declined from 36.8 in 1995 to 33.6 in 1998. It is however likely that due to the civil strife experienced by the citizens of that country in the recent past, poverty levels might have drastically increased. In contrast, in Burkina Faso and The Gambia poverty levels increased during the period for which data are available. In Burkina Faso the proportion of the population classified as poor increased from 44.5 per cent in 1994 to 45.3 percent in 1999. The proportion of the population of The Gambia below the food poverty line increased from 33 per cent in 1992 to 37 per cent in 1998.

It is interesting to note that available data show that poverty levels in urban areas in Benin have declined, from 28.5 per cent of the population in 1994/95 to 23.3 per cent in 1999/2000; but in rural areas the proportion of the population that are poor increased from 25.2 per cent to 33 per cent for the same period. Although data are not available for other countries, it is highly likely that a similar scenario obtains in a number of countries in the sub-region. This is because in many countries in West Africa years of persistent drought and pest infestation has led to a sharp drop in agricultural output, hence the decline in rural income levels. In countries like Ivory Coast, Sierra Leone, Senegal (Southern Senegal), Liberia and Guinea Bissau the problem is compounded by internal conflict, which has displaced millions of farmers. A large number of farmers have been forced to leave their settlements to seek refuge from war and civil strife in urban areas, resulting in increased urban poverty.

Poverty in West Africa is more prevalent among women and in rural areas, although urban poverty is on the increase, largely as a result of increased rural-urban migration, which increases urban unemployment and also exerts pressure on social services. Urban poverty in many West African countries has been exacerbated by the unprecedented population increases in urban areas, which is attributable to the influx of both economic and political refugees. Rural poverty accounted for 94 per cent of total poverty in Burkina Faso, 70 per cent in Ghana, and 88 per cent in Mali. Marked differences have been observed across countries between urban levels of poverty and rural levels. In Ivory Coast a 1998 poverty survey revealed that 42 per cent of the rural population fell below the poverty line compared to

23 per cent of the urban population. In The Gambia, results of a poverty survey in the same year revealed that 34.8 per cent of the population in rural areas were extremely poor, living below the food poverty line whilst 15 per cent of the population living in urban areas and 4 per cent of those in the Greater Banjul area were below the extreme poverty line (Republic of The Gambia, 2002). In all the countries for which data are available similar disparities have been observed in poverty levels between urban and rural populations.

Even wider disparities have been observed in poverty levels across socio-economic groups within the sub-region. In general, the observed poverty levels are higher among food crop producing farmers than among those producing crops for the export market. Results of a poverty survey in Burkina Faso in 1998 revealed that whereas 53.4 per cent of food crop farmers fell below the poverty line, 42 per cent of cash crop farmers were poor. Further, poverty was worsening among food crop farmers whilst it was declining among cash crop farmers. In Ivory Coast the proportion of food crop farmers that were below the poverty line exceeded that of cash crop farmers by five percentage points. The difference observed in a 1998/99 poverty survey between the two socio-economic groups was 20 percentage points. Differences in poverty levels between socio-economic groups depict the poor performance of the economies of the West African sub-region, which are largely dependent on agriculture. The causes of rural poverty in Africa have been attributed to the lack of access to land, and low and variable agricultural output and incomes due to poor farm practices, droughts, and diminished employment opportunities (Kabbaj, 2003).

The high incidence of poverty in the West African sub-region has both social and economic implications. Globally, the poor have been identified as having lower educational attainment, poor sanitary conditions, poor access to safe water and poor health and nutrition, conditions not conducive to longevity. In Burkina Faso 1993 estimates of child mortality rate for the very poor and less poor were at 223.9 and 199.2 per 1,000 respectively. Malnutrition rates for the same period in Burkina Faso were put at 35 per cent for the very poor and 33.3 per cent for the non-poor. In The Gambia, the 1998 Household Poverty Survey results revealed that Lower River, Central River and Upper River Divisions with the highest poverty indices had the highest levels of malnutrition.

Apart from the high levels of malnutrition that may partly explain the high mortality rates among the poor compared to the less poor in West Africa, another possible explanation is differentials in access to, and affordability of, health services. In Ghana, for example, it was observed that between 1991/92 and 1998/99 use of health facilities declined amongst the very poor. In the rural areas 65 per cent of the very poor did not consult health personnel or attend a health centre or hospital when they fell ill (Oduro and Aryee, 2003). Similarly, in Niger 29 per cent of women in the lowest wealth quintiles obtained ante-natal care compared to 77 per cent of women in the highest wealth quintile in 2000. Such disparities in the use of health facilities may partly explain differences in infant and child survival between the poor and non-poor in the sub-region. It is worth noting that the structural adjustment programmes of the 1980s in most countries in West Africa led to the introduction of cost recovery in health services and the withdrawal of most government subsidies in provision of the social services. These measures could have had an impact on the purchasing power of the poor, hence a reduction in the uptake of health services.

The evidence of poverty as reviewed earlier pointed to the possible consequences of poverty for the intervening factors that could have an impact on infant and child survival in the sub-region. From this evidence one can conclude that in West Africa poverty is a major contributory factor to the persistently high levels of morbidity and mortality in the sub-region.

4.3. Hunger/Nutrition

A major challenge facing sub-Saharan African countries today is the inability of the sub-region to combat hunger and poverty. One-third of the sub-region is malnourished and childhood mortality rates are among the highest in the world. The African continent continues to register the highest population growth rates in the world, despite the high mortality rates observed over the years. Africa is the only continent where hunger and poverty are projected to worsen in the next decade (International Food Policy Research Institute, 2002). According to a FAO report, a large number of countries have succeeded in turning the tide against hunger but in some countries the trend shifted in the opposite direction. In West Africa, Nigeria was listed among countries that had regressed in terms of improving nutritional status. According to the report, several countries in Central and West

Africa have seen their numbers of hungry people rise due to civil conflict (The State of Food Insecurity in the World 2003 (SOFI 2003).

In West Africa most households have insufficient food in terms of quantity, quality and utilization. In the sub-region about one-third to one-half of the population suffers nutritional deprivation, including protein-energy malnutrition and deficiencies of vital micronutrients (Lwanga et al, 2002). Stunted growth, a measure of chronic malnutrition, is widely prevalent among West African children with more than one-third of them stunted. The proportion of chronically malnourished children ranged from 7 per cent in Nigeria to 39 per cent in Niger. In some countries the prevalence of chronic malnutrition worsened over the years. In Niger, for example, the proportion of children that were stunted rose from 32 per cent in 1992 to 40 per cent in 2000 (Odura and Aryee, 2003). There have been seasonal variations in the levels of malnutrition in some countries. In The Gambia for example, levels of malnutrition are highest amongst children during the rainy season (often referred to as the hunger season) than during the dry season when food is more readily available.

High levels of malnutrition in West Africa have implications for both the health and economy of the sub-region. Malnutrition increases the risk and severity of infectious diseases in the region, particularly among children, and women of reproductive age. Malnutrition is said to be a contributing factor to about half of all childhood deaths. Malnutrition affects the immune system's response to infection and interferes with the body's ability to utilize food. Recent research findings have shown that even mild and moderate forms of micronutrient malnutrition can substantially increase the rates of childhood illness and death. Childhood mortality is said to increase exponentially with lower nutritional status. Malnutrition levels observed among pregnant women in West Africa have been high with almost half of pregnant women suffering from iron-deficiency anaemia. Malnutrition during pregnancy, apart from posing a threat to maternal survival, can also put the life of the child at risk in view of the fact that such a child is highly likely to be an under-weight child and susceptible to diseases or it may even die before being born.

Improving the nutritional status of the population of West Africa has gained a new impetus in view of an increasing threat of HIV/AIDS. Poor nutritional status has been found to be a recipe for heightened susceptibility

of HIV infected persons to illness and opportunistic infections. This has become a much greater concern in West Africa in view of the fact that 50 per cent of adults infected with HIV are women aged 15-49 (SANA, 2002). These women are in their most reproductive years and have the potential to transmit the disease to their children through pregnancy, labour or breast-feeding.

Another dimension of the problem of malnutrition is that children born to malnourished women are more likely to have low birth weight, which decreases their chances of attaining full growth and increases their mortality risk. In West Africa malnutrition during pregnancy is quite common due to excessive physical work during pregnancy and cultural practices, which restrict access to adequate nutrition for women. In most countries in West Africa the tradition of giving men the most nutritional part of a family's diet at the expense of women and children remains entrenched in many communities. In addition myths exist that forbid pregnant women from eating certain nutritional food. Some of these cultural practices could explain the high incidence of malnutrition among pregnant women in the sub-region.

Civil strife and the resultant population displacement in many West African countries have contributed to the high prevalence of malnutrition among both adults and children. Conflict contributes to food insecurity in two ways. First, through displacement a large number of people are exposed to hunger and starvation and second, conflict causes structural food insecurity. Structural food insecurity occurs when conflict prevents farmers from producing food and/or when access to food is disrupted due to a blockade of roads and means of transport and access to markets. According to FAO, conflict in sub-Saharan Africa resulted in losses to almost US$52 billion in agricultural output between 1970 and 1997. The World Bank (2004) estimates that US$800 million spent on conflict in West Africa could have been used for development. The conflict situation in many countries in the sub-region has had serious consequences for the economies of countries and has seriously aggravated poverty levels in general, and malnutrition in particular. The World Bank has identified the conflict in Ivory Coast as particularly damaging to the economy of the sub-region. It served as a regional hub for land-locked countries in the region: 43 per cent of Mali's and 77 per cent of Burkina Faso's exports are shipped through Abidjan (World Bank, 2004).

This conflict has serious implications for the already volatile economies of neighbouring countries.

The negative effects of conflict on food security is manifest in the high incidence of malnutrition and childhood mortality in countries like Guinea Bissau, Sierra Leone, Liberia, Guinea and Ivory coast. Levels of undernourishment among children in conflict situation are often higher than that of adults. Citing the United Nations International Children's Education Fund (UNICEF), Kabbaj (2003) indicated that the incidence of malnutrition tends to be higher among children than among adults and is worse during emergency situations (such as famine or military conflicts). Children also suffer more than adults. Children in conflict situations in West Africa are therefore, susceptible to infectious diseases and have a higher likelihood of dying at an early age.

Apart from the effects of hunger in terms of reducing longevity, hunger can also negate a country's development efforts. Three UN agencies, the FAO, the World Food Programme and the International Fund for Agricultural Development documented the debilitating effects of hunger on both individual and overall economic growth (FAO, 2002). The agencies showed that unless hunger is dealt with effectively, prospects for achieving other goals would be severely compromised. The incidence of malnutrition in West Africa unless effectively addressed is likely to have a negative impact on productivity and to frustrate efforts aimed at poverty reduction. Even as the sub-region faces a new challenge of HIV/AIDS, a spate of natural impediments to increased agricultural output such as environmental degradation, drought and pest infestation, malnutrition is increasingly likely to accelerate poverty in the sub-region.

Most countries in West Africa, especially those bordering the Sahara Desert are semi-arid and are faced with a problem of rapid environmental degradation, drought and erratic rainfall patterns. Since agricultural production in most countries is largely dependent on rainfall, agricultural output has been quite unpredictable and fluctuated over the years. Years of persistent drought in the 1970s and 1980s resulted in large population movements from rural to urban areas. These movements affected the Sahelian countries, which were hardest hit by the drought. Such population movements have resulted in the loss of much needed labour for the agricultural sector and increased urban poverty. Over the years, rainfall patterns in the

sub-region have been quite erratic, which has aggravated the food security situation in most countries.

The need to cope with the food needs of a rapidly growing population of West Africa has forced farmers in many countries to employ farming techniques that have had dire environmental consequences. Excessive tree felling during the clearing of agricultural land and over-grazing has resulted in the destruction of the environment, which has led to accelerated desert encroachment in many countries in the sub-region. These developments have had negative consequences on agricultural production, leading to increased poverty and food shortages.

In 2004 the West African sub-region experienced the worst locust plague for 15 years. In the affected zones, families lost 70 to 80 per cent of their harvests. The extent of damage caused by the locust invasion differed across countries in the region. According to FAO estimates, leaving Mauritania aside, only five per cent of the savannah grassland on the southern fringes of the Sahara was likely to suffer food shortages in 2005. The regions hardest hit by locusts in West Africa were Senegal, Central Mali, Northern Burkina Faso, Niger and Chad. The FAO estimated that grain production in the nine Sahel countries would decline from 14.3 million tones in 2003 to 11.6 million tones in 2004. In Niger, grain output in 2004 plunged by 19 per cent according to the Inter-State Committee to Fight Drought in the Sahel (CILSS). In Senegal grain production is estimated to have dropped by 22 per cent. The locust invasion had not only destroyed crops but also destroyed pasture. In the northern regions of Burkina Faso, 80 per cent of pasture had been completely wiped out by locusts. In some rural areas in the sub-region, the price of grain had doubled whilst the price people could get for their cattle halved as herdsmen who were running out of fodder sold their animals to buy grain (Integrated Regional Information Networks, 2004). This precarious situation in West Africa is likely to worsen the state of nutrition in the sub-region, increase poverty and malnutrition and reduce longevity.

Poor nutritional conditions in West Africa, particularly of women and children, are likely to increase vulnerability to infectious diseases, increase morbidity and mortality and eventually increase poverty levels in West Africa. The periodic locust infestation in a number of West African countries poses a serious threat to food security in the face of a below average

grain harvest in many countries in the sub-region. The potentially negative effects of natural calamities on food security in West Africa, as exemplified by the 2004 locusts invasion, is testimony of the vulnerability of the sub-region's food security to natural disasters.

4.4. HIV/AIDS

HIV and AIDS have brought enormous strain on the economies of many countries in sub-Saharan Africa. In addition to the human toll, the epidemic has brought additional pressure to bear on many countries' health sectors and household economies have been crippled through ill-health by reduced economic production in many communities. The incidence of HIV/AIDS in West Africa, although among the highest in world, is still lower than levels observed in Eastern and Southern Africa. On average the incidence of the disease is lower than the sub-Saharan average of 7.5 per cent. According to available statistics, the highest incidence of HIV/AIDS has been observed in Ivory Coast (7.0 per cent), Liberia (5.9 per cent), Nigeria (5.4) and Burkina Faso (4.2 per cent). The incidence of the disease was lowest in Senegal (0.8 per cent), The Gambia and Niger (1.2 per cent) and Benin (1.9 per cent).

The data presented in Table 3 show that more than 50 per cent of the adults living with HIV/AIDS in the sub-region are women aged 15-49. The high infection rates observed in the sub-region among women in their prime ages is indeed worrying. As women in West Africa produce a large share of the food grown in the sub-region, a high incidence of HIV/AIDS could have serious consequences for food security in the region. Also of concern is the large number of children orphaned by the disease. Considering lower survival chances of orphaned children compared to non-orphans, an increase in orphan-hood could cause an increase in the already high levels of childhood mortality in West Africa.

Although the data presented in Table 3 point to relatively low levels of HIV/AIDS prevalence, other studies indicate much higher levels in some population groups. In the Ivory Coast studies carried out in the early 1990s indicated infection levels of nearly 15 per cent among pregnant women and as high as 62 per cent among prostitutes in the capital Abidjan (FAO website, 2004). Due to the frequent movement of people across the border from Burkina Faso to Ivory Coast in search of work, there are concerns about the spread of the disease across the border. The UN estimated that

by 2005 HIV could be responsible for 20 to 24 per cent more deaths in the 15-49 age group in both countries. In Ghana studies conducted in the past have shown that AIDS infection was rising among school children. A study conducted in a Ghanaian coastal town among 40 pupils who volunteered to donate blood to a hospital found that more than half the pupils were HIV positive (Ameyibor, 1998). In Senegal concern for the vulnerability of children to HIV infection prompted the government to promote condom use in the country, specifically targeting school-going youth.

Table 3 Estimated number of adults, women and children living with HIV/AIDS, adult HIV/AIDS prevalence rate, AIDS deaths and AIDS orphans by country, 2003

	Population living with HIV / AIDS				AIDS	
Country	Women	Children	Adults	Adult Rate	Deaths	Orphans
Burkina Faso	150,000	31,000	270,000	4.2	29,000	260,000
Ivory Coast	300,000	40,000	530,000	7.0	47,000	310,000
Gambia	3,600	500	6,300	1.2	600	2,000
Ghana	180,000	24,000	320,000	3.1	30,000	170,000
Guinea	72,000	9,200	130,000	3.2	9,000	35,000
Liberia	54,000	8,000	96,000	5.9	7,200	36,000
Mali	71,000	13,000	120,000	1.9	12,000	75,000
Niger	36,000	5,900	64,000	1.2	4,800	24,000
Nigeria	1,900,000	290,000	3,300,000	5.4	310,000	1,800,000
Senegal	23,000	3,100	4,000	0.8	3,500	17,000
Togo	54,000	9,300	96,000	4.1	10,000	54,000

Note: these statistics are estimates at the end of 2003 published by UNAIDS in their 'Report on the Global HIV/AIDS Epidemic, July 2004'. The estimates include all people with HIV infections, whether or not they have developed symptoms of AIDS, alive at the end of 2003. If a country is not included in the table it is because there are no reliable statistics for that country. Adults in the table are defined as men and women aged 15-49 and children are defined as under the age of 15 years. Orphans are children aged under 17 years who lost one or both parents to AIDS.
Source: UNAIDS (2004), Culled from HIV and AIDS Statistics for Africa.

In Africa, the impact of HIV/AIDS has been found to have multi-dimensional effects. The disease has been found to have an impact on the health sector in various ways. HIV/AIDS affects countries by increasing pressure on health resources, by imposing a negative impact on the quality of care, by increasing infection rates among health workers and by causing a reduction in the number of health personnel. Health personnel numbers have declined either through illness, death or health care workers deciding to quit their work as a result of increased workload and eventual frustration.

These impacts of the disease eventually translate to increased health bills in the sub-region.

At the household level HIV/AIDS strips families of assets and income-earners and ends up impoverishing them. In Ivory Coast, a study revealed that income in households affected by the disease was half that of average household income. This was attributed not only to the loss of income due to illness among household members, but also because other members had diverted more time and effort away from income-generating activities (Bechu, 1998). Similar studies conducted in Burkina Faso, Rwanda and Uganda, calculated that AIDS will not only reverse efforts to reduce poverty, but will also increase the percentage of people living in extreme poverty (from 45 per cent in 2000 to 51 per cent in 2015). In Burkina Faso it was estimated that rural families reduced their agricultural work or even abandoned their farms because of AIDS. A similar study in Ethiopia found that AIDS-affected households spent 11-16 hours per week performing agricultural work, compared with an average of 33 hours for non-AIDS households.

The economic loss to AIDS-affected households is not only limited to loss of the contribution to the household economy of the infected person but also results in the meagre income having to be spent on medical care for the patient and eventually on to meet funeral expenses. According to a study in Ivory Coast, health care expenses rose by up to 400 per cent when a family member had AIDS. Such expenses can seriously diminish household resources, which can affect household nutrition and the general health of households. For most children, the loss of parents or guardians to AIDS requires them to assume responsibilities. Often these orphans have to fend for themselves and in most cases they cannot afford to pursue education. This state of affairs often has dire consequences on the survival chances of children and the future growth and development of these children.

From the evidence reviewed here it is clear that the cumulative impact of HIV/AIDS can negate the development efforts of any country and impede efforts aimed at poverty reduction and improving the health of a populace. Although national efforts in West Africa to control the spread of HIV/AIDS have not been discussed in this chapter, it is evident that despite the relatively low levels of HIV infection, there are indications that the potential exists for an increase in the pandemic in the region. This is be-

cause socio-cultural practices conducive to the spread of the disease are still highly prevalent as rates of infection are increasing in most countries. Some of these practices relate to the high prevalence of polygamy, wife inheritance, female genital cutting and a culture of denial and stigmatization of HIV positive persons. Overall, the findings are indicative of the fact that in West Africa, unless HIV infection rates are drastically reduced, the target of the first MDG 'halving poverty and hunger by 2015' is quite unlikely to be attained in view of the debilitating effects of the pandemic on the population of the sub-region.

5. Conclusion

Mortality levels in West Africa continue to be extremely high. Gains in mortality reduction in the sub-region can only be consolidated within a favourable socio-political environment. The attainment of peace and stability in the sub-region is therefore a prerequisite for the attainment of the desired goal of rapid mortality reduction.

In the West African sub-region, poverty levels are highest in rural areas among food crop farmers and female-headed households. These population groups are quite vulnerable: those in rural areas have limited access to essential services, particularly health and education services, and this increases their vulnerability to disease. Poverty strongly influences mortality levels in the sub-region both directly and indirectly. The poor are more prone to malnutrition and less likely to use modern health services. This, in addition to other factors, explains the high levels of mortality in the West African sub-region. Considering the impact of poverty on mortality levels in the sub-region, poverty can be seen to be a contributory factor to high mortality in the sub-region.

Regarding the nutritional status of the population of the sub-region, the available evidence shows that micronutrient deficiency is highly prevalent. The evidence further shows that the poor and rural populations are the most likely population groups to be malnourished. Ironically, food crop farmers are much more vulnerable than other population groups. This finding is a major concern in view of the fact that a large proportion of farmers in West Africa are food crop farmers. Considering the vulnerability of malnourished populations to infectious diseases and the potential for nutritional deficiency to affect productivity at work, meeting the food

requirements of the rapidly growing population of West Africa would be a daunting task under the prevailing circumstances. Malnutrition, while contributing to increased poverty and mortality levels, is also a consequence of poverty in West Africa.

In West Africa the scourge of HIV/AIDS is not only a strain on the economies of states and households, but it is also a hindrance to the development of those countries. The epidemic has meant an increased demand on resources for the health sector resulting in the diversion of resources otherwise meant for development initiatives. The disease has also resulted in a reduction of productivity at work and has begun to have a negative impact on food security in some West African countries. This situation has set in motion a cycle of malnutrition, disease, mortality and food insecurity.

Overall the evidence in this paper has shown that mortality is both a determinant and a consequence of poverty and hunger in West Africa. For the sub-region to overcome the problems related to mortality, poverty and hunger, it is essential that efforts be intensified towards improving productivity of the agricultural sector, the quality of health care services to fight against HIV/AIDS. In terms of priorities, it is absolutely necessary to take on the challenges posed by the three problems at the same pace and time. This is because neglect of any of these problems or even under investing in any could negate the efforts aimed at solving the others.

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Part II

MACRO PERSPECTIVES

5

Public Health and Mortality in China's Less Developed Rural Areas

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1. Introduction

Eradicating poverty, improving public health, and lowering mortality are some of the key concerns and actions promoted by the United Nations Millennium Development Goals (United Nations, 2000). Fighting poverty and enhancing public health are often interdependent. Poverty is an important cause of poor health, and poor health can also result in poverty, especially in a society without an effective health care system.

China made impressive progress in lowering mortality rates in the period from the early 1950s to the late 1970s when life expectancy at birth increased rapidly although the level of its economic development was still low. According to the data provided by China's Population Information and Research Centre, life expectancy at birth for the national population rose from less than 35 years in the late 1940s to 56 in 1957, 64 in the early 1970s and 68 in 1981 (Huang and Liu, 1995). However, lower but perhaps more reliable estimates show that China's life expectancy at birth increased to 50 in 1957, 61 in 1970 and 65 in 1981. This was still a gain of approximately ten years in life expectancy per decade for some 30 years– an extraordinary improvement that had never previously been recorded in any large population (Banister, 1987: 116).

China has also achieved great success in poverty reduction in recent years. According to Chinese researchers, the number of rural people living

[1] The authors would like to thank Cai Yong for his help. The authors also like to thank Pfizer for its support to this research.

below the national poverty line has fallen substantially from 250 million in 1978 to 26 million in 2006 thanks to rapid economic growth and the remarkable efforts to eradicate poverty (He, 2006; Lin and Li, 2005). Estimates published by the World Bank show that in China the number of people living under the poverty line of one dollar a day decreased by 422 million from 633.7 million in 1981 to 211.6 million in 2001.[2] This played an important part in poverty reduction in the world where the number of people living under the poverty line fell by 390 million during the same period (Chen and Ravallion, 2004). Without China's achievement, the number of people living below this poverty line would have increased in the world. It is largely due to this change that the health status of the Chinese population has continued to improve and its life expectancy at birth has risen further by six or seven years since the early 1980s (Banister and Hill, 2004; Li and Sun, 2002).

Despite these achievements, China is facing new challenges in both fighting poverty and in improving population health. According to the World Bank, China still has more than 160 million people –a number far greater than that of most national populations in the world– living below the poverty line of one dollar per day (Lin and Li, 2005). China's official data sources also show that there are still 26 million people whose net annual income is less than the national poverty threshold income of 668 yuan and more than 40 million people with an annual income of between 683 and 944 yuan. The income level of all these people is well below the international poverty line (He, 2006; Wei, 2006). Although there are marked differences in their definitions and the ways in which these figures were computed, they clearly indicate that poverty reduction remains a major challenge for China's future development. Poverty perpetuates poor health. Eradicating poverty therefore will continue to play a crucial a part in future improvements of public health and mortality as it has done in recent decades.

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[2] An average net annual income of 668 yuan was the official poverty line used in China in 2005. Yuan is the Chinese currency and at the current exchange rate, 100 Yuan is equivalent to approx. US$ 12.50. For a detailed discussion of changes in defining poverty in China, see Lin and Li (2005) and The State Council Leading Group Office of Poverty Alleviation and Development and News Office of State Council (2001).

Poor health could also lead to poverty. It is for this reason that improving health care for the poor is regarded as an important strategy for helping them to get out of poverty. While China has been very successful in raising living standards, disparities in the distribution of income and wealth in society have grown considerably. The improvements in standards of living in many less developed areas or disadvantaged populations have fallen behind those in advanced areas or in the population as a whole. This, together with the collapse of Co-operative Medical Systems and the rapid increase in the cost of medical care, make it difficult for poor people to get adequate health care. There is evidence that the gap in health and mortality has increased between China's advanced and less developed areas in recent years. Poor health conditions and difficulties in getting required medical care (or their financial consequences) have already become major obstacles in further eradicating poverty (Zhao, 2006).

This chapter investigates health care and mortality in China's less developed rural areas. We start with an introduction to the data used in the study and 15 of the poorer counties from which these data were collected. Then we examine several health determinants and their impact on health conditions in the study population. Following that, we analyse morbidity and mortality patterns in these counties and compare them with those recorded in advanced areas. The chapter ends with a number of concluding remarks.

2. Data Used in this Study and Fifteen Poor Counties

The study has been conducted using the data collected through China's 2003 National Health Services Survey (NHSS) and recent censuses. The 2003 survey was conducted by the Ministry of Health (MOH) and is the third of its kind. The first two were undertaken in 1993 and 1998 respectively. The 2003 NHSS was carried out in 28 districts and 67 counties throughout China. The total population in these districts and counties that year was about 45 million. The survey gathered detailed data about respondents' economic conditions, health status, their participation in health care systems, use of health facilities and other relevant information from 194,000 individuals and 57,000 households. A detailed discussion of the 2003 survey can be found in the survey report published by MOH (Center for Health Statistics and Information of MOH, 2004).

Fifteen of the 67 surveyed counties were included in the 592 poor counties defined in 1994 and which are still recipients of poverty-reduction support from Chinese governments. These 15 counties are Tang, Fengning, Wuxiang, Kalaqin (Qi), Zhungeer (Qi), Ruyang, Sui, Macheng (county-level city), Hefeng, Luocheng, Shibing, Hanyin, Yuzhong, Lintan, and Hotan. As shown in Table 1, these counties are located in Hebei, Shanxi, Henan, Hubei, Guizhou, Shaanxi and Gansu provinces and Guangxi, Inner Mongolia and Xinjiang autonomous regions respectively. The total population living in these counties was about six million, and more than 80 per cent of them were officially classified as agricultural population in 2003. Educational levels were low in these counties and according to the 2000 census results, the illiteracy rate was close to 15 per cent. The level of economic development is still very low in all these counties except Zhungeer where notably higher per capita GDP and annual income were recorded. In all other counties, the average annual income for the agricultural population varied between 961 and 2,088 yuan. Although considerably higher than China's national poverty line, they are still much lower than the international poverty standard of 365 US dollars per year.

The 2003 NHSS sampled approximately 150 villages and 9,000 households (generally 60 households from each village and 10 villages from each county) from the 15 poor counties. Detailed demographic, health and economic data were collected from these households and their members. The survey results show that the average per capita annual income recorded in the survey sites ranged from 951 yuan to 3,430 yuan, and was fairly consistent with that computed from other sources (see Table 1). They further confirm that the majority of the population in these counties no longer lives below China's poverty line, but their income levels are still very low by international standards. The conformity of the two sets of results also suggested that data gathered from the surveyed areas in the 15 counties could be used to investigate some major health determinants and their impact on health care and morbidity patterns in China's less developed rural areas.

Mortality data for the 15 selected counties were obtained through China's recent censuses, which recorded deaths occurring in the previous year. Life tables could be constructed from these data for every county. In addition, data collected from China's national disease surveillance points can also be used in the examination of major causes of death in China's poor

counties. The counties included in China's disease surveillance networks do not overlap completely with those surveyed by the MOH in 2003. But these counties have been divided into several groups according to their socio-economic development levels, and major causes of death found in the less developed rural areas are likely to be similar to those in the poor counties included in the national health survey. Some of these data have been affected by registration problems. For example the census slightly under-recorded deaths and the causes of death registered at the national disease surveillance points may not be very accurate, which is often the case in less developed areas, owing to the lack of well-trained medical professionals and the lack of knowledge about health and diseases. Nonetheless, these data are generally reliable and sufficient for describing morbidity and mortality patterns in China's less-developed rural areas and their differences in comparison with those observed in advanced areas.

Table 1 Social, economic and demographic indicators for 15 selected counties, c 2003

Name of the county	Province/ Region	Population (in 1,000)	Agricultural population (%)	Illiteracy rate (%)	Per-capita income (yuan)
Tang	Hebei	531	86.3	10.1	1,980
Fengning	Hebei	381	78.0	10.4	1,412
Wuxiang	Shanxi	200	83.5	4.9	1,790
Kalaqin (Qi)	Inner Mongolia	367	89.5	12.3	1,600
Zhungeer (Qi)	Inner Mongolia	272	69.2	21.9	3,060
Ruyang	Henan	421	87.1	9.1	1,897
Sui	Henan	791	89.2	13.8	1,600
Macheng (Shi)	Hubei	1,163	70.8	14.4	2,088
Hefeng	Hubei	216	91.2	10.4	1,558
Luocheng	Guangxi	364	88.9	6.1	1,099
Shibing	Guizhou	156	91.8	19.8	1,559
Hanyin	Shaanxi	289	90.2	27.9	1,498
Yuzhong	Gansu	426	91.7	13.1	1,684
Lintan	Gansu	146	92.3	39.3	1,078
Hotan	Xinjiang	276	82.3	10.7	961

Notes: a) Proportions of agricultural population for Fengning, Ruyang, and Sui are for the year 2000. b) Illiteracy rates are obtained from the census results and for 2000. c) Macheng is a county-level city.

Sources: Gansu People's Government (2004); Guizhou Provincial Statistics Bureau (2004); Hebei People's Government (2004); Henan Provincial Statistics Bureau (2004); Hubei Provincial Statistics Bureau (2004); Inner Mongolia Autonomous Region Bureau of Statistics (2004); Population Census Office under the State Council and Department of Population, Social, Science and Technology Statistics of National Bureau of Statistics (2002); Shaanxi Provincial Statistics Bureau (2004); Shanxi Provincial Statistics Bureau (2004); Statistics Bureau of Guangxi Zhuang Autonomous Region (2004); Statistics Bureau of Xinjiang Uyger Autonomous Region (2004).

While the 2003 NHSS collected detailed information from individuals and households, the authors of this paper do not have access to these data.

The analysis reported here therefore has to be based on published results which have been aggregated at the level of a county. Because of this constraint, certain desired analyses could not be carried out. The relationship between socio-economic conditions, living environment, other health determinants and patterns of morbidity and mortality could not be tested and measured effectively using available statistical methods. Largely for these reasons, this study takes a comparative approach to reveal the considerable gap between China's less developed rural areas and the national average or developed regions in their socio-economic development, health care and mortality. In doing so, it also examines the relationship between poverty and population health and a number of factors through which poverty exerts its influence on morbidity and mortality.

3. Major Health Determinants and Their Impact on Population Health

As suggested by epidemiological transition theories and previous mortality studies, a number of factors play important roles in affecting population health and mortality (Omran, 1971 and 1983; Mosley and Chen, 1984; Caldwell, 1986; Olshansky *et al.* 1998; Vallin, 2005). This section examines living standards, living environments, provision of health services, health care coverage, people's knowledge about health and disease prevention, and their impact on population health in China's less developed rural areas.

3.1. Low Standard of Living, Malnutrition, and Inadequate Spending on Health Care

One of the most observable characteristics of less developed rural areas and a major reason for them being regarded as poor is their low standard of living, which is clearly indicated by their income and expenditure. According to 2003 NHSS results that are shown in Table 2, in China's less developed rural areas, the average reported annual income was 1,704 yuan which is only about half of the national average and slightly more than a quarter of the average income for the population living in cities. Their average expenditure was 1,455 yuan, which is 56 per cent of the national average and 29 per cent of the city dwellers.

Table 2 Living conditions in rural China, 2003

	Whole country	Cities	15 counties
Number of people being surveyed by 2003 NHSS	193,689	49,698	32,305
Per capita income (*yuan*)	3,302	6,565	1,704
Per capita expenditure (*yuan*)	2,590	4,934	1,455
Per capita health expenditure (*yuan*)	288	459	191
Percentage of households using tap-water	52.2	95.8	26.1
Percentage of households using toilets with water flushing systems	27.1	79.1	0.8

Source: Center for Health Statistics and Information of MOH (2004).

Low standard of living has affected the health status of the population in at least the following two ways. First, low standard of living often results in poor nutritional intake. Even in China's urban areas the level of nutrition intake varies notably depending upon the level of income and wealth. When the population is divided according to the level of income, the average amount of daily caloric intake of the top ten per cent of the population is almost double that of the bottom ten per cent of the population (Meng *et al.* 2004). Such a link is expected to be stronger in rural areas where Engel's coefficient is greater and the impact of the income level on food consumption is larger than in urban areas. According to the data gathered from China's disease surveillance points, infant deaths due to nutrient deficiency were as high as 86 per 100,000 in rural areas in 1998 (Department of Control Disease of MOH and Chinese Academy of Preventive Medicine, 1998). Malnutrition is still a serious health problem in China where ten per cent of children under five were underweight for their age in 2000 (WHO, 2004). In poor rural areas, the proportion was higher than the national average and underweight children accounted for more than 20 per cent (Rao and Liu, 2004). Those who suffer from malnutrition in general are more vulnerable to various types of diseases.

Second, low income makes it difficult for poor people to access health care. According to the 2003 NHSS, people living in China's less developed rural areas spent an average of 191 yuan on health care in the reference year. This amount accounted for 13 per cent of the average annual expenditure, but might not be enough for a patient to get decent medical treatment. In the survey year, the national average cost for a single visit to a doctor was about 130 yuan. In other words, the total annual health expenditure in the 15 poor counties allowed each person to visit a doctor only 1.5 times on average. This amount of money, which it is already a heavy burden for people in poor rural areas, was not enough to pay for a single visit to a

doctor in large and medium-sized cities where better equipped hospitals were located. The cost of such a visit was about 280 yuan in 2003. For these reasons, people in poor rural areas usually had their health problems treated in village or township hospitals. In some cases they treated the problems themselves or had no treatment at all. This will be further discussed later.

3.2. Poor Living Environment and High Prevalence of Infectious and Digestive Diseases

People in less developed rural areas often live in hygienically inadequate conditions. According to the 2003 NHSS, 96 per cent of residents in cities used tap-water, but only slightly more than a quarter of people could do so in the 15 poor counties, where drinking water for the majority of the population still came from other less hygienic sources such as primitive wells, rainfall or rivers (see Table 2). Moreover, less than one per cent of households had water flushing toilets and virtually all toilets in these areas were regarded as unhygienic (Center for Health Statistics and Information of MOH, 2004: 70). Drinking water and toilet facilities are two important components of the living environment. Their improvement has played a crucial part in preventing and controlling infectious diseases in the process of the epidemiological transition. China has made noticeable progress in improving drinking water and toilet facilities in recent years, but the inadequate supply of clean drinking water and lack of hygienic toilet facilities remain major contributing factors for the high incidence of infectious diseases and digestive diseases in less developed rural areas.

The 2003 NHSS collected information from people who reported to have suffered from various types of diseases during the two weeks prior to the survey. These results show that during the reference period, the cases of infectious diseases were about 4 per 1,000 and digestive diseases were about 25 per 1,000 respondents in less developed rural areas. They were higher than the national average of 2.5 and 21.1 per 1,000 respondents, and notably higher than those recorded in cities –1.8 and 17.7 per 1,000 respectively. Similarly, in the poor rural areas proportions of those suffering from infectious diseases and digestive diseases out of all people reported having illnesses were also higher than the national average and much higher than those in cities and advanced rural areas. A notable example of this kind is the prevalence of tuberculosis which will be discussed later. The high prevalence of these diseases and the notable disparity in morbidity structure

between China's advanced regions and poor rural areas are closely related to the marked difference in their socio-economic development levels and people's living conditions. This is consistent with those described by the epidemiological transition theory and those observed in other populations (Omran, 1971 and 1983; Olshansky and Ault, 1986; Olshansky *et al.*, 1998; Vallin, 2005).

3.3. Inadequate Medical Facilities and Low Level of Health Services

Another major factor affecting the control of diseases and the health status of the population is the availability of effective medical services. The provision of health care in China's less developed rural areas is far from adequate and the quality of the service is low. In China's large cities for example, each hospital on average serves an area of 1.4 square kilometres and 14,800 people. But in less developed rural areas a hospital often serves an area of several hundred square kilometres, and the number of people served by a hospital is close to 100,000. Moreover, hospitals in less developed areas tend to be small and poorly equipped. These observations are further supported by the difference in the number of medical professionals between these areas. There are 5.8 doctors and 5.8 nurses for every thousand residents in large cities. By contrast there are only slightly more than one such medical professional per thousand population in less developed rural areas. Many doctors and nurses in rural areas have only limited training and are often not able to deal with complex medical problems.

Inadequate health care of this kind has many direct health consequences. For example, the 2003 NHSS showed that while almost all pregnant women had antenatal checkups in large and medium-sized cities, only about three-quarters of pregnant women in less developed rural areas had received antenatal checkups during the five years before the survey. In cities and advanced rural areas, around 90 per cent of women gave births in hospitals, but only 46 per cent of women in less developed rural areas had hospital deliveries. Due to the lack of adequate antenatal care, the proportion of women having difficult deliveries is noticeably higher in less developed rural areas in comparison with large and medium cities and advanced rural areas. Similarly, in comparison with those in urban and advanced rural areas, the proportion of mothers and their newborns having received postnatal visits by medical professionals, and the proportion of children being immunized are also relatively low in less developed rural areas. This unsatis-

factory situation has directly contributed to the high infant mortality in these places. This especially relates to mortality caused by acute infectious diseases, diseases of the upper respiratory tract, pneumonia, and conditions originating in the perinatal period. According to the data collected from the national disease surveillance points, the infant death rate in rural areas due to pneumonia was about 15 times that in urban areas in 1998 (Department of Control Disease of MOH and Chinese Academy of Preventive Medicine, 1998). Had timely treatment been available or easier to access in less developed rural areas, many of these lives could have been saved.

The negative health consequence of the low availability of medical care facilities is also reflected in the proportion of people that died at home. As revealed by a recent survey conducted in 118 villages where the level of average income is similar to that recorded in the 15 poor counties, 79 per cent of deaths took place at home between 2001 and 2003 – a strong indication that a large number of them did not receive adequate treatment before their death (Han and Luo, 2005).

3.4. Limited Health Care Coverage and Restricted Access to Health Care

Whether people could get adequate health care is affected by both the availability and the accessibility of health care facilities. The latter is influenced by both people's living standard that was discussed earlier and their health care coverage. In the late 1970s, the Co-operative Medical Systems existed in 90 per cent of China's rural areas, although the level of benefit provided by the systems was moderate (Wu, 2003). According to the 2003 NHSS, only 20 per cent of the rural population was covered by various health insurance schemes. In the 15 poor counties, the health care coverage was even lower and stayed at 11 per cent (see Table 3). This is only about one-sixth of that recorded in large cities.

Table 3 Patients visiting doctors for medical treatment and proportions of people without health care coverage, 2003

	Whole country	Cities	15 counties
% having no health care coverage	70.3	44.8	89.0
Visits to doctors in the two previous weeks (per 1,000 people)	133.8	118.1	115.1
Average total cost per visit (*yuan*)	119.0	217.0	103.0
% patients who did not visit doctors for treatment	48.9	57.0	46.1
% patients who did not have any treatment	13.1	9.7	15.8
% patients who did not had any treatment because of financial difficulty	38.2	36.4	47.6

Source: Center for Health Statistics and Information of MOH (2004).

Low income and lack of health care coverage have seriously prevented people from receiving the needed medical treatment in China's less developed rural areas, and the situation has been further aggravated by the recent spiralling increase in the cost of health care. The 2003 NHSS shows that in the 15 poor counties, 4,200 out of 32,000 respondents reported having various types of illness during the two weeks before the survey was taken. Slightly more than half of them visited doctors for treatment and a total of 3,700 visits were recorded. The average cost (including non-medical cost) of each visit was just above 100 yuan. If we take the average annual income in these areas into consideration (1,704 yuan), it is obvious that visiting doctors has now become rather expensive. A single visit costs more than a person's three-week income on average. The survey also showed that in the 15 counties nearly half of those suffering from various kinds of health problems did not see doctors for treatment. Some patients treated the illness themselves (for example seeking remedy in self-medication or from a pharmacist) and 16 per cent of them did not have treatment at all. About half of those who did not have any treatment attributed this to economic hardship. Poverty and low health care coverage have already noticeably influenced people's access to medical services.

Problems of this kind are more observable in the accessibility of in-hospital treatment. The 2003 survey recorded that 900 patients out of all respondents surveyed in the 15 poor counties were hospitalized for a total of about 1,100 times during the year prior to the survey. Table 4 shows that on average each hospitalization lasted for about 11 days.

Table 4 Patients getting in-hospital treatment and its cost, 2003

	Whole country	Cities	15 counties
Hospitalizations in the previous year (per 1,000 people)	36.0	42.4	33.6
Mean number of days staying in hospitals	12.6	18.1	11.0
Average total cost of in-hospital treatment (*yuan*)	3,904	6,954	1,912
% inpatients asking for early discharge from the hospital	43.3	34.5	51.1
% asking for early discharge because of financial difficulty	63.9	53.0	69.8
% patients who ought to but did not receive in-hospital treatment	29.6	27.8	39.0
% not receiving in-hospital treatment due to financial difficulty	70.0	56.1	76.5

Source: Center for Health Statistics and Information of MOH (2004).

The average total cost for each in-hospital treatment was close to 2,000 yuan. This is rather expensive and higher than a person's average annual income in this area. Because of the high costs, slightly more than half of in-patients (51 per cent) asked to be released from hospitals before the date

recommended by the doctor. Whether in-patients asked for an earlier discharge was related to their income level and the availability and type of health care coverage. As expected, the majority of those asking to be released earlier (70 per cent) did so because of economic hardship, which was higher than the national average and that recorded in cities. In addition, nearly two-fifths of patients in these counties (39 per cent) should have had in-hospital treatments but did not and this is notably higher than for city dwellers. Again, economic difficulty was the major determinant for such decisions. More than three quarters (77 per cent) of those who ought to but did not have in-hospital treatments attributed this to financial difficulties.

3.5. Lack of Health Knowledge and High Prevalence of Preventable Diseases

In addition to what has been examined above, people's knowledge about health and disease prevention and the availability of such knowledge or information also influence the health status and the spread of disease in a population. In China's less developed rural areas, people in general have a low level of education and poor access to information about health. According to the 2003 survey, approximately 41 per cent of respondents in the 15 counties reported as having actively obtained health information in comparison with 68 per cent recorded in cities. In large and medium-sized cities, nearly two-thirds of respondents stated that books, magazines and newspapers were their major sources of health knowledge, but only about 15 per cent of people acquired such knowledge in a similar way in the poor rural areas.

The marked difference in the availability of information and knowledge about health and disease prevention is also reflected in the proportion of people having heard about HIV/AIDS. While the Chinese government has been promoting HIV/AIDS education for a quarter of a century and 90 per cent of people reported having heard or having some knowledge of the disease in cities, only 57 per cent of the respondents did so in the 15 counties. People's awareness of and attitudes towards disease prevention directly affect their behaviour, such as personal illness control and whether they are likely to take the advantage of preventive measures like immunization or other forms of health care. It is noteworthy that it is in some of China's less developed or remote rural areas, for example in some parts of Henan, Guangxi and Yunnan, that the spread of HIV/AIDS has become a serious

health problem in recent years (State Council AIDS Working Committee Office and UN Theme Group on HIV/AIDS in China, 2004).

The prevalence of tuberculosis is another example. According to the 2003 NHSS there were 37 recorded tuberculosis cases per 100,000 respondents in China's large cities, but there were 155 cases per 100,000 respondents in the 15 poor counties. These results are computed on only the basis of patients who coughed continuously for at least three weeks and were diagnosed with tuberculosis in hospitals. The adjusted rate published by the MOH, which has included patients who had the disease but had not been diagnosed in this way, is noticeably higher.[3]

4. Mortality in China's Less Developed Rural Areas

The previous section has shown that in China's less developed rural areas, living standards are low and living environment is poor. Adequate medical services are often not available. Most people do not have any health care coverage and their knowledge about health and disease prevention is rather limited. All these have a considerable impact on population health, which is clearly reflected in morbidity and mortality patterns observed in these areas.

As discussed in the previous section, the 2003 NHSS collected information about people's health conditions and diseases recorded during the two weeks prior to the survey. These results show that in cities more people had cardiovascular diseases and other non-communicable diseases. By contrast, a larger proportion of people in less developed rural areas suffered from infectious diseases, digestive diseases, and respiratory diseases. This is confirmed by the causes of death found in China's disease surveillance points. As mentioned earlier, the disease surveillance network does not include all counties that were surveyed in 2003. But it provides information on causes of death in different areas grouped according to their levels of economic development. Disease patterns observed in less developed rural

[3] The MOH adjusted TB prevalence rate for the entire surveyed population is 153.4 per 100,000, which is notably higher than the 115.6 per 100,000 computed according to the above method. According to a recent WHO health report, China's TB prevalence rate was 250 per 100,000 in the year 2000 (WHO 2004).

areas are expected to be close to those existing in the 15 counties. Table 5 presents the distribution of deaths by major causes for the whole country, cities and types 3 and 4 rural areas. Here type 3 refers to rural areas where necessities of daily life have just reached an adequate level and type 4 includes China's least developed and poorest rural areas. The situation in these areas is similar to that in the 15 poor counties surveyed by the 2003 NHSS. Seven of the 15 counties were actually included in the two types of rural areas defined by the national disease surveillance network.

As shown in Table 5, the causal structure of deaths in less developed rural areas was very different from those observed in cities. In Chinese cities and also in advanced rural areas, the overwhelming majority of deaths are caused by cancer, heart disease, cerebrovascular disease and other non-communicable diseases. The proportion of those dying from infectious diseases is low. This pattern is close to that found in developed countries in the world. In contrast, in poor rural areas, the proportion of deaths due to non-communicable chronic diseases is much lower and that caused by infectious diseases, diseases of upper respiratory tract, pneumonia, influenza, maternal diseases, and conditions originating in the perinatal period is considerably higher –a pattern very similar to those recorded in many less developed countries.

Morbidity patterns and the causal structure of death influence mortality to a considerable extent. The examination of the 2000 census data collected from the 15 counties shows that under-registration of deaths existed in some counties. This is particularly observable among children under 15 years of age. As shown in Table 6, in comparison with the recorded national average, mortality rates among children under 15 are markedly lower in Tang, Fengning, Wuxiang, Ruyang, Sui and Kalaqin. Infant mortality rates in Tang, Wuxiang and Sui are reported as being less than half of the national level. Similarly, the life expectancies at birth observed in Tang, Ruyang, Sui, Hefeng and Zhungeer are also close to or even higher than that for the national population. This is very unlikely given their less developed economy and low standards of living discussed in the last section. Under-registration of deaths is also observable among people aged 15 and above, but mortality records for those above this age seem to be more complete

than those below this age[4] These incomplete data nonetheless reveal some characteristics of mortality patterns in China's less developed counties.

Table 5 Percentage distribution of deaths by major causes, 1997 and 1998

Whole rural areas	Country	Cities	Rural areas	
			Type 3	Type 4
Infectious and maternal diseases	7.2	3.9	11.4	23.1
Non-communicable Chronic diseases	77.5	83.6	0.3	60.6
Injury and Poisoning	10.3	6.1	13.1	10.2
Unknown Reasons	5.0	6.4	5.1	6.1
Total	100.0	100.0	100.0	100.0

Note: See the text for the classification of diseases and types 3 and 4 rural areas.
Source: Department of Control Diseases of MOH and Chinese Academy of Preventive Medicine (1997 and 1998).

So far as infant mortality in less developed rural areas is concerned, two points are particularly worth mentioning. First, according to the data collected in seven of the 15 counties (Lintan, Hotan, Luocheng, Shibing, Yuzhong, Hanyin and Macheng), their infant and child mortality rates were considerably higher than and in some cases double or more than double the national average. When comparing with those recorded in large cities, their infant mortality was about ten fold higher. This is clearly related to the greater number of deaths caused by acute respiratory diseases and infectious diseases in these areas. Assuming that in other counties death records were more or less complete among those aged between 35 and 64 and that their mortality patterns were similar to those of the United Nations General Mortality Model, mortality levels, especially infant mortality rates can be estimated for these counties using Mortpak, a UN demographic estimation package (United Nations 2003). Results obtained from this simple estimation suggest that infant mortality in Tang, Fengning, Wuxiang, Ruyang, Sui and Kalaqin would rise to more than 30 per 1,000.

Second, the sex ratio of recorded infant mortality is lower than one in 11 of the 15 counties. This is similar to the national average and indicates higher mortality among girls than among boys. In Ruyang, Tang and Macheng, the sex ratio of infant mortality was only between 0.38 and 0.45.

[4] The mortality statistics presented in Table 6 are based on unadjusted census results. Even the national figures are affected by the under-registration of deaths. According to Banister and Hill (2004), the adjusted mortality is slightly higher and the life expectancy at birth is slightly lower than these unadjusted figures.

Female infant mortality was 2.2 to 2.7 times that of male infant mortality. This pattern is very different from those observed in other countries with similar mortality levels and it is a clear indication of human intervention such as female infanticide or negligence of female children.

Table 6 Recorded mortality in 15 selected counties, 2000 (IMR and 14q1 per 1,000)

Name of the county	IMR	14q1	Sex ratio of IMR	e_0
Tang	11.5	7.4	0.40	72.2
Fengning	20.7	6.4	0.73	71.1
Wuxiang	9.2	11.0	0.83	71.1
Kalaqin (Qi)	21.5	6.2	0.94	69.5
Zhungeer (Qi)	30.5	6.3	0.59	73.3
Ruyang	18.0	8.6	0.38	72.9
Sui	13.1	6.1	0.59	73.5
Macheng (Shi)	40.9	12.9	0.45	66.4
Hefeng	27.9	7.5	1.17	73.1
Luocheng	46.9	11.6	1.09	71.3
Shibing	44.9	19.3	0.89	70.2
Hanyin	41.0	21.1	0.64	64.7
Yuzhong	42.5	12.3	0.85	69.1
Lintan	66.2	16.2	1.17	63.5
Hotan	60.3	31.3	1.14	65.2
National average	27.3	10.7	0.71	72.9

Sources: Computed from the life tables provided by Yong Cai.

In addition to high infant and child mortality, it is also notable that in some of these counties, mortality for those aged between aged 15 and 44 was much higher than the national average, female mortality in particular. For example, the risk of women dying between ages 15 and 44 was 1.7 to 2.6 times of the national average in Macheng, Shibing, Hanyin, Lintan and Hotan. Among those aged 45 and above, mortality recorded in the 15 counties was slightly higher than that computed for the national population, and the sex ratio of mortality was broadly similar to that in the national population. The noticeable gap in mortality between these counties and China's cities and advanced rural areas is confirmed by the difference in their life expectancies. In Lintan, Hanyin, Hotan and Macheng where death registrations seem to be more complete, life expectancy at birth varies from 63 to 66 years, or 6 to 9 years lower than the recorded national average. We can also use methods similar to that mentioned above to estimate life expectancies for other counties where death records are less complete. While using different assumptions or different mortality models could lead to different estimation results, in most cases estimated mortality rates are higher than those recorded in these counties by the census.

5. Concluding Remarks

China has maintained rapid economic growth and achieved great success in reducing poverty in the last quarter of a century. Because of these achievements, the number of people living below poverty line, either according to international standards or those set by the Chinese government, has fallen considerably. Mortality has further declined and China's life expectancy has reached 72 years.

However, China still faces many challenges in fighting poverty and improving public health. Providing better health care in less developed rural areas is one of them. It is important to note that poverty has prevented people from getting adequate medical services. Because of the collapse of Cooperative Health Care System in the 1980s, the deterioration in Labour Insurance Scheme and the fast increase in cost of health service, China has now become a country with a fairly low rate of health care coverage and rather expensive medical services relative to the income level. These changes create difficulties and prevent poor or disadvantaged people from getting adequate medical care. The fact that in less developed rural areas more than half (52 per cent) of patients who needed to have in-hospital treatments but did not have them or had not completed the in-hospital treatment recommended by doctors because of financial difficulties, is a clear indication that such effects have already reached an alarming level. The problem has become so severe that some Chinese officials recently suggested that China's health care reform is largely a failure (Bai, 2005).

It is equally important to note that poor health and its considerable economic consequences are also major obstacles to the eradication of poverty in poor rural areas and disadvantaged population groups. Because of the high cost of health care, poor health often results in the need to make catastrophically high financial payments, which in turn leads to impoverishment. Those with low living standards are particularly vulnerable to such poor health induced poverty. According to a survey conducted in China's poor rural areas and reported by Rao and Liu (2004), the medical expenditure in about 18 per cent of families was actually greater than their total income. Nearly a quarter of the 11,353 surveyed households borrowed money and 5.5 per cent of them sold their properties or belongings to pay the medical bills. According to the 1998 NHSS, after paying their medical expenses, the proportion of poor people in rural areas increased from 7.2 to

10.5 per cent. As noted by Rao and Liu (2004: 51-52), in poor families where average per capita income was less than 500 *yuan,* the medical expenditure accounted for 23 per cent of the total income. High medical cost has already become a heavy financial burden and a major cause of becoming poor in many families. Among poor households enumerated by the 2003 NHSS, 27 per cent suggested that disease, injuries or other kinds of health problems were the major reason for their impoverishment (Center for Health Statistics and Information of MOH, 2004).

To help poor peasants come out of the vicious cycle of poverty, poor health, and poverty, the Chinese government needs to increase its efforts in fighting poverty and to improve health care further, especially in less developed rural areas. It is noteworthy that while Chinese mortality has continued to decline in recent years, the improvement made in less developed rural areas has been slower than that in large and medium-sized cities and advanced rural areas. To stop this mortality gap from further increasing, actions must be taken to meet the challenges brought about by the increasing inequality in the distribution of wealth and in health care.

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6

Generalised Deprivation and Infant Mortality in Rural India

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1. Introduction

Maternal well-being is an important determinant of infant mortality. Studies indicate that factors such as birth injuries, sepsis, low birth weight, placenta previa, birth asphyxia, intrauterine hypoxia, and premature birth are important causes of infant mortality and stillbirth (see, for example, United Nations, 1954; Waldron, 1998a, 1998b; James, Aitken and Subramanian, 2000; USAID, 2004). Infant deaths due to many of these causes could be largely controlled by hospitalisation at birth and effective obstetric care (United Nations, 1954). But the leading causes of infant mortality such as preterm birth and low birth weight are associated with the health/nutritional status of the mother (Jejeebhoy and Rao, 1995; USAID, 2004). This means that infant and late foetal deaths could be reduced, to a large extent, by improving the nutritional status of the mother, particularly during pregnancy. For this reason, there is a case for considering hunger and poverty to be an apposite indicator of poor health and nutritional status. In this connection, the observation by Sen (1987:17) becomes highly relevant: he points out that nutritional status "depends on such factors as metabolic rates, body size, age, sex (and, if a woman, whether pregnant or lactating), activity levels, medical conditions (including the presence or absence of parasites), access to medical services and the ability to use them, nutritional knowledge and education, and climatic conditions". This list, apart from being comprehensive, points to the importance of deprivation in

[1] This paper has benefited immensely from helpful discussions that I have had with S. Subramanian, and also by his comments on an earlier version. I thank R. Dharumaperumal for his assistance with word-processing of the paper.

non-income dimensions to being in good nutritional status. In this chapter, I shall concentrate only on explaining how access to infrastructural facilities impinge on the nutritional status of women during pregnancy which, if not the sole factor, is an extremely important determinant of late foetal and infant mortality.

Sen (1987) suggests the nutritional status of the mother, apart from being a function of the quantum of food consumed, is a function of nutritional intake/absorptive capacity of the body. Nutritional intake capacity depends on the mother's health. The health status of the mother in turn depends on a number of environmental factors such as the availability of clean drinking water, the control of conditions like amebiasis, hookworm infestation, chronic diarrhoea, and malaria, and the availability of clean fuel for energy requirements (Jayaraj and Subramanian, 2004). By ensuring that the households have access to the basic amenities of life, particularly safe and protected drinking water, a large number of these conditions that affect the nutritional intake capacity of mothers could be prevented.

Provision of safe and adequate drinking water also helps to conserve the mother's energy, which improves her nutritional status and that of the foetus and the nursling (Burger and Esrey, 1995). Availability of safe drinking water is also likely to reduce the incidence of late foetal and infant mortality due to diarrhoea and other intestinal infestations. Hygiene and use of healthcare facilities, apart from being influenced by access to basic amenities, also depend on the mothers' education and literacy status.

Women's work is also cited as an important determinant of the incidence of infant deaths. Work, particularly domestic drudgery (Patrizia and Francoise, 1987) and in agriculture (Swaminathan, 1997) influences the health status of the mother and the survival of infants. Domestic drudgery, particularly cooking, has adverse health effects. Biomass smoke levels and poor ventilation lead to respiratory infections in young children, adverse pregnancy outcomes for women exposed during pregnancy, chronic lung disease and associated heart disease in adults, and cancer (Tata Energy Research Institute, 1994). Banerjee (1996) points out that polluted air indoors, apart from causing adverse pregnancy outcomes, causes high infant mortality. High infant mortality in turn is an important cause of high reproductive burden, which is an important determinant of women's nutritional status.

Work in agriculture, particularly the tasks of transplanting rice saplings and weeding often performed by women, has adverse effects on pregnancy. Batliwala (1998: 34) observes that performing the task of transplanting "means that every woman-heavily pregnant or otherwise-is squatting on her haunches for hours at a time. Obstetricians confirm that such physical strain and pressure on the uterus could well trigger off premature labour in the last trimester of pregnancy, and not to mention increasing chances of still birth". This observation makes it clear that work in agriculture is an important factor which triggers premature birth and an important cause of infant mortality.

The utilisation of healthcare facilities should help reduce late foetal and infant deaths. Use of healthcare facilities, apart from being influenced by women's knowledge and education levels, is determined by easy access to such facilities. Easy access in turn, depends on the availability of transport facilities, in particular public transport, and the type of roads (metalled or non-metalled road) that connect a village with urban centres where the healthcare facilities are often located. For these reasons, it is clear that the health of the population in general, and that of women during pregnancy in particular, depends on access to basic infrastructural facilities.

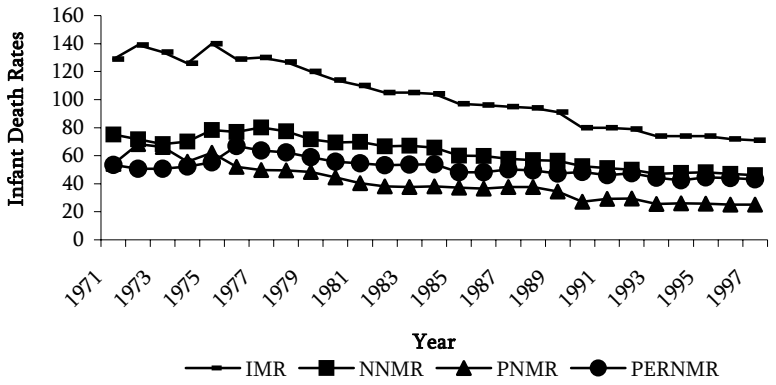
It is thus imperative that we examine the relationship between deprivation in access to infrastructure and the incidence of infant mortality which, to a large extent, is determined by women's health status. Such an attempt envisages the construction of an index of 'generalised deprivation' of access to infrastructure (henceforth index of generalised deprivation). Also, for reasons stated earlier, an attempt will be made to study the impact of female literacy and work participation of women in agriculture on infant mortality.

2. Trends in Infant Death Rates

Trends in infant mortality rates in India have been analysed by using data provided by the Sample Registration System for a period of 27 years between 1971 and 1997. A visual account of the trends in rates of infant mortality, and of neonatal, postnatal, and perinatal mortality are provided in Figure 1. Since the beginning of the 1970s there has been a steady decline in the infant mortality rate in India. However, the slope of the curve has become less steep since the beginning of the 1990s, and indeed the decline in the infant mortality rate may have stagnated between 1993 and 1997.

While neonatal mortality rate too has declined in India, the gap between the infant mortality rate and the neonatal mortality rate has narrowed overtime. This suggests that deaths of infants in the first 28 days are assuming relatively greater significance in determining the level of infant mortality in India. Further perinatal mortality has been very close to neonatal mortality for most of the period between 1971-1997, almost equalling neonatal mortality rates towards the end of this period.

Figure 1 Indicators of infant death rates in India: infant mortality and neonatal, postnatal and perinatal mortality per 1,000 live births, 1971-1997



The observed pattern of these mortality rates suggests that further reductions in infant mortality rates in India depend on reductions in the perinatal (that is, mortality within the first week of birth) and neonatal mortality. Causes of neonatal and perinatal mortality include birth defects, premature birth, injuries at birth, and low birth weight. Births attended by trained professionals and in hospitals will usually lead to a reduction in the number of infant deaths due to these causes. I thus examine the trend in the type of medical care utilised at birth and the relationship between medical attention at birth and the rates of: (1) infant mortality, (2) neonatal mortality, (3) postnatal and post-neonatal mortality, (4) perinatal mortality, and (5) stillbirth.

As a first step, a brief account of the trends in the distribution of births by the type of medical attention received at birth is provided. For this

purpose, data furnished by the Sample Registration System for all India, have been used.

Figure 2 provides the percentage distributions of total births for which medical attention in institutions and by trained professionals was received–the two categories that represent access to healthcare by professionals qualified to assist mothers at birth–for the period 1971-1997.

Figure 2 Trends in the distribution of births by type of medical attention at birth in India, 1971-1997

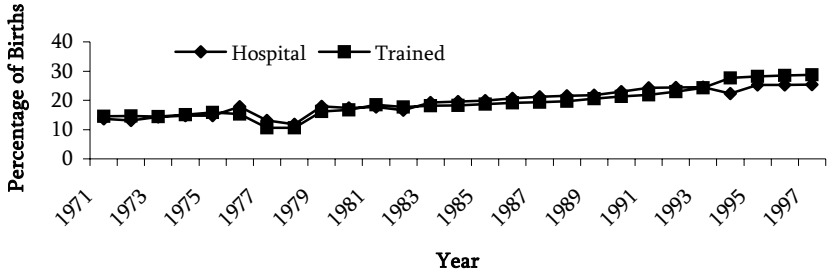


Figure 2 shows that: (1) there has been a steady improvement in healthcare provided at birth in this period: both lines are increasing; (2) between 1971 and 1976, birth attendance by trained professionals was higher than births in hospitals, but since then births in hospitals have increased faster, and the line for hospital births lies above that representing births attended by trained professionals for most part in this period; (3) in the last four years shown in the data the proportion of births attended by trained professionals was again higher than births in hospitals; and (4) it appears that by 1993 the improvements in medical attention at birth in India had halted. It should be noted that the decline in infant mortality rate in India in the five years since 1993 has been very slow. While it is true that the percentage of total births attended by trained professionals (births in institutions and attended by trained professionals) went up considerably from 28.2 per cent in 1971 to 55.1 per cent in 1997, even as late as 1997, 43.9 per cent of the births in India were not attended by professionals qualified to assist at birth. Having described the trends, Table 1 shows the relationship between infant death rates and the type medical attention received at birth.

Table 1 Estimated correlation co-efficient between types of medical attention received and indicators of infant death rates, India 1971-1997

Infant death rates	Institutions	Trained professionals	Both institutions and trained professionals
IMR	-0.952	-0.910	-0.949
NMR	-0.934	-0.928	-0.951
PNMR	-0.900	-0.830	-0.881
Peri-NMR	-0.736	-0.828	-0.803
Still BR	-0.737	-0.728	-0.747

Note: (1) The abbreviations IMR, NMR, PNMR, and Peri-NMR, respectively denote infant, neonatal, postnatal, and perinatal mortality rates; and Still BR the stillbirth rate. (2) IMR, NMR, and PNMR are defined, respectively, as the number of infant deaths per one thousand live births in a year, respectively, less than a year old, less than 28 days old, and more than 28 days but less than a year old. (3) Perinatal mortality is the sum of the numbers of deaths of infants of less than 7 days old and the stillbirths in a year. Still BR and Peri-NMR are defined per thousand live and stillbirths per annum.

Source: (1) Data on IMR are taken from Registrar General of India (1999): Compendium of India's Fertility and Mortality Indicators 1971-1997, based on Sample Registration System (SRS), New Delhi. (2) Data on type of medical attention at birth have been obtained, respectively for the periods 1971 to 1980, and 1981 to 1997, from: (i) Sample Registration System, for the years since 1971 to 1980; and (ii) Selected Socio Economic Statistics, India-2000, published by Central Statistical Organisation, Ministry of Statistics and Programme Implementation, New Delhi.

Simple correlation coefficients were estimated between each indicator of infant mortality and the proportion of births (i) in institutions, (ii) attended by trained professionals and (iii) in institutions and attended by trained professionals. The estimated correlation coefficients are provided in Table 1. All the correlation coefficients are negative, and all absolute values exceed 0.7. These results are statistically significant at the 1 per cent confidence level. These results reinforce the importance of attention at birth by trained professionals to reduce IMR.

3. Generalised Deprivation: Measurement

The importance of access to infrastructure on the health and nutritional status of women during pregnancy has already been discussed. An empirical examination of the relationship calls for the construction of an 'index of generalised deprivation' of access to infrastructural facilities. Six basic facilities have been considered in developing this index: (1) public transport (availability of a bus stop or a railway station), (2) drinking water provided through a tap, (3) health/medical care, (4) modern or metalled road, (5) electricity for lighting, and (6) clean fuel for cooking .

In each case, instances of lack of access to a particular section of infrastructure has been quantified in terms of the number of persons living in

villages or households that *do not* have access to the facility. The following quantities have been defined for the rural areas of *each* district:

Pj is the total population of district j.

P1j is the population living in villages that do not have either a bus stop or a railway station (a village is the smallest unit of revenue administration in India). The availability of public transport simplifies access to healthcare facilities located outside the village. This information is available from the Population Census. The population of all the villages in a district has been aggregated to obtain the total population in the district not served by at least one of these two facilities as:

$$P^1_j = \sum_{l=1,L} n_l$$

where n_l is the population of lth village which does not have either a bus stop or a railway station, and L represents the total number of the villages in a district which do not have either a bus stop or a railway station.

P^2_j is the population living in villages that do not have access to tap water for drinking purposes. Drinking water provided by a tap is considered to be safe, and does not require physical effort to lift it. This information is also available from the Population Census. Using these data, the villages which do not have a tap have been identified, and P^2_j is estimated as:

$$P^2_j = \sum_{t=1,T} n_t$$

where n_t, is the total population of the tth village that does not have access to tap water, and T represents the total number of such villages.

P^3_j is the population living in villages that do not have any kind of medical facility (including that of the services of a community health worker). Availability of medical facility in a village makes access to it easy. The quality of medical services provided at the local level might not be of adequate standard, but we have made no adjustment for the quality of healthcare facility, as data required for such adjustment are hard to obtain. The Population Census provides data on the availability of all types of medical or health services, including that of a community health worker, for

each village. These data have been utilised to identify the villages that do not have access to any healthcare facilities, and by aggregating the population of all such villages P^3_j has been obtained as:

$$P^3_j = \sum_{h=1,H} n_h$$

where n_h is the total population of the hth village that does not have any kind of medical facility, and the total number of such villages is represented by H.

P^4_j is the population living in villages that are not connected by 'pucca' (or metalled) road. This facility is included in the expectation that the availability of a 'pucca' road helps mobility and simplifies access to healthcare facilities located outside a village. The Population Census contains data on the existence of roads of various types, a navigable waterway or a footpath that links each village to the world outside. This source of information helps to identify villages that are not connected by a 'pucca' road. The population of the villages has been aggregated to obtain P^4_j as:

$$P^4_j = \sum_{r=1,R} n_r$$

where n_r is the population of the rth village that is not connected by a 'pucca' road, and R denotes the total number of such villages in the district.

P^5_j is the population living in households that do not have access to electricity. Access to electricity for lighting might be expected to reduce the indoor carbon monoxide levels and to help detect infants suffering during the night. The Population Census provides data on the proportion of households not having access to electricity for each district. Employing these data, the population living in households that do not have access to electricity has been estimated as:

$$P^5_j = \pi_j P_j$$

where π_j is the proportion of the households in district j which do not have access to electricity, and P_j is the total population of the district. It is important to note here that we have assumed that the average family size

does not vary between households that have access to electricity and those that do not have access to electricity.

P^6_j is the proportion of the population that depends on cow dung cake, firewood, coal/lignite, and other sources as principal sources of energy for cooking. Burning these fuels for cooking increases the level of carbon monoxide indoors. The Population Census provides data for each district on: (i) the proportion of households which depend on cow dung cake, firewood, coal/lignite and other sources (consisting of largely the crop residue) as medium of energy for cooking; (ii) the total population; and (iii) the total number of households. By using these data, the proportion of all rural households that depend on labour intensive and heat and carbon monoxide-emitting sources of fuel has been obtained as:

$$\gamma_j = \alpha_j + \beta_j + \varrho_j + \xi_j$$

where α_j, β_j, ϱ_j, and ξ_j respectively are the proportions of the households in district j using cow dung cake, firewood, coal/lignite, and other sources as fuel for cooking. P^6_j has been estimated as: $\gamma_j P_j$. Notice that P_j is the total rural population of district j. In estimating P^6_j we have assumed that the average household size does not vary between households that use the above-mentioned sources of fuel and relatively clean sources like LPG and kerosene for cooking.

A composite indicator of deprivation for the rural areas of each district obtained by aggregating the population deprived of the facilities is given by:

$$(1)\ D_j = \Sigma_{i=1,6}\, P^i_j$$

where P^i_j is the population of jth district deprived of access to facility i, and D_j is the aggregate population of district j deprived of at least one of the 6 selected infrastructural facilities. It is clear that D_j has not been normalized for population size. A procedure that will yield a normalized composite index of deprivation that is in the nature of the 'headcount ratio' (a widely employed rudimentary index of poverty) is obtained by:

$$(2)\ D^*_j = \Sigma_{i=1,6}\, P^i_j / 6P_j$$

By using information on D^*_j, an overall index of deprivation D^* for the total rural population in the 15 major states (the states and the total number of districts in the 15 states will be provided later) has been estimated as:

$$(3)\ D^* = \Sigma_{j=1,J}\, \varphi_j\, D^*_j$$

where D^*_j is the value of the composite index of deprivation for district j, φ_j is the share of rural population accounted for by district j in the total rural population in the 15 major states, J represents the total number of districts in the 15 states, and D^* is the weighted average (the weight being the share of rural population accounted for by a district of the total rural population in the 15 major states) of the extent of deprivation suffered by the rural population in the 15 major states.

Notice that D^*_j s and D^* are contained in the interval [0,1]. While the lower bound signifies access to all six facilities, the upper bound corresponds to a situation where there is no access to any of the six facilities.[2]

4. Sources of Data

Data for constructing the index of 'generalised deprivation' of access to infrastructural facilities have been obtained from the Population Census of India 1991. For the rural areas of each district data on total population, total number of households, proportion of the households that (a) do not have access to electricity; and (b) use cow dung cake, firewood, coal/lignite and other sources which largely consist of the crop residue, for cooking have been obtained from the publication titled *Census of India 1991: Housing and Amenities*. Data on the availability of infrastructural facilities for each village are provided in the *Village Directory, Census of India 1991*. For seven states the village directory also contains data on the total population of each village. But for eight other states, the data on total population of villages had to be abstracted from *Village Primary Census Abstract, Census of India 1991* and matched with information on infrastructural facilities available in the village directory for each village. Considerable problems were encountered while matching the data. Details can be obtained from the author.

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[2] Notice that, in constructing the generalised deprivation index, equal weight has been assigned to each one of the infrastructural facilities chosen. In the absence of information on the extent of independent influence exerted by each factor on infant mortality, any weighting structure employed would be arbitrary. The selection of the weighting structure is further complicated by the fact that the factors chosen are complementary in nature and not substitutes. For these reasons, equal weight has been accorded to each one of the basic amenities chosen to construct the index of generalised deprivation.

The number of villages included in the analysis performed was 547,795, distributed across 381 districts that constitute the 15 major states (see Table 3). The rural population of the selected states accounted for 97.63 per cent of the total rural population of India (excluding the population of Jammu and Kashmir, where the 1991 Population Census was not conducted). Four districts, Greater Bombay (Mumbai), Madras (Chennai), and Calcutta (Kolkotta) were left out of the analysis because they are 100 per cent urban.

As noted earlier, we also explore the relationships between (1) female literacy and infant mortality rate (IMR), and (2) wage work participation of women in agriculture and IMR. Data on female literacy, defined as the proportion of literate females to total females aged 7 and above, for each district were taken from Census of India, 1991, (Series–1, India), *Final Population Totals: Brief Analysis of Primary Census Abstract,* Paper-2 of 1992. WPAG, defined as the percentage of females employed in agriculture to total females in a district, has been derived from: Census of India, 1991, *Provisional Population Totals: Workers and Their Distribution*, Paper-3 of 1991, Registrar General & Census Commissioner, New Delhi, India.

5. Generalized Deprivation: Magnitude and Spatial Variability

The main objective for constructing the index D^*_j is to explore the relationship between infant mortality rate in the rural areas and the extent of generalised deprivation. The extent and spatial distribution of deprivation suffered by the rural population in India has both intrinsic and practical utility for planners, policy makers and researchers. The estimated deprivation index (D^*_j) for rural India is 0.62. This is on the higher side of the scale 0 to 1, suggesting that the extent of generalised deprivation suffered by the rural population in India is extremely high. The values of the deprivation index for districts vary between a low of 0.21 in the Gandhinagar district in the state of Gujarat to a high of 0.90 in Deoghar in Bihar. The estimated coefficient of variation for D^*_j was 28 per cent, indicating that there is considerable spatial variability in the extent of deprivation in rural India.

In order to provide a picture of the spatial distribution of generalised deprivation, the districts were grouped into five categories in terms of their degree of the deprivation: (i) very low (ii) low (iii) medium (iv) high and (v) very high. These five groups consist, respectively of districts with depriva-

tion index values in the intervals (i) [0.21, 0.35] (ii) (0.35, 0.48] (iii) [0.48, 0.62] (iv) [0.62, 0.76] and (v) [0.76, 0.90]. The intervals for the five groups were arrived at by an equal distribution of the difference between the lowest and the highest values of D^*_j, respectively at 0.21 in Gandhinagar district in Gujarat and at 0.90 in Deoghar in Bihar. Table 2 provides information on the distribution of the districts (number and the proportion) in each deprivation group and the share of the total rural population accounted for by districts in each category.

The information in Table 2 is largely self-explanatory. It clearly shows the extent of deprivation suffered by the rural population. While only 23 per cent of the rural population were living in districts where the levels of deprivation was either low or very low (so judged according to the average level of deprivation experienced by the rural population in India), a little less than 55 per cent were living in districts where the levels of deprivation were high or very high. More than a quarter of India's rural population experienced levels of deprivation in excess of 0.75 measured on a scale from 0 to 1.

Table 2 Distribution of districts and rural population by levels of deprivation, India, 1991

Level of deprivation	No. of districts	% in each group	% rural population in each group
Very low	35	9	7
Low	60	16	16
Medium	81	21	23
High	106	28	29
Very high	99	26	26
Total	381	100	100

In order to get a better picture of the extent of spatial disparity in deprivation, the distribution of districts in each state classified by the level of deprivation suffered by the rural population is provided in Table 3. Further, the states are grouped into two categories: those located to the South and to the North of Vindhyas–the mountain range that runs across the middle of the Indian sub-continent. It is clear from Table 3 that, in general, the population living in districts to the south of Vindhyas is relatively better served with basic amenities than their counterparts living to the north of the mountain range. A comparison of the percentage of districts that falls in 'high' and 'very high' deprivation groups brings out the sharp north-south divide in access to basic amenities. While only six per cent of the districts in the south were highly or very highly deprived, in the north the correspond-

ing proportion was 72 per cent. The results clearly show that people in rural South India have better access to basic amenities than their counterparts in North India.

In general the rural population living to the north of Vindhyas is worse-off than those living in south. However, in some of the northern states people do enjoy better access to the basic amenities. For example, the rural areas of Haryana, Punjab, and Gujarat are better served with basic amenities. Sixty-nine per cent of the districts in Haryana belonged to the 'very low' deprivation category, only just behind Kerala–the best performing state in India. The rural populations in Gujarat and Punjab have also had better access to basic amenities compared to their counterparts in Tamil Nadu: the second best in the South India. In Assam, Bihar, Madhya Pradesh, Orissa, and West Bengal more than 90 per cent of the districts had a high or very high deprivation index.

Table 3 Number of districts in each state according to levels of deprivation, 1991 (percentage in brackets)

States	Levels of deprivation					Total
	Very low	Low	Medium	High	Very high	
States located to the South of Vindhyas						
Andhra Pradesh	0 (0)	4 (18)	14 (64)	4 (18)	0 (0)	22 (100)
Karnataka	0 (0)	4 (20)	15 (75)	1 (5)	0 (0)	20 (100)
Kerala	10 (71)	4 (29)	0 (0)	0 (0)	0 (0)	14 (100)
Maharastra	0 (0)	13 (45)	15 (52)	1 (3)	0 (0)	29 (100)
Tamilnadu	1 (5)	13 (65)	6 (30)	0 (0)	0 (0)	20 (100)
Sub(total	11 (10)	38 (36)	50 (48)	6 (6)	0 (0)	105 (100)
States located to the North of Vindhyas						
Assam	0 (0)	0 (0)	0 (0)	8 (35)	15 (65)	23 (100)
Bihar	0 (0)	0 (0)	0 (0)	11 (26)	31 (74)	42 (100)
Gujarat	9 (47)	8 (42)	2 (11)	0 (0)	0 (0)	19 (100)
Haryana	11 (69)	5 (31)	0 (0)	0 (0)	0 (0)	16 (100)
Madhya Pradesh	0 (0)	0 (0)	0 (0)	16 (36)	29 (64)	45 (100)
Orissa	0 (0)	0 (0)	0 (0)	1 (8)	12 (92)	13 (100)
Punjab	3 (25)	8 (66)	1 (8)	0 (0)	0 (0)	12 (100)
Rajasthan	0 (0)	0 (0)	10 (37)	15 (56)	2 (7)	27 (100)
Uttar Pradesh	1 (2)	1 (2)	17 (27)	40 (63)	4 (6)	63 (100)
West Bengal	0 (0)	0 (0)	1 (6)	9 (56)	6 (38)	16 (100)
Sub(total)	24 (9)	22 (8)	31 (11)	100 (36)	99 (36)	276 (100)
Total	35 (9)	60 (16)	81 (21)	106 (28)	99 (26)	381 (100)

Source: Same as in Table 1.

6. Magnitude and Spatial Variability in Infant Mortality Rate

The magnitude and spatial variability in infant mortality rate is discussed by using the estimates at the district level provided by Rajan and Mohanachandran (1998). This is probably the only source of information on IMR for the rural and urban areas of each district in India. The data show that the probability of a new born child dying before its first birthday in rural India in 1991 varied between 2.6 per cent in Thiruvananthapuram in Kerala and 15.5 per cent in Baleshwar in Orissa. The estimated co-efficient of variation for IMR is high (33 per cent)

For further analysis, districts have been classified into five categories based on their level of IMR: (i) Very Low, (ii) Low, (iii) Medium, (iv) High, and (v) Very High. These groups, respectively, include districts for which the IMR is in the intervals (i) (26, 51.8], (ii) [51.8, 77.6], (iii) [77.6-103.4], (iv) [103.4 -129.2], and (v) [129.2, 155]. It is important to note that the classificatory scheme adopted is not based on any 'normative' consideration, but is based on the lowest and highest levels of IMR estimated to have obtained for rural areas across India.

The distribution of districts by the level of IMR and region is given in Table 4. Figures show that as late as in 1991, there were 76 districts in India where the IMR was in excess of 103 (nearly 20 per cent). This is more than nine times higher than for England and Wales (11 in 1991) and almost 300 per cent as high as that of Kerala (37).

The table also clearly shows that the chances of infants' survival in states in Northern India were much lower than their counterparts in the south. While only five per cent of the districts in the north had a very low IMR, more than one-third of the districts in the south had a very low infant mortality rate. Moreover, all the 15 districts where the IMR was very high were in the north. It may be noted that all districts where the generalised deprivation was very high are also in north India. These results show that the spatial distributions of generalised deprivation and IMR are similar.

However, there are exceptions to the general spatial pattern observed. In Punjab and Haryana, all but one district in Haryana belonged to the low IMR group. On the other hand, three of the five states in the south had at least one district in the medium IMR category. Surprisingly, the performance of Bihar appears to be as good as that of Maharastra and Gujarat,

where access to infrastructural facilities was far better than in the former. Thus, the case of Bihar appears to somewhat negate the *a priori* expectation on the relationship between generalised deprivation and infant mortality. This calls for identifying state and local specific factors that may influence the IMR, but such an attempt is beyond the scope of this chapter.

Table 4 Number of districts in each state according to levels of IMR, 1991 (percentage in brackets)

States	Levels of IMR					Total
	Very low	Low	Medium	High	Very high	
States located to the South of Vindhyas						
Andhra Pradesh	10 (45)	11 (50)	1 (5)	0 (0)	0 (0)	22 (100)
Karnataka	2 (10)	15 (75)	3 (15)	0 (0)	0 (0)	20 (100)
Kerala	13 (93)	1 (7)	0 (0)	0 (0)	0 (0)	14 (100)
Maharastra	8 (28)	13 (45)	6 (21)	2 (7)	0 (0)	29 (100)
Tamilnadu	7 (35)	13 (65)	0 (0)	0 (0)	0 (0)	20 (100)
Sub(total	40 (38)	53 (50)	10 (10)	2 (2)	0 (0)	105 (100)
States located to the North of Vindhyas						
Assam	1 (4)	7 (30)	13 (57)	2 (9)	0 (0)	23 (100)
Bihar	4 (10)	26 (62)	12 (29)	0 (0)	0 (0)	42 (100)
Gujarat	5 (26)	6 (32)	8 (42)	0 (0)	0 (0)	19 (100)
Haryana	1 (6)	15 (94)	0 (0)	0 (0)	0 (0)	16 (100)
Madhya Pradesh	0 (0)	0 (0)	10 (22)	23 (51)	12 (27)	45 (100)
Orissa	0 (0)	0 (0)	2 (15)	9 (69)	2 (15)	13 (100)
Punjab	0 (0)	12 (100)	0 (0)	0 (0)	0 (0)	12 (100)
Rajasthan	0 (0)	5 (19)	14 (52)	8 (30)	0 (0)	27 (100)
Uttar Pradesh	2 (3)	13 (21)	30 (48)	17 (27)	1 (2)	63 (100)
West Bengal	1 (6)	10 (63)	5 (31)	0 (0)	0 (0)	16 (100)
Sub(total	14 (5)	94 (34)	94 (34)	59 (21)	15 (5)	276 (100)
Total	54 (14)	147 (39)	104 (27)	61 (16)	15 (4)	381 (100)

Source: Same as in Table 1.

7. The Relationship between IMR and Generalised Deprivation

In this section I examine the relationship between IMR and generalised deprivation and the impact of literacy and female work participation in agriculture. To begin with, the correlation co-efficient between IMR and generalised deprivation index is 0.58 which is significant at 1 per cent level. In other words, about 33 per cent of the total variation in rural infant mortality rates across districts in 1991 can be explained by the variation in the incidence of generalised deprivation. To analyse the impact of female literacy, female paid work in agriculture and generalised deprivation, the following linear multiple regression equation has been estimated.

$$(5)\ IMRj = a_0 + b_1D^*_j + b_2FLIT_j + b_3\ WPAG_j + b_4DUMM_j + u_j,$$

where D^* is the deprivation index; FLIT is the female literacy rate; WPAG is the rate of paid work participation of females in agriculture; DUMM is the regional dummy variable that takes value 1, if district j belongs to states in the south or else 0; u is the unobserved random error term; j represents the district; a_0 is the intercept, b_1 to b_3 are slope coefficients, and b_4 is the co-efficient of regional dummy. It should be noted that only the incidence of paid work in agriculture on infant mortality has been analysed, as females who work as wage labourers, rather than cultivators, are more likely to be engaged in transplanting and weeding, which are cited to be important activities that may trigger off premature labour (see Batliwala, 1998). For the reasons discussed earlier, it could be expected that the coefficients of FLIT and DUMM will be negative and that of D^* and WPAG will be positive.

The estimated equation is as follows:

$$(5') \quad IMRj = 60.8+46.8.D^*j-0.29.FLITj+49.1.WPAGj-21.4.DUMMj+ej$$

$$(6.276) \quad (-3.759) \quad (2.484) \quad (-5.468)$$

$$R^2 = 0.447 \quad F=75.912 \quad N=381$$

The results show that all the coefficients have the expected signs, and are significant at 1 per cent level. The value of R^2 suggests that the variables included in the model explain 45 per cent of the total variability in the estimated IMR across districts. These results confirm that it is possible to reduce IMR by increasing the literacy status of women and by lowering the generalised deprivation. The results also show that work in agriculture has positive impact on IMR. It is important to note that while women's work participation is likely to improve their autonomy, work in agriculture has a deleterious impact on their physical well-being.

The co-efficient of D^*_j suggests that generalised deprivation has a positive influence on IMR. Available evidence also underscores the importance of access to basic amenities, antenatal care, and nutrition. Data on indicators of infant death classified by birth interval and birth size of infants are provided in Table 5.

They clearly show that as the time gap between successive births declines, the infant, neonatal, and postnatal mortality rates increase. Birth interval is expected to be inversely related to the nutritional status of

women. A short interval between successive births leaves little scope for women to regain their lost nutrients and fats (see Girma and Genebo, 2002). It is also important to note that the birth size of babies (an a indicator of the general nutritional status of mothers) is inversely related to the rates of infant deaths: neonatal, postnatal, and infant mortality rates increase as we move away from very small to large birth size (Table 5). These results confirm that deterioration in the nutritional status of women has a negative impact on the survival chances of infants.

Table 5 Data on infant death rates and indicators of nutritional status of mothers, 1988-98

Indicators of nutritional status	Rural			Urban		
	NMR	PNMR	IMR	NMR	PNMR	IMR
Birth interval						
< 24 months	77.4	41.6	119.0	49.4	23.1	72.6
24-47 months	37.5	24.3	61.9	26.9	15.4	42.2
47 + months	26.0	16.5	42.5	17.9	7.9	25.9
Birth size						
Very small	111.2	42.6	153.8	106.5*	17.5*	40.3
Small	48.5	29.7	78.2	43.5	23.1	35.4
Average	32.4	21.6	54.0	21.5	13.9	66.6
Large	33.4	21.1	54.6	31.0	9.3	124.0*
Total	51.7	28.0	79.7	33.5	15.8	49.2

Note: * The rate is based on relatively small number of births

Neonatal, postnatal, and infant mortality rates classified by the educational status of mothers, level and types of medical care and standard of living are provided in Table 6. Medical care includes antenatal care received from a health worker, delivery assistance provided by a doctor, nurse, trained midwife, or other health professional, and postnatal care received in a health facility or at home within two months of delivery. No care represents the worst situation, whereas receiving all three types of care represents the best-case scenario. The standard of living index has been constructed by combining information on the type of house, the type of toilet facilities, the source of lighting, the main fuel for cooking, the source of drinking water; , whether there is a separate room for cooking, house ownership status, agricultural land, livestock, and durable goods. In every case the access has been ranked from best to worst, and weights have been assigned in that order. The aggregate index of living standard obtained has been used to classify households into Low, Medium and High. This index essentially captures access to basic amenities and source of livelihood, namely land.

Table 6 Data on indicators of infant death rates and indicators of access to healthcare and amenities, 1988-98

Indicators of access to amenities	Rural			Urban		
	NMR	PNMR	IMR	NMR	PNMR	IMR
Literacy/Educational status of women						
Illiterate	57.0	32.4	89.4	44.1	23.8	67.8
Literate < Middle school	44.0	20.3	64.3	30.8	11.8	42.6
Middle school	36.1	15.0	51.1	29.5	13.3	42.8
High school and above	26.9	8.8	35.7	22.2	8.2	30.4
Medical care						
No care	54.2	36.8	90.9	46.2	20.0	66.2
One or two types	35.8	19.0	54.7	35.8	19.3	55.1
All three types	22.4	14.5	36.9	21.8	8.2	30.1
Standard of living						
Low	56.5	33.7	90.2	48.8	27.3	76.1
Medium	50.7	25.3	76.0	34.6	16.9	51.5
High	37.4	14.7	52.1	24.1	8.9	33.0

As might be expected, in every case, the mortality rates of infants decline as we move from worst to best-case scenario. For example, the neonatal mortality rate declines from 56.5 to 37.4 as we move from low to high standard of living. Similarly, it declines from 57 to 27 as we move from births to illiterate women to those who have completed at least high school education. These results clearly suggest that access to basic amenities, education, and medical care improves the survival chances of infants.

8. Concluding Observations

In this chapter I analysed the impact of generalised deprivation on infant mortality. I also studied the trends in perinatal, neonatal, postnatal and infant mortality rates in India. The analysis showed that the contribution of neonatal mortality to infant mortality rate has been increasing over time and that further reduction in IMR is closely related to a reduction in neonatal mortality: While it may be true that neonatal mortality is relatively more difficult to reduce than postnatal mortality (Visaria, 2004), the experience in developed countries and the data for India do show that neonatal mortality could be reduced to a considerable extent. In England and Wales neonatal mortality has been reduced to 3.6 per thousand live births in 2002. But in India the corresponding rate was shockingly high at 52 in 1998-99. The analysis of the data on infant mortality by access to healthcare points to the importance of having access to antenatal care, delivery assistance by trained

professionals, and postnatal care. It is important to note that the neonatal mortality rate for births that did not receive healthcare of any type (54.2) is more than two hundred per cent higher than that for births that received all three types of care.

In 1995 premature births accounted for 53.5 per cent of all infant deaths in India (Arokiasamy and Pradhan, 2005). It appears that the immediate causes that trigger premature labour are not well known. However, the causes of death of premature babies appear to be known. Premature infants lack body fat, and their lungs are immature. Consequently these infants tend to loose body heat and develop breathlessness. Deaths due to these causes could be avoided by providing proper neonatal care. This fact points to the importance of access to healthcare from trained professionals at birth as well as quality healthcare.

Women's educational attainment and birth weight also influence the survival chances of infants. The evidence suggests that birth weight is a function of the nutritional status of women, and nutritional status depends on, the quantity and quality food consumed and access to basic amenities that improves the nutrient absorptive capacity of the body. Access to basic amenities might also relieve women and female children from the drudgery of domestic work, and help the later to attend school. Schooling has a positive impact on survival of infants.

The estimated linear regression on infant mortality clearly shows that infant mortality in India could be reduced by increasing access to infrastructural facilities. The results also show that female literacy helps to reduce IMR. The spatial patterns in infant mortality and generalised deprivation show that rural population in north India suffers in both. Illiteracy, child labour, non-school attendance, poor nutritional status, and low expectation of life at birth appear to be high Indian states in the north compared to the situation in states in the south. This suggests that deprivation in different spheres thrive together. The nexus between deprivation and poor health in different areas can be broken by investing in infrastructural facilities.

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7

Understanding the Relationship between Poverty and Mortality in the Philippines

Josefina V. CABIGON

1. Introduction

In most of her official pronouncements, President Macapagal-Arroyo's priorities in relation to the 2000 millennium development goals (MDG) are poverty alleviation and provision of quality education. Nothing is mentioned about improving population health despite the link between poverty reduction and health advancement. As Sachs (2004:947) put it: '… the first millennium goal … to reduce by half the proportion of the population in extreme poverty … by 2015 cannot conceivably be accomplished if the health goals are not achieved.' Empirical evidence is needed in the Philippines to reinforce Sachs' view.

In the current development discourse, what appears to be the common view is that development in the past 50 years has not changed the lives of many poor (e.g. Sachs, 1992; Sen, 2000; Kingsbury, 2004). The millennium goals are clear evidence that the international community has agreed that there can be no development without poverty reduction (Remenyi, 2004) and that the millennium poverty reduction and social development targets[1] of these goals are achievable with adequate resolve and political will of both

[1] The corresponding targets of the millennium goals are: (1) 50% reduction of people in extreme poverty; (2) universal primary education for all; (3) elimination of gender disparities in primary and secondary education; (3) reduction in infant mortality by two-thirds; (4) reduction in maternal mortality by three-quarters; and (5) access to reproductive health services for all (Remenyi, 2004).

the poor and donor countries. More so if the national governments, for example the Philippine government, are provided with hard evidence of the equal importance of poverty and mortality reduction.

In a forum sponsored by the United Nations Development Programme, Briones (as cited in Torres, n.d.) said the MDG targets of reducing extreme poverty by half between 1990 and 2015 and reduction of child mortality may likely be achieved at the national level by the successes in the urban areas like the National Capital Region. It is equally likely that 39 of the 79 provinces will not actually reach the poverty targets; provinces in the Mindanao, Bicol and Western Visayas Regions that suffer from problems of terrorism, conflict and rebellion will lag behind in reducing child mortality. It would be more helpful to understand further why such provinces are lagging behind in the reduction of both poverty and child mortality by juxtaposing poverty and mortality indicators in the 10 poorest and 10 richest provinces to demonstrate the realities of their mortality situation.

Using the percentage of skilled attendants at delivery as a proxy for maternal mortality and relating it to wealth quintiles, Matthews (2002) found that of the Asian countries, the Philippines, India and Indonesia showed close to 70 percentage-point difference between the richest and poorest quintiles in skilled delivery attendance. It would be more enlightening to demonstrate the link between wealth quintiles and more proxy indicators of mortality or health in the Philippines at the macro and micro levels thereby bolstering the evidence of a wide gap between the poor and the rich in terms of health status and access to health care.

According to the first and second Philippines Progress Reports on the MDG (Office of the United Nations Resident Coordinator, Philippines 2004, National Economic and Development Authority 2005), the following findings remain: (1) poor environment, poor nutrition, low and ineffective public spending for health, particularly in achieving the MDG goal of reducing child mortality; (2) slow rate of progress in maternal health improvement, and the unavailability of timely and accurate information on maternal mortality and access to reproductive health (RH) services in relation to the MDG goal of improving maternal health; and (3) TB still in the 10 leading causes of morbidity as to the MDG goal of combating HIV/AIDS, malaria and other diseases. Tuberculosis is a disease common to poor Filipinos and the trend data in tuberculosis mortality may be more

helpful in monitoring the progress in meeting a part of target 9 of MDG 6. Changes in the patterns of TB mortality and other causes of death by age and gender are worth examining. TB incidence by wealth quintile controlling for gender provides further insights.

In light of the above, the chapter has two main objectives. One is to establish trends in both poverty and mortality using several indicators. The initial patterns of the mortality and poverty link could be discerned if simultaneous declines in poverty and mortality occurred. However, given the complexity of this link, it is important to go further than just trend analysis and examine the poverty-mortality link at the macro and micro levels, employing other poverty and mortality indicators where relevant. This is the second objective and main focus of this paper.

2. Data and Methods

In establishing mortality trends from 1960 to 2000, various indicators have been used. Life table infant mortality rate (IMR) and expectation of life at birth (e_o) have been obtained from my other related works (Cabigon, 1990; Flieger and Cabigon, 1994; Cabigon and Flieger, 1999). These figures were derived after careful assessment of the robustness of several techniques to estimate the completeness of death coverage for the population aged 5 years and over to obtain adjusted age-specific death rates. The adjusted age-specific death rate of the age group 5 to 9 was used to derive infant and child central death rates from the United Nations Latin American pattern. The under-five mortality rates (U5MRs) are calculated from the life table IMRs and child mortality rates. The maternal mortality ratios (MMR) are official estimates recommended by the Technical Working Group on Maternal and Child Mortality of the Philippines of the National Statistical Coordination Board (NSCB).

As the "disease of the poor" in the Philippines, TB mortality is included in the trend analysis and may be viewed as a health and poverty indicator. In establishing the trend in overall TB mortality, published estimates on TB of all forms per 100,000 population by the Department of Health (DOH, 1996) for 1975, 1980, 1985, 1990, 1995 and 2001 are used. These estimates are based on weekly reports of notifiable diseases from all provincial and city health offices throughout the country. Comparable World Health Organization (WHO) estimates are also cited where relevant.

To further understand mortality in the Philippine context, trends in the leading causes of death by gender are also examined. Data on disease patterns have been obtained from the 1994 and 2000 Vital Statistics Reports of the NSO. In this chapter, the causes of death in broad categories except for respiratory TB, taken as per cent of total deaths by gender and age groups 5-14, 15-24, 25-44, 45-64 and 65+, are analysed. It is worth mentioning that the ranking of the leading causes of death does not differ between using rates or per cent of total deaths.

The actual level of mortality attributed to each of the main diseases is highly suspect. However, data for the 1960s in the Philippines passed the permissive tests used by Preston *et al.* (1972:3). These include: absence of gross error (e.g. a decline in death rates with age after age 50 years, implausible life expectancy), empirical regularities, highly predictable frequencies of particular causes of death, errors not obscuring fundamental changes in the structure of mortality, and pattern of cause structure of mortality changing systematically as the level of mortality changes. Recorded deaths after the 1960s appear to follow similar patterns, as will be shown later. Given that little can be done to quantify any corrections to the data which might seem appropriate, examining the relativity of trends for the main categories of recorded causes to gain some useful insights into the main killer diseases in the Philippines may be a better option than ignoring the available data altogether. The possibilities of data deficiencies should not however be discounted.

As to trends in poverty, three main sources will be used to ascertain meaningful trends from 1960 to 2000. The first source is the poverty incidence calculated and published by the National Statistical Coordination Board (NSCB) based on the Family Income and Expenditure Survey (FIES) carried out every three years starting from 1961. Unfortunately, the official estimates from 1961 to 2000 could not be interpreted as a continuous series because the method of estimation is not uniform. The estimates prior to 1997 were calculated using a method different from the one used in 1997 and 2000. A provincial poverty methodology approved by the NSCB Executive Board at its meeting on January 15, 2003 was employed to derive the 1997 and 2000 estimates but not used for the earlier estimates. Nonetheless, NSCB poverty incidence refers to the poor whose income fall below the poverty threshold and who cannot afford to provide for their minimum basic needs in a sustained manner.

Balisacan's works on poverty incidence estimation are the second source. He calculated two main sets of poverty estimates (Balisacan, 1994:120-123). One is based on population distributions reported in the FIESs. The other set, which he termed Fixed Physical Areas (FPA), is based on population distributions for fixed physical areas. Under each set he calculated three indices, the head-count index, the poverty gap index and the Foster-Greer-Thorbecke index. The head-count estimates based on the FIESs are used here. Balisacan's head-count poverty index is simply the proportion of the population below a given official poverty line. His estimates are not strictly comparable with the NSCB official estimates because he held constant the real poverty lines for the period under consideration and his estimates are based on uniformly constructed grouped data.

The third source refers to the World Bank poverty estimates based on the internationally comparable "$1 a day" poverty line. The human development index (HDI) for 1994, 1997 and 2000, calculated and published by the NSCB, is also utilised in this chapter. The index is calculated in the same way as the United Nations Development Program HDI that combined life expectancy at birth (e_o), income and education. With regard to the examination of the poverty-mortality linkage which is the main focus of this chapter, the lack of appropriate recent data at the time of writing and revising this chapter to examine the relationship in a multivariate context is a constraint. I thus examine the poverty-mortality relationship in a descriptive way by using the most recent available information and update earlier work at the country, provincial and household-individual levels.

At the country level, I examine how the Philippines fared compared to other selected countries belonging to the high, upper middle, lower middle and low income groups in 2000 and 1990. For 2000, I used the 2002 World Bank data on purchasing power parity (GNI PPP) and e_o by sex and IMR for both sexes combined from the 2004 World Population Data Sheet of the Population Reference Bureau (2004). PPP refers to gross national income converted to international dollars using a *purchasing power parity* conversion factor. International dollars indicate the amount of goods and services one could buy in the United States with a given amount of money. For 1990, the sources are the World Bank (1992) figures except for the life expectation at birth for the Philippines which came from Flieger and Cabigon (1994) and infant mortality values from the official estimate rec-

ommended by the Technical Working Group on Maternal and Child Mortality.

At the provincial level, I examine the HDI, income, education and life expectancy index calculated and published by NSCB for the years 1994 and 1997 based on the UNDP[2] classification. Poverty prevalence for the 10 poorest and 10 least poor provinces and IMR are also analysed.

At the household-individual level, I use the 1998 and 2003 National Demographic Health Surveys (NDHSs) with IMR, U5MR and the percentage of skilled attendance at delivery as proxy indicator of maternal mortality by wealth index quintile. The source of the 1998 NDHS figures is Gwatkin *et al.* (2000) while the source of the 2003 NDHS figures is the Final Report (NSO and ORC-Macro International, 2004). The wealth index is derived from household ownership of consumer goods, dwelling characteristics such as flooring material, type of drinking water source and toilet facilities. Principal component analysis was employed to derive the wealth index. Resulting scores were standardised to define the wealth quintiles expressed as quintiles of individuals in the population. For example, the quintile IMR for the poorest group is IMR per 1000 live births among all people in the population quintile concerned (Gwatkin *et al.*, 2000).

Other health indicators by wealth index quintile based on the 2003 NDHS are also analysed. These are perinatal mortality, vaccinations of children age 12-23 months, prevalence of symptoms of acute respiratory infection among children under five years, and treatment of living children for iron deficiency. Problems in accessing health care and antenatal care, knowledge of places to go in case of pregnancy complications, tetanus toxoid injections during pregnancy, place of delivery, delivery by C-section, and micronutrient intake among mothers after delivery are the other proxy indicators of maternal mortality. Experience of at least one symptom of TB and awareness of the Directly Observed Treatment Short-course (DOTS) chemotherapy programme among women and men are indicators of TB incidence and knowledge, respectively.

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[2] High -- 0.80 to 1; Medium -- 0.50 to 0.79; Low -- 0.0 to 0.49.

3. Findings

3.1. Trends in Mortality

Table 1 provides data on a number of mortality indicators from 1960 to 2000. A drastic decline in infant mortality rates from 1960 to 1980 and a decelerating decrease thereafter is observed. This trend is more marked among male infants compared to female infants. The pace of increase in the number of years a newborn baby is expected to live (e_o) has been slow since 1960. This decelerating pace of mortality decline can also be observed in the recent years for children below 5 years old (U5MR) and maternal mortality ratio (MMR).

Table 1 Selected mortality indicators in various years, Philippines

Year	Infant mortality			Life Expectancy			Under-5 mortality	Maternal Mortality
	Male	Female	Total	Male	Female	Total	Total	
1960	117	95	106	55.1	58.8	56.9	156	na
1970	94	83	89	57.3	61.5	59.3	122	na
1980	65	59	62	59.7	65.1	62.3	92	na
1990	60	53	57	62.2	67.4	64.7	80	209[a]
1995	53	48	51	62.7	67.9	65.2	71	180[a]
2000	42	38	40	63.1	69.1	66.0	53	na

Note: Infant mortality and under-5 mortality (per 1,000), Maternal mortality (per 1000,000). Total is calculated with sex ratio at birth of 105; [a] Official estimates based on 1993 and 1998 National Demographic and Health Survey; na=Not available;
Sources: Cabigon (1990); Flieger and Cabigon (1994); NSO and MI (1994); NSCB (1995); Cabigon and Flieger (1999); NSO, DOH and MI (1999)

Table 2 presents the estimated tuberculosis, all forms mortality rate per 100,000 population from two sources. WHO estimates indicate a worsening trend in recent years while DOH estimates show a saw-tooth pattern trend from 69 per 100,000 population in 1975 to 55.6 per 100,000 in 1983, then a rise to 57.9 in 1985 then a fall to 36.7 in 1993, then a rise to 38.9 in 1995 and then a slight fall in 2001. Note that the WHO estimate for 1993, 42, is higher than the DOH estimate of 36.7. However, the rising trend in both the DOH estimate from 1993 to 1995 and in the WHO estimate from 1993 to 2003 indicates some slight worsening in TB mortality in the Philippines.

Table 2 Tuberculosis Mortality (per 100,000 population), 1975 to 2003 from various sources

Source and year	TB mortality rate
WHO	
2003	57.0
1993	42.0
DOH Weekly reported notifiable diseases	
2001	38.0
1995	38.9
1993	36.7
1990	39.2
1985	57.9
1983	55.6
1980	59.6
1975	69.2

Sources: WHO Report 2004:100 for 2003 and Blumenfeld *et al.*, 1999:1 for 1993; DOH, 1995 Philippine Health Statistics: Table 16:81.

Table 3 presents the causes of deaths by gender from 1964 to 2000. Respiratory TB among males and females declined slightly from 1964 to 1990 but rose during 1990-94 and then fell between 1994 and 2000. The observed worsening trend in overall TB mortality in recent years is caused by increase in respiratory TB and other infectious diseases which include TB meningitis and all other forms of TB. Respiratory TB remains one of the six leading causes of mortality.

What is noticeable is a steeper decrease in mortality due to respiratory tuberculosis for females compared to males. Among males, respiratory TB ranked first in 1964, ranked third from 1970 to 1990, ranked second in 1994 and ranked fourth in 2000. Among females, it ranked second in 1964 and 1970, ranked third from 1974 to 1984, ranked fourth in 1990 and 1994 and ranked sixth in 2000. While females were more disadvantaged compared to males in the 1960s with regard to respiratory TB mortality, the reverse has been true since the 1980s. Of the other communicable diseases, influenza, pneumonia and bronchitis exhibit an upward trend (both sexes) up to 1974 and a large, monotonic decline thereafter. With respect to the non-infectious diseases, cardiovascular diseases show a clear and substantial increase while certain degenerative diseases and malignant and benign neoplasms indicate a slow rising then constant trend (both sexes).

Table 3 Distribution of deaths by cause and gender in the Philippines, 1964-2000

Sex/Broad category of disease	Year							
	1964	1970	1974	1980	1984	1990	1994	2000
Male								
Respiratory TB	10.6	10.4	10.2	9.6	9.2	8.2	9.1	8.2
Other infectious diseases	7.7	5.8	7.4	6.0	6.0	5.2	4.1	9.2
Influenza, pneumonia, bronchitis	9.6	17.8	20.4	15.8	14.6	12.4	7.9	7.7
Diarrhoea, gastritis, enteritis	7.5	4.7	1.5	4.5	3.3	1.7	0.2	1.0
Cardiovascular diseases	7.8	10.5	13.2	16.6	18.1	24.6	26.8	28.3
Certain degenerative diseases	3.9	4.0	4.3	4.8	4.9	5.7	6.9	8.0
Malignant & benign neoplasms	3.1	3.8	4.2	5.0	5.1	6.4	7.9	9.0
Motor vehicle accidents	0.6	0.6	0.6	0.9	0.7	1.1	1.6	1.9
Unknown	10.0	12.8	10.8	9.7	9.6	5.8	6.5	8.0
All others	39.2	29.6	27.4	27.1	28.5	28.9	29.0	18.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N	117,575	133,344	60,061	176,545	186,148	185,788	191,846	217,404
Female								
Respiratory TB	11.7	11.1	9.9	8.9	8.1	6.6	6.8	5.7
Other infectious diseases	7.1	5.7	6.9	6.1	6.7	5.7	4.1	7.6
Influenza, pneumonia, bronchitis	20.6	19.7	22.0	18.0	16.9	15.4	10.5	10.9
Diarrhoea, gastritis, enteritis	7.2	4.6	1.4	4.6	3.4	1.8	0.2	1.2
Cardiovascular diseases	7.7	10.8	13.6	18.3	19.5	26.7	29.3	31.5
Certain degenerative diseases	3.1	3.1	3.2	3.7	4.0	4.9	6.1	7.7
Malignant & benign neoplasms	3.6	4.5	4.9	6.0	6.4	8.0	9.9	11.2
Motor vehicle accidents	0.2	0.3	0.3	0.5	0.4	0.7	0.9	1.0
Complications of pregnancy	1.9	1.4	1.3	1.3	1.1	1.0	1.8	0.8
Unknown	-	12.4	10.6	8.9	8.9	5.5	9.0	9.6
All Others	36.9	26.4	25.9	23.7	24.6	23.7	21.4	13.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N	97,361	100,694	123,914	121,461	127,211	128,102	129,594	149,527

Note: the composition of cause of death categories varies across the years. Their corresponding codes based in the international classification of diseases (ICD) for 1964 on Preston *et al.* (1972: 566-564) and for the other years, on the Vital Statistics Reports (National Statistics Office). More detailed tables available from the author on request.

The proportion of deaths assigned to the 'Unknown' category (symptoms, signs and ill-defined conditions, other causes of perinatal morbidity and mortality) decreases gradually from about 12 per cent in 1970 to 6 per cent in 1990 for both sexes. This decline may indicate better diagnosis or reporting, most likely of non-communicable diseases over time, which may partly explain the rising and constant mortality trend in these diseases. However, if the observed pattern of change in non-communicable diseases were entirely due to improved disease recognition and specification, the resulting bias would be similar for both sexes and across periods. That the

observed pace of change in mortality from non-communicable diseases substantially differs by sex, with a marked increase among males and a much slower pace among females, and then a rise and fall since 1994 does not indicate a serious and systematic bias. Hence, some of the observed changes may be genuine.

Table 4 shows that the proportionate share of deaths due to respiratory TB is as expected: the lowest among the youngest age group 5-14, and the highest among the 45-64 years old (males and females). With the exception of 1984 and 2000, the proportionate share of deaths to total deaths at reproductive ages is higher for females than males. It is in the oldest age group 65 years and over that the proportionate share of deaths due to TB is consistently higher for males than females. This evidence presented appear to confirm the global findings that men at ages 15-24 and women at reproductive ages are more likely to be afflicted with TB and that TB mortality is higher among males than among females aged 65 and over.

Table 4 Percentage of Deaths due to Respiratory TB to total deaths in a given age group by gender and age 5 years and over by gender, 1970 to 2000

Age	1970		1974		1980		1984		1990		1994		2000	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
5-14	2.8	3.3	2.3	2.6	0.0	0.0	0.0	0.0	0.0	0.0	1.39	1.5	1.3	1.4
15-24	10.6	12.9	10.1	11.5	10.2	14.0	8.5	13.0	5.3	8.1	4.5	5.7	4.6	5.7
25-44	20.3	24.9	15.8	21.6	16.4	18.8	17.6	17.5	9.4	11.5	9.8	10.7	8.6	8.5
45-64	25.2	29.0	22.9	35.0	21.2	20.7	19.4	17.9	14.7	12.5	14.7	11.7	11.9	8.7
65+	13.5	12.5	12.6	11.6	12.3	10.8	11.4	9.5	9.7	6.9	9.5	6.5	8.5	5.2

3.2. Trends in Poverty

Irrespective of the methods of estimation, the proportion of people living in poverty in the Philippines has been declining (Table 5). The greatest decline seems to have occurred during the 1985-1995 period but has slowed during the 1997-2000 period. Similar socioeconomic improvement can be observed from the changes in human development Index: in 1994, 26 per cent of the provinces had low HDI, but in 2000 it was only 9 per cent (Table 6).

Table 5 Selected poverty Indices in various years

Year	NSCB official estimates[a]	NSCB official estimates[a]	World Bank[b]	Balisacan[c]	Balisacan[d]
1961				59.2	
1971				52.2	
1975			35.7		
1985		49	32.4	53.9	41.5
1988		50			
1991		45		44.6	
1994		41			
1995			25.5		25.0
1997	33.0	37			
2000	34.0				

Note: [a] Poverty incidence or per cent of population whose income fall below the poverty threshold and who cannot afford in a sustained manner to provide for their minimum basic needs derived on a provincial poverty methodology. [b] Poverty incidence at the national aggregate level using the internationally comparable "$1 a day" poverty line. [c] Poverty incidence based on the head count reported in the FIES. [d] Poverty incidence on spatially consistent poverty lines applied to the distribution of per capita consumption expenditures.
Sources in chronological order from first to fifth columns: National Statistical Coordination Board (NSCB). "Highlights: Poverty incidence 1997 and 2000", accessed online at www.nscb.gov.ph; David and Maligalig (May 2001); Balisacan (2002) Table 6:13; Balisacan (1994) Table 2:122; Balisacan and Pernia (2002).

To summarise, it appears that a simultaneous decline in poverty (indicated by poverty incidence and the human development index) and mortality (measured in terms of infant mortality rate, under-five mortality and maternal mortality ratio, expectation of life at birth) is evident although the decline has been decelerating in the recent period. Nonetheless, tuberculosis, the disease of the poor, seems not to have shown a substantial decline and has remained higher among males and older persons than among females and younger ones.

Table 6 Per cent distribution of Provinces by human development index, 1994, 1997 and 2000

HDI	Year		
	2000	1997	1994
High (0.80-1.00)	-	-	-
Medium (0.50-0.79)	90.9	81.8	73.7
Low (0.00-0.49)	9.1	18.2	26.3
Total	100.0	100.0	100.0
N	77	77	76

Source: National Statistical Coordinating Board (NSCB) "Highlights of the Report of the 1997 Philippine Human Index" and "Highlights of the Report of the 2000 Philippine Human Index" accessed online at www.nscb.gov.ph.

3.3. Poverty-Mortality Relationship

3.3.1. Global Country-Level Perspective

According to United Nations estimates, the Philippines is one of the 11th – 15th lowest middle income countries, and has a life expectancy at birth of 70 years (67 years for males and 72 years for females) (Table 7).

Table 7 Life expectancy, infant mortality (per 1,000 live births) and income per capita (in US $) for Selected Countries

Country	2002 GNI PPP per capita	Expectation of life at birth			Infant Mortality Rate
		Males	Females	Both	
A. 10 Highest high income [a]					
1. Luxembourg	53,290	75	81	78	4.9
2. Norway	36,690	77	82	80	3.4
3. United States	36,110	75	80	77	6.7
4. Switzerland	31,840	77	83	80	4.4
5. Denmark	30,600	75	79	77	4.4
6. Ireland	29,570	75	80	77	5.1
7. Canada	28,930	77	82	79	5.2
8. Austria	28,910	76	82	79	4.5
9. Australia	27,440	77	83	80	4.7
10. Japan	27,380	78	85	82	3.0
B. 5 Highest upper middle income [b]					
1. Trinidad and Tobago	9,000	63	66	64	65
2. Mexico	8,800	74	80	77	11
3. Costa Rica	8,560	67	73	70	17
4. Malaysia	8,500	72	78	75	12
5. Uruguay	7,710	69	74	71	25
C. 11– 15th Lowest middle income [c]					
1. China	4520	70	73	71	32
2. **Philippines**	**4450**	**67**	**72**	**70**	**29**
3. Jordan	4180	71	72	72	22
4. Guatemala	4030	63	69	66	39
5. Guyana	3940	60	67	63	53
D. 10 Lowest low income [d]					
1. Yemen	800	58	62	60	75
2. Ethiopia	780	45	47	46	105
3. Madagascar	730	53	58	55	84
4. Congo	710	47	50	48	84
5. Guinea Bissau	680	43	47	45	125
6. Congo, Dem Republic	630	46	51	49	100
7. Burundi	630	42	44	43	74
8.Tanzania	580	44	46	45	105
9. Malawi	570	42	45	44	121
10. Sierra Leone	500	34	36	35	180

Note: [a] Above $9075 as high income countries according to World Bank criteria; [b] $2936-9075 as upper middle income countries according to World Bank criteria; [c] $736-2935 as lower middle income countries according to World Bank criteria; [d] $735 or less as low income countries according to World Bank criteria. Source: Population Reference Bureau 2004 World Population Data Sheet; World Bank World Development Indicators 2003.

It is closest to China in terms of GNI PPP per capita, life expectancy and infant mortality rate. Both countries show much better values in mortality indicators than Trinidad and Tobago, which ranked highest among the upper middle income countries. These figures suggest a poverty-mortality relationship that is not straightforward. The same pattern is also evident with the 10 richest countries, with Japan, the 10th richest country showing the longest life span and lowest infant mortality compared to other countries in its group. Among the 10 poorest countries the Democratic Republic of Congo, the 6th poorest low income country, had a better survival rate than Ethiopia, the 9th poorest low income country. These observations imply that the relationship between poverty as indicated by GNI PPP per capita and mortality is neither monotonically negative (with IMR as the indicator) nor positive (with life expectancy as the indicator).

A similar non-monotonic positive association between poverty and mortality is evident in the corresponding figures for 1990 (Table 8). The Philippines showed the highest life expectancy of 65 followed by Bolivia among the five lowest lower-middle-income countries. Japan the third richest country in 1990, registered the longest lifespan. Nepal, the 5th lowest low income country had higher life expectancy (52 years) than Senegal (47 years), the 3rd in the lowest lower middle income group.

Another trend observed in Tables 7 and 8 is a sharper decline in infant mortality with faster development, measured by GNI PPP or GNP per capita. This is in contrast with the more gradual upward trend observed in life expectancy as development increases. While the most economically advanced countries have an average life span that is about twice that of the poorest countries, the poorest countries have over 10 times the infant mortality rates of the most developed countries. It is worth noting that the infant mortality rate is usually taken as a proxy indicator of the overall socioeconomic condition of a country because in most instances, the infant mortality-development relationship is clearer than the life expectancy-development relationship.

Table 8 Life expectancy, infant mortality (1,000 live births) and income (in dollars) per capita for Selected Countries, 1990

Country	GNP per capita income	Expectation of life at birth			Infant Mortality Rate [f]
		Males	Females	Both [e]	
A. 9 Highest high income [a]					
1. Switzerland	32,680	75	82	78	7
2. Finland	26,040	73	79	76	6
3. Japan	25,430	76	82	79	5
4. Sweden	23,660	75	81	78	6
5. Norway	23,120	74	81	77	8
6. West Germany	22,320	73	80	76	7
7. Denmark	22,080	73	78	75	8
8. United States	21,790	73	80	76	9
9. Canada	20,470	74	81	77	7
B. 5 Highest upper middle income [b]					
1. Saudi Arabia	7,050	63	66	64	65
2. Greece	5,990	74	80	77	11
3. Korea, Rep.	5,400	67	73	70	17
4. Portugal	4,900	72	78	75	12
5. Trinidad and Tobago	3,610	69	74	71	25
C. 5 Lowest lower middle income [c]					
1. Cote d' Ivoire	750	54	57	55	95
2. Philippines	**730**	**62**	**67**	**65**	**57**
3. Senegal	710	46	49	47	81
4. Zimbabwe	640	59	63	61	49
5. Bolivia	630	58	62	60	92
D. 5 Lowest low income [d]					
1. Nepal	170	53	51	52	121
2. Somalia	120	47	50	48	126
3. Ethiopia	120	46	50	48	132
4. Tanzania	110	46	49	47	115
5. Mozambique	80	45	48	46	137

Note: According to World Bank criteria: [a] above $7620=high income countries; [b] $2466-7620=upper middle income countries; [c] $611-2465= lower middle income countries; [d] $610 or less= low income countries; [e] calculated assuming sex ratio at birth = 105; [f] refers to 1991. Source: World Bank (1992): Table 1, pp. 218-219; Table 28, pp. 272-273 and Table 32, pp 280-281; for Philippines, same source for GNP but on mortality; Flieger and Cabigon (1994) and NSCB (1995).

3.3.2. Macro-Provincial Perspective

As would be expected, the correlation between 1995 IMR and 1997 poverty incidence is 0.81. The correlation coefficient between TB mortality and poverty incidence using 1997 figures and province as units of analysis is very low (r=.05) and not significant. This is more a reflection of the wide variation among provinces in the reporting of notifiable diseases: the better-off provinces are more likely to submit more complete reports to the DOH central office than their counterparts.

It is worth noting that in a provincial-level multivariate analysis (NSCB, 1995) of IMR, the incidence of poverty was not as important as other predictors like access to safe drinking water, the proportion of underweight children and the proportion of children fully immunised. This highlights the greater role of proximate determinants compared to poverty incidence in explaining infant mortality. The data used refer to 1990. There are no data on the proximate determinants available for 1995 so a multivariate analysis could not be performed with 1995 mortality and 1997 poverty incidence.

Table 9 reveals that almost all provinces belong to the medium group if the expectation of life at birth index in 1994 and 1997 is used. However, if the income index is considered, the majority of provinces fall into the low human development group. Two-thirds of the 77 provinces in 1997 were classified as high in the education index, corresponding to 51 per cent in 1994. Mortality, income and education indices do not portray a clear positive poverty-mortality linkage either. What the data show, however, is that improvement in education has been much faster than improvement in poverty and mortality reduction in the provinces.

Table 9 Percentage distribution of provinces by various indices, 1997 and 1994

	Human Index		Education		Income		Expectation of life at birth	
Group	1997	1994	1997	1994	1997	1994	1997	1994
High	-	-	66.2	51.3	-	-	-	-
Medium	81.8	73.7	33.8	48.7	4.0	6.6	97.4	94.8
Low	18.2	26.3	-	-	96.0	93.4	2.6	5.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N	77	76	77	76	77	76	77	76

Source: National Statistical Coordinating Board (NSCB) "Highlights of the report of the 1997 Philippine Human Index" accessed online at www.nscb.gov.ph.

Table 10 shows that most of the 10 poorest provinces according to 2000 poverty incidence are on Mindanao Island (Sulu, Tawi-Tawi, Maguindanao, Lanao del Sur, Sultan Kudarat and Camiguin). Sulu and Lanao del Sur and all of the Luzon provinces (Masbate, Ifugao, Romblon and Camarines Norte) have remained the most impoverished since 1997. The remaining Mindanao provinces experienced a worsening of poverty during 1997-2000 – more than half of the families lived in extreme poverty. As expected, the 10 least poor provinces in 1997 and 2000 are in Metro Manila, the most developed region in the country and on Luzon Island. In terms of HDI,

Sulu, Tawi-tawi, Maguindanao and Lanao del Sur of Mindanao Island and Ifugao of Luzon are also in the bottom 10. Four of the Mindanao islands (Basilan, Agusan del Sur, Lanao del Norte and Sarangani) and Samar from the Visayan Island joined the impoverished provinces. All of the top 10 provinces performing well in terms of HDI are on Luzon Island with Ilocos Norte, Batangas, Pampanga and Isabela joining the group of the least poor provinces based on poverty incidence.

With the exception of Batanes and Isabela, the least poor provinces as indicated by poverty incidence and HDI exhibit lower IMRs than their poorest counterparts. However, as observed with the country-level data, the positive relationship between poverty and mortality is not straightforward as the ranking in poverty incidence and HDI do not directly correspond to the rank order of IMR. The observations of Briones noted earlier are confirmed by the above findings. Sharp disparities in income and health among provinces hamper the attainment of the MDG targets in some provinces.

Table 10 Poverty incidence and HDI of families in the 10 poorest Provinces and 10 least poor Provinces

Province	Poverty Incidence		IMR	Province	HDI			IMR
	2000	1997	1995		2000	1997	1994	1995
Poorest				*Bottom 10(HDI)*				
Sulu	63.2	67.1	71.5	Sulu	0.351	0.336	0.357	71.5
Masbate	62.8	61.4	63.1	Tawi-tawi	0.390	0.430	0.387	73.4
Tawi-tawi	56.5	35.0	73.4	Basilan	0.425	0.439	0.423	64.9
Ifugao	55.6	57.7	64.6	Ifugao	0.461	0.452	0.406	64.6
Romblon	55.2	52.8	58.3	Maguindanao	0.416	0.416	0.449	68.0
Maguindanao	55.1	41.6	68.0	Lanao del Sur	0.464	0.415	0.442	66.1
Lanao del Sur	55.0	55.6	66.1	Agusan del Sur	0.482	0.482	0.459	62.5
Sultan Kudarat	54.3	36.6	53.0	Samar	0.511	0.493	0.462	66.8
Camiguin	53.1	32.5	57.1	Lanao del Norte	0.512	0.470	0.473	53.5
Camarines Norte	52.7	49.7	64.9	Sarangani	0.516	0.494	0.529	51.2
Least Poor				*Top 10 (HDI)*				
2nd District, NCR	4.1	4.5	18.6	Bulacan	0.760	0.702	0.727	41.0
4th District, NCR	4.9	4.6	28.3	Bataan	0.746	0.727	0.653	45.9
Bulacan	5.4	8.3	41.0	Cavite	0.735	0.724	0.782	46.8
1st District, NCR	5.8	5.7	27.6	Rizal	0.733	0.693	0.730	45.1
Batanes	7.5	8.7	63.1	Batanes	0.717	0.713	0.760	63.1
Rizal	8.0	8.3	45.1	Laguna	0.709	0.676	0.721	47.3
Laguna	8.6	12.3	47.3	Ilocos Norte	0.684	0.646	0.623	47.7
3rd District, NCR	9.0	4.6	31.4	Batangas	0.683	0.684	0.672	44.4
Bataan	9.9	7.7	45.9	Pampanga	0.665	0.648	0.664	41.2
Cavite	10.2	8.0	46.8	Isabela	0.649	0.626	0.624	54.8

Sources: National Statistical Coordination Board (NSCB). "Highlights: Poverty incidence 1997 and 2000"; "Highlights of the Report of the 1997 Philippine Human Index"; and "Highlights of the Report of the 2000 Philippine Human Index", accessed online at www.nscb.gov.ph; NSCB (1995); Cabigon and Flieger (1999).

3.3.3. Micro-Level Perspective

Table 11 indicates that according to the 1998 and 2003 NDH surveys the infant mortality among the poor is twice that among the rich. Under-five mortality among poor people is about three times that among the rich. The poor are the least advantaged when it comes to being attended by medically trained personnel at childbirth (the rich are four times more likely to have skilled delivery attendance than the poor). Infant and child mortality among the poor, irrespective of urban-rural residence and gender, is about twice that among the rich (Gwatkin *et al.*, 2000).

Table 11 Infant mortality and under-five mortality rates (per 1,000) by wealth index quintile, 1998 and 2003 NDH surveys

Quintile	IMR		Under 5	% of live births attended by skilled delivery attendants		
	2003	1998	2003	1998	2003	1998
Poorest	42	49	66	80	25.1	21.2
Second	32	39	47	60	51.4	45.9
Middle	26	34	32	50	72.4	72.8
Fourth	22	25	26	33	84.4	83.9
Richest	19	21	21	29	92.4	91.9
Poorest/Richest ratio	2.2	2.3	3.1	2.7		
Richest/Poorest ratio					3.6	4.3

Note: According to Gwatkin *et al.* (2000), socioeconomic status is defined in terms of assets or wealth based on household ownership of consumer goods, dwelling characteristics such as flooring material, type of drinking water source and toilet facilities. Principal component analysis was used to derive the asset or wealth index. The resulting factor scores were standardised to define the wealth quintiles. Sources: National Statistics Office and Macro International (2004: Table 8.2a) for 2003 figures and Gwatkin *et al.* (2000) for 1998 figures.

The 1998 NDHS showed that rich mothers are 11 times more likely to be attended by doctors during delivery compared to poor mothers (Table not shown). There are 33 rich mothers for each poor mother delivering at private facilities. The difference in skilled delivery attendance and place of delivery in these rich-poor gaps is slight between urban and rural areas. The number of poor mothers giving birth at home is four times that of their rich counterparts. While in the urban areas, the ratio of poor mothers to their rich mothers delivering at home is 5, the comparable ratio in the rural areas is 2 (Gwatkin et al, 2000).

The 2003 NDHS revealed that as was the case for IMR, perinatal mortality among the poorest is twice that among the richest (Table not shown). Poor children under five years are 2.5 times more likely than rich children to experience symptoms of acute respiratory infection. Rich children are 1.9

times more likely than poor children to have received iron drops or syrups during the six months before the survey (NSO and ORC Macro, 2004).

According to the 2003 NDHS, poor women having problems in accessing health care when they are sick are 1.9 times greater than that of rich women. There are nine rich pregnant women receiving antenatal care by a doctor for each poor pregnant woman . In contrast, there are about 4 poor pregnant women who are provided with antenatal care by a nurse or a midwife for each rich pregnant woman. In terms of quality of antenatal care, poor pregnant women are 1.5 times more likely than rich pregnant women not to have been informed of any pregnancy complications or where to go in case of pregnancy complications. They are also 1.3 times more likely than their rich counterparts not to be given tetanus toxoid during pregnancy. Whether the health facility is public or private, the poor women are disadvantaged when it comes to place of delivery. The rich are 3.4 times more likely to deliver at a government hospital than the poor. The gap is much wider if the health facility is private. There are 38 rich mothers for each poor mother delivering in private facilities. Delivery by Caesarean section among the rich is 12 times that among the poor. The rich are 1.4 times more likely than the poor to have received vitamin A dose postpartum in the first two months after delivery (NSO and ORC Macro, 2004).

Among the women and men surveyed in the 2003 NDHS the poor are 1.6 times more likely than the rich to have reported at least one symptom of TB. The rich women are about twice more likely than their poor counterparts to be aware of the DOTS program of the DOH.

In summary, a clear positive poverty-mortality relationship is evident at the micro- or household individual level regardless of the type of mortality indicator used. The rich always hold an advantage over their poor counterparts.

4. Summary and Discussion

In terms of mortality trends, this paper has shown the following: (1) a drastic decline in infant mortality from 1960 to 1980 and a decelerating decrease thereafter, with male babies more disadvantaged than female babies; (2) a slow pace of decline in life expectancy at birth since 1960, regardless of sex, as well as in under-five and maternal mortality since 1990;

and (3) TB mortality remaining as one of the six leading causes of mortality since 1960; it affects men in the 15-24 age group and women in the reproductive ages. The slow pace of decline in overall mortality, infant mortality, child mortality and maternal mortality and the slight increase in TB mortality in recent years show that meeting the MDG targets of reducing child mortality, improving maternal health and combating TB may be very difficult.

With respect to trends in poverty, this chapter has demonstrated that there was a significant reduction in poverty incidence between 1985 and 1997. However, available figures for poverty incidence and HDI for 1997 and 2000 indicate only a slight improvement. Most of the poorest provinces, mostly in Mindanao, remained at the extreme poverty situation in 1997 and 2000. The slight but simultaneous decline in mortality and poverty over time implies a weak positive relationship between the two. However, further examination at the macro and micro levels is needed before some definitive conclusions can be drawn.

At the global level, the Philippines and China are similar in terms of their GNI PPP per capita in 2002, placing them in 11th – 15th lowest middle income countries. Likewise, mortality indicators, life expectancy and infant mortality rate, in 2000 for these two countries are similar. The global figures for the period around 2000 and 1990 revealed that while the most economically advanced countries have about two times the life span of the poorest countries, the poorest countries have over 10 times the infant mortality level of the most developed countries. Comparison of poverty and mortality indicators among countries in the same income groups exhibits a more marked relationship between poverty and infant mortality compared to that between poverty and life expectancy at birth. Furthermore, such relationships are non-monotonic.

At the provincial level, initial exploration of the poverty-mortality link reveals that poverty incidence and infant mortality are significantly correlated ($r=0.8$). However mortality, income and education indices do not show a clear positive poverty-mortality linkage. While the poorest provinces do show higher infant mortality than their richest counterparts, the pattern they display is not clear as some of the richest provinces exhibit an infant mortality level similar to the level observed among the poorest provinces (e.g. Batanes and Isabela). It is interesting to note, however, that the im-

provement in education has been much faster than in poverty and mortality reduction in the Philippine provinces.

The clearest and monotonic poverty-mortality linkage is evident at the household-individual level of analysis. The 1998 and 2003 NDH surveys revealed that infant and child mortality rates among the poor are two to three times higher than that of the rich. A similar pattern is observed in the rich-poor differential in both the urban and rural population as well as among males and females. Skilled delivery attendance is also worst among the poor, with the rich more likely to have skilled attendance at delivery than the poor. Utilisation of private facilities for delivery is also higher among the rich compared to the poor. All of the other health indicators related to child, maternal and TB mortality reveal the poor are always at a disadvantage compared to the rich.

The findings of this paper provide further evidence that the association between poverty and mortality is complex. To gain further understanding of the poverty-mortality relationship, a number of important and relevant empirical findings and theoretical explanations are discussed below.

As consistently shown in the literature, there are variables other than income that dominate in the poverty-mortality linkage. In my 1990 study on the relationship between socioeconomic and health-related variables and life expectancy at the provincial level, it was found that the factors strongly associated with overall survival are road density, motor vehicles, safe drinking water supply, and toilet sanitation (Cabigon, 1990). Flieger *et al.* (1981) found that life expectancy at birth was correlated significantly with their development indicators: percentage of urban population, percentage of towns with electricity, percentage of population 25 years old and over with college education, and number of manufacturing establishments per 10,000 population. West (1981) demonstrated that provincial infant mortality decreased with the proportion of females with elementary education and with the proportion of households with pumped water, but increased with the proportion of males who are farmers and of females who married early.

Preston (1975, 1980, 1986) found that some 75-90 per cent of the increase in life expectancy for the world as a whole between the 1930s and the 1960s is attributable to factors other than national income or improved nutrition. Christian *et al.* (1977) demonstrated that the proportion of the population having access to potable water emerged as the strongest predic-

tor of infant mortality, explaining approximately 60 per cent of the variance compared to calorie and protein availability per capita, medical services such as doctors, nurses and hospital bed availability per capita, and per capita adult illiteracy rates. Pendleton and Yang (1985) showed that socioeconomic variables and levels of health and health care expenditure are significantly associated with mortality in developing countries. Caldwell (1986, 1989) refuted the integral element of the demographic transition theory (Notestein, 1945; Spiegelman, 1968; Coale, 1969, 1973; United Nations, 1973) which argues that modernisation or industrialisation is a precondition for both mortality and fertility declines. He showed that China, Costa Rica, Kerala and Sri Lanka experienced a drastic decline in mortality, in the absence of significant national economic advancement, through political will in China and both through political and social will in the other three countries. In these countries a large proportion of the already tight national budget was earmarked for education and health.

Alachkar and Serow (1988) discovered that around 88 per cent of the variance in life expectancy in 185 developed and developing countries can be explained by the share of the labour force in agriculture, the level of fertility as indicated by the crude birth rate, the proportion of the population enrolled in secondary school and the number of persons per physician. Kunitz and. Engerman (1992) pointed out that the association between real wages or income and mortality is not invariably monotonic; they classified the causes as epidemiological, sociological, geographical, demographic, technologic and economic.

Other relevant theories relate to the epidemiological transition theory. Mckeown *et al.* (1972) and Mckeown (1978) argued that a large increase in food supplies causing better nutrition results in increased resistance to infectious diseases and hence, a decline in mortality. Omran's (1977) epidemiological transition theory states that there is a long-term shift in mortality and disease patterns with the last stage characterised as the age of degenerative and man-made diseases. He postulates that better personal hygiene, nutrition and housing are the important determinants of this shift. Mercer (1990) on the other hand contends that this shift cannot be understood singly as a consequence of improvement in the economic standard of living. His view is that preventive and public health measures, socio-demographic changes affecting transmission rates of infectious diseases, links between communicable and non-communicable diseases involving immunological-

cellular processes, and the changing impact of infectious diseases in childhood are more important determinants than affluence and nutrition.

Other explanations are cultural and medical. Lopez and Ruzicka (1983) argued that mortality differentials in some societies reflect the role and status of females both within the family and in society at large inasmuch as they represent the health consequences of social, economic and cultural discrimination against females. Sagan (1987, cited in Moore 1993: 77-78) argued that longevity gain was a change in attitude more than a change in health status and the burden of disease. A stable family structure and maternal affection produce healthier, taller, more disease-resistant and more intelligent children. Moore (1993) and Garrett (1994) talked of microbes (most commonly known as viruses), which are adapting, changing, and evolving, as the greatest potential danger to human lives. This may be one of the reasons why tuberculosis in the Philippines has long been a major killer with some indication that the tuberculosis virus is becoming more resistant to available drugs.

While improvement in poverty and mortality reduction is evident in the Philippines, understanding the poverty-mortality relationship is complex. The relationship between poverty and mortality examined at the national and provincial-level analyses is non-monotonic. It is only at the household-individual level of analysis that a clear poverty-mortality linkage is evident. However, given the cost of a national survey and the rarity of death event, monitoring the progress of the Millennium Development Goals solely through national surveys may be difficult. Fortunately, there are other alternatives worth exploring to unravel such complex poverty-mortality relationship.

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Part III

MICRO PERSPECTIVES

8

Poor but Healthy?
The Paniyas of Kerala, India

Delampady NARAYANA

1. Introduction

The health status of population groups is difficult to measure, except by mortality indicators, which are easily observed. While mortality can be measured accurately, the event itself cannot be a measure of the ill health and suffering preceding that event, or of suffering unrelated to death. The last four or so decades have seen attempts at arriving at some more complete measures of health. The Quality Adjusted Life Years (QALY), Disability Adjusted Life Years (DALY), and Health Adjusted Life Years (HALY) are all measures, which combine premature mortality with time lived in disability, or illness. These measures, however, suffer from problems of value judgment. For instance, DALY assigns a different value to time lived at different ages–a year lived at age two counts for only 20 per cent of a year lived at age 25. Why should a particular state of health of an individual aged x be weighted differently from another individual aged y (Anand and Hanson, 2006), or why should a state of health A be treated differently from a state of health B. These valuations all seem to be turning around the *perceptions of a group of experts* (Murray, 1994: 439) who have chosen the weights. Thus, perception, in one form or another, is an inalienable part of measure of health.

Idler and Benyamini (1997) reviewed 27 studies on self-rated health as a predictor of mortality. In 23 of the 27 studies self ratings of health reliably predicted survival in populations after accumulating for known health risk factors. This, together with the ease of collecting such information, makes perceived health a preferred measure of health status in many situations.

A related issue is the inconsistency between a person's own understanding of health and the appraisal of a medical expert. The importance of perceptive measures cannot be underestimated as no objective medical diagnosis can provide an adequate understanding of pain and suffering as pain is a matter of self-perception (Sen, 2006: 265). At the same time it is argued that "the internal view of the patient is not only informed by knowledge to which others do not have access, but it is also limited by the social experience of the person in interpreting what is happening and why" (Sen, 2006: 265-6). The most quoted illustration of this incongruity is the Bihar-Kerala-United States (US) comparison in Murray and Chen (1994) and Sen (2006). Bihar (a low longevity state in India) has a much lower rate of reported morbidity compared to Kerala (a high longevity state in India), where the reported rates of illness are lower than that in the US. In terms of self-reported morbidity, the US is the least healthy, followed by Kerala, with the most backward Bihar enjoying the highest level of health. This is contrary to objective measures of health in Bihar. Thus, there is a need to socially situate the self-perception of illness.

Another dimension relates to the social relativity of the practice of accessing medical care. Evidence from Belgium, a complex federal state based on two distinct partitions of the population into three regions and three communities, illustrate this aspect of health. The Flemish community consists of all residents of Flanders and a small Dutch speaking minority in Brussels; the German communities are residents of a few communes in eastern Wallonia; and the French community consists of all other residents of Wallonia and Brussels. Belgium has a federal, high-quality health care system funded by proportional social security contributions levied at the same rates throughout the country. The Walloon population has a per capita consumption of publicly funded health care that is significantly higher than that consumed by the Flemish population. More diagnostic tests were routinely performed, and more specialist services were routinely used for same pathology (Van Parijs, 2006). This could be due to medical habits, institutional differences, or academic training of Walloon doctors that favour a wide spectrum of diagnostic tests.

This situation in Belgium poses peculiar problems for health policy makers. Which measure of health should be adopted for providing access to health care services? A social group most deprived and largely illiterate rates its health as good and utilises health care services sparingly; while another

group, highly literate with better housing, better access to water supply and sanitation, rates its health as poor and utilises health care more often. What should a policy maker do? Maintain the status quo, allocate more resources for the most deprived social group, or ration the services to the better off who rate their health to be poor? We illustrate the complexity of this problem by closely examining a Gram Panchayat (Local Self Government unit) in Kerala.

The argument in this chapter runs as follows. Social groups endowed with low levels of physical and human capital are expected to show poor health. The Paniyas of Kerala is one such social group, largely illiterate and extremely poor but reporting good health, which is contrary to our understanding of the poverty-poor health relationship. If there exists a poverty-poor health relationship in the community (except the Paniyas), then we could infer that there is a perception problem as regards the Paniyas. It would be further corroborated if we could show that chronic diseases, perception of which is under-reported (Murray and Chen, 1994: 97), are prevalent among the Paniyas to the same extent as among any other social group.

This chapter is organised as follows. The data and measures of health used here are described next. Section 3 describes the education, land ownership, poverty, and access to amenities of the social groups in the study area, namely Kottathara. The health status of Paniyas in comparison with other social groups and analyses of the poverty-poor health relationship among other social groups in Kottathara are presented in the following section. This is followed by discussion of chronic disease in Kottathara.

2. Data and Measures of Health Status

The data for the study came from Kottathara, Wayanad district in Kerala, India. The Kottathara survey covered the entire Gram Panchayat with 3352 households. The demographic information was collected from all these households with 16,110 individuals. The survey was carried out during April-June 2003 (Kottathara Baseline Survey henceforth).

We measured health status by self-reported health in the baseline survey. Several indicators are employed, depending on the age group. Information on perceived health was obtained from all adults by asking them the

self assessed health on a five point likert scale–excellent, very good, good, bad, and very bad. The original five point likert scale was later grouped into a binomial scale. Bad or very bad are classified as "poor health". Information on disability was collected by asking about physical incapacity or handicap, in locomotion, sight, hearing, speech, and amnesia. Chronic illness was taken to be illness lasting six months or longer.

We used two approaches to measuring illness and poor health in the population. First, we used prevalence rates. A prevalence rate tells us the total number of individuals who have an attribute or illness *at a given moment* in time, divided by the population at risk of having the attribute or illness (Last, 1988). Second, we present relative risks (RR), which measure the strength of an association comparing two populations, a population exposed to a particular risk factor (e.g. toxic chemicals) to a population not deposed (e.g. no toxic chemicals). Relative risks are ratios of incidence rates. A relative risk of 1 means there is no association (e.g. risk of having an illness is the same for individuals exposed to chemicals and not exposed). A relative risk greater than 1 suggests that individuals exposed to the risk factor have a greater likelihood of experiencing an illness. The stronger the association the greater is the relative risk. A relative risk of less than 1 suggests lower livelihood of reporting an illness.

In addition to risk factors, relative risks can be derived for modifiable factors (e.g. smoking) and for risk *markers* which are not modifiable (e.g. sex, age). Relative risks can also be used for assessing socio-economic inequalities in health by comparing small groups. We consider the following groups as advantaged: men, individuals from APL households (households Above the Poverty Line), forward castes, non-wage labourers, and educated persons.

Data from a clinical examination of a sample of the study population in Kottathara were also used in the study. The Health Survey was carried out in September-October 2006 on a representative sample of 543 households from Kottathara. In addition to collecting data on reported health status, trained public health nurses carried out a clinical examination of all individuals.

3. Kottathara Panchayat in Wayanad district

The data for the study came from Kottathara Panchayat situated in the mountainous Wayanad district in northern Kerala (Map 1). Wayanad, covers an area of 2,131 square kilometres, and is largely rural. The total population of the district in 2001 was 786,627, and only four per cent live in urban areas (the lowest among all 14 districts in Kerala), with a population density of 366 persons/sq. km (Census of India, 2001). Wayanad is also one of the poorest districts in Kerala.

Map 1 Wayanad, and other districts of Kerala

Over one third of Kerala's Scheduled Tribes (ST) live in Wayanad; about 17 per cent of population in Wayanad district is tribal compared to the state average of 1 per cent (Census of India, 2001). STs are one of the most deprived groups in Indian society, possessing little human and physical capital and they often face economic and social exclusion. A number of tribal groups live in Wayanad: Paniyas, Kurichiar, Kurumas, Irulas, and Kattunayakkas. These groups vary in terms of socio-economic status and quality of life. For example, the Paniyas are landless agricultural labourers

and have few assets, and the Kurichiars are land owners and cultivators, and are considered to be more advanced than the rest.

The religious groups in Kottathara include Hindus (54 per cent), Christians (23 per cent), Muslims (22 per cent), and Jains (1 per cent). There are also several caste groups, which remain an important social stratification system. The caste/tribe affiliations of the population in Kottathara is 31 per cent SC/ST, 34 per cent Other Backward Castes (OBC), and 35 per cent forward castes. The official Indian classification did not sufficiently discriminate among groups in the Panchayat as each of the three broad groups is heterogeneous. The Paniya tribal group showed a much higher level of deprivation compared to other tribal groups or scheduled castes. The distribution of households by social group affiliation is shown in Table 1.

Table 1 Number of households of each social group in Kottathara, 2003

Social groups	SC/ST	OBC	FC	Total
Paniya	393			393
Other ST/SC	642			642
Total	1,035	1,149	1,168	3,352

Note: The caste and religion of the head of the household is taken as representing the caste and religion of the household. Source: Kottathara Baseline Survey, 2003

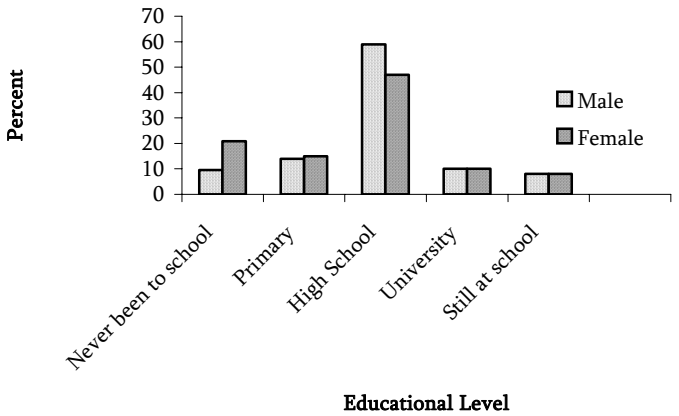
Over 50 per cent of individuals over the age of 15 years in Kottathara, have a high school education (completed or not), but 15% have never been to school. More males have at least a high school education, while more females have never gone to school (see Figure 1). These gender disparities do not persist at the university level.

The educational level of individuals varies between genders and social groups (Table 2). The first column shows the proportion of each social group that has never been to school. The percentage of Paniya men and women that have never attended school is four times higher than in other social groups. Also, a higher percentage of females compared to males have never been to school *across all social groups*.

The second, third, and fourth columns present the distribution of education levels *among those individual who have attended school but are not currently in school*. Over 60% of the individuals have at least a high school education, with the exception of Paniyas. Although the level of education varies across social groups, there are no major gender differences within social group.

Also, university education is more likely among the forward castes than among the lower castes.

Figure 1 Level of education (completed or not), among males and females (15 years and older) (per cent), Kottathara, 2003



Source: Kottathara Baseline Survey, 2003

Table 2 Levels of education among males and females (15 years+) by social group, Kottathara, 2003

Social group	Never been to school (%)	Education among individuals who went to school (%)		
		Primary	High school	University
Paniya				
Males	46.1	48.2	51.0	0.8
Females	57.0	49.7	49.4	0.9
Other ST/SC				
Males	11.1	16.9	77.0	6.1
Females	30.2	16.4	76.7	6.9
OBC				
Males	4.6	19.3	73.6	7.1
Females	18.5	24.0	66.4	9.6
FC				
Males	1.5	7.4	69.8	22.8
Females	4.0	13.4	63.1	23.5
Total				
Male	9.6	16.4	71.1	12.5
Female	20.8	20.3	65.5	14.2

Note: Columns 3, 4 and 5 total 100%.
Source: Kottathara Baseline Survey, 2003

Land is an important asset in this community and the possession of land is an indicator of wealth. Possession of land owned by social groups is

given in Table 3. Thirty per cent of the population has less than 0.10 acres of land, and one quarter of the population has over one acre. Household whose wealth and standard of living is above the poverty line are over four times more likely to own over 1 acre of land compared to those who live below the poverty line (39% vs. 9%). It is clear that landlessness in Kottathara is overwhelmingly a characteristic of Paniyas, and to a lesser degree that of OBCs. We also see that ownership of land of more than one acre is predominantly among the forward castes.

Table 3 Household land holdings, by social group (per cent), Kottathara 2003

Social groups	Land Ownership (%)	
	No land owned	Own 1 acre and more
Paniyas	13.2	1.3
Other ST/SCs	0.9	22.6
OBC	2.1	15.4
Forward castes	1.5	46.1
Total	3.0	25.8

Source: Kottathara Baseline Survey, 2003

Forty-three per cent of households in the Panchayat are classified as living below poverty line (BPL) (Table 4). The average income of the BPL households, as estimated by the annual per capita consumption, is about 6,743 rupees, almost 2 thousand rupees less than that of the APL households. One out of two BPL households earns an annual income per member that falls under 5,400 rupees, the State Specific Poverty Line (SSPL) (Table 4). The SSPL is estimated from household consumption data by the National Sample Survey Organisation (NSSO). This poverty line is fixed for inter-temporal poverty comparisons.

Table 4 Household poverty, and income among Below Poverty Line (BPL) and Above Poverty Line (APL) households, Kottathara, 2003

Poverty level	Poverty status		Average income*	Poverty incidence**
	Number of HH	% of HH		
BPL	1,454	43.4%	6,743	44.7%
APL	1,898	56.6%	8,592	23.2%
Total	3,352	100%	7,790	32.5%

Note: * Rs per capita and year as estimated by the annual per capita household consumption; SSL- State Specific Poverty Line. Source: Kottathara Baseline Survey 2003. ** % with income below SSPL

The majority of households gets their drinking water from a public, private well or pipe (96 per cent), and there is little variation across social

groups (Table 5). Forty-six per cent of households have access to electricity and 20 per cent of households have telephones. Among the Paniyas, only a quarter of their households had electricity and none has phones.

Table 5 Access to amenities among Paniyas households (%), Kottathara 2003

Amenities	Paniyas	Other ST/SC	OBC	FC	Total
Source of drinking water					
Public, private well, Pipe	96.2	93.1	97.8	96.7	96.4
Pond, River	3.8	6.9	2.2	3.3	3.6
House has electricity	24.2	53.7	38.8	57.2	46.4
Telephone at home	0.0	5.6	16.9	36.5	19.6

Source: Kottathara Baseline Survey, 2003

The inter group variations are high in Kottathara Panchayat. A high proportion of the Paniyas had no or fewer years of schooling. In Kottathara, a largely agricultural economy, almost 60 per cent of the households own less than 50 cents of land and landlessness is high among the Paniyas. Poverty is high not only among the Paniya but also among Other ST/SC.

4. Health Status of Paniyas in Comparison with Others

In Kottathara, there is wide disparity in levels of deprivation between the Paniyas and other social groups. Table 6 sums up this disparity; Paniyas have lower incomes, fewer assets, participate less in community organisation, and have lower levels of education. All of these deprivations constrain the capacity to lead healthy lives.

Table 6 Comparison of selected socio-economic characteristics of Paniya and other groups, Kottathara, 2003

Socio-economic characteristic	Social group	
	Paniyas	Others groups
Households below poverty line (%)	83.7	38.0
Average income (Rs per capita per year)	4,911	8,972
Households own no land (%)	13.2	1.6
Households participating in community organization (%)	19.6	50.3
Individuals never attended school (%)	52.0	10.1

Source: Kottathara Baseline Survey, 2003

Although the poorest and most deprived of all social groups, the Paniyas do not report poor health status, rather they report better overall health, and experience fewer health problems! The relative risks for perceived poor health, disability and chronic illness are lower for the Paniyas compared to

other groups (Table 7). This pattern applies to both males and females, among working age adults and for the elderly populations.

Table 7 Comparison of selected health indicators of Paniya and other groups for males and females (15 to 59 years and above 60 years), Kottathara, 2003

Indicator	Female			Males		
	Paniyas (1)	Other groups (2)	Relative risk (2) / (1)	Paniyas (3)	Other groups (4)	Relative risk (4) / (3)
Adults (15 to 59 years)						
Prevalence of poor perceived health (%)	16.4	19.0	1.16	8.4	13.9	1.65**
Prevalence of disability (%)	3.5	4.2	1.20	2.2	3.7	1.68*
Prevalence of chronic illness (%)	11.8	17.9	1.52**	6.3	11.8	1.87**
Adults (above 60 years)						
Prevalence of poor perceived health (%)	63.8	81.1	1.27**	62.9	75.7	1.20**
Prevalence of disability (%)	21.3	24.0	1.13	20.2	21.2	1.05
Prevalence of chronic illness (%)	37.2	70.5	1.90**	38.2	64.2	1.68**

Note: *p<.05, **p<.01. Source: Kottathara Baseline Survey, 2003

Table 8 Comparison of selected health indicators of Paniya and other groups for males and females, Kottathara, 2003

	Paniyas			Other groups		
	Male	Female	RR	Male	Female	RR
Adult (15 to 59 years)						
Prevalence of poor perceived health (%)	8.4	16.4	1.95	13.9	19.0	1.37
Prevalence of disability (%)	2.2	3.5	1.59	3.7	4.2	1.14
Prevalence of chronic illness (%)	6.3	11.8	1.87	11.8	17.9	1.52
Elderly (above 60 years)						
Prevalence of poor perceived health (%)	62.9	63.8	1.01	75.7	81.1	1.07
Prevalence of disability (%)	20.2	21.3	1.05	21.2	24.0	1.13
Prevalence of chronic illness (%)	38.2	37.2	.97	64.2	70.5	1.10

Source: Kottathara Baseline Survey, 2003

It is interesting that both among the Paniyas and other social groups perceived poor health disability and chronic illness were more prevalent among women compared to men of working age (Table 8). But the gender differentials disappear among the elderly for both the Paniyas and other groups.

If the accepted wisdom is that poverty and poor health are related, then the self assessed health of the Paniya tribe shows something quite contrary to our expectations. Extreme poverty seems to go with perceived

good health. In order to better understand this relationship, we now examine the poverty-poor health relationship for other groups in the community.

5. Poverty and Ill Health

As discussed earlier, the forward castes are most advantaged in educational attainment and access to amenities, followed by other backward castes and the other SC/ST groups are most deprived. If the poverty-ill health relationship holds, then we should see a social gradient in ill health with the forward castes reporting best health. Among working age men and women perceived poor health is higher for the other ST/SC and OBC compared to the forward castes. Population below the poverty line (BPL) report a higher proportion with poor health. Similar social differentials with regard to wage labourers and uneducated are observed. This pattern is obtained for both males and females (Table 9). Thus, the poverty-ill health relationship seems to exist among social groups other than the Paniyas.

However, women report higher prevalence of ill health compared to men across all social groups (Table 9). Women are about 40 per cent more likely to report poor health than men and for wage labourers it is over 150 per cent. Table 10 shows that similar social groups and gender differentials exist for chronic illness.

Table 9 Prevalence of perceived poor health among working age men and women, by social group, Kottathara 2003

Characteristic	Female		Male		Relative risk Female / Male
	Incidence (%)	Relative risk	Incidence (%)	Relative Risk	
Social group					
Other ST/SC	21.8	1.32**	15.2	1.27**	1.43**
OBC	19.7	1.19**	14.9	1.22**	1.32**
FC	16.5	-	12.2	-	1.35**
Poverty status of household					
BPL	22.6	1.35**	18.2	1.57**	1.24**
APL	16.8	-	11.6	-	1.45**
Wage status					
Wage labourer	24.4	1.32**	16.0	1.23**	1.53**
Non wage labourer	18.5	-	13.0	-	1.42**
Education					
Uneducated	48.1	3.12**	50.4	3.94**	0.95
Educated	15.4	-	12.8	-	1.20**
Total	19.0	-	13.9	-	1.37**

Note: **p<.01. Source: Kottathara Baseline Survey, 2003

Table 10 Prevalence of chronic illness among working age men and women, by social group, Kottathara 2003

Characteristic	Female		Male		Relative risk Female / Male
	Incidence (%)	Relative risk	Incidence (%)	Relative Risk	
Social group					
Other ST/SC	19.8	1.15**	11.7	1.03	1.69**
OBC	17.6	1.03	12.3	1.08	1.43**
FC	17.1	-	11.4	-	1.50**
Poverty status of household					
BPL	20.5	1.26**	13.8	1.28**	1.49**
APL	16.3	-	10.8	-	1.51**
Wage status					
Wage labourer	24.4	1.36**	13.2	1.11	1.85**
Non wage labourer	18.0	-	11.9	-	1.58**
Education					
Uneducated	39.6	2.48**	39.8	3.46**	0.99
Educated	16.0	-	11.5	-	1.39**
Total	17.9	-	11.8	-	1.52**

Note: **p<.01. Source: Kottathara Baseline Survey, 2003

It is striking that while the risk of perceived poor health among other ST/SC relative to forward castes was high for the working age adults, it is insignificant for the elderly (see Table 11). Perceived poor health is more likely among males living below the poverty line, but not for females. While the non-schooled females are more likely to report poor health, there is no difference between the educated and uneducated among males. The social groups' gender, educational and poverty differentials for chronic diseases are very similar to that observed for reported poor health (see Table 12).

Table 11 Prevalence of poor perceived health among elderly men and women (60 years and older), by social group, Kottathara 2003

Characteristic	Female		Male		Relative risk Female / Male
	Incidence (%)	Relative risk	Incidence (%)	Relative Risk	
Social group					
Other ST/SC	86.2	1.10	74.6	1.07	1.16*
OBC	82.0	1.04	85.3	1.23**	0.96
FC	78.7	-	69.5	-	1.13**
Poverty status of household					
BPL	84.8	1.07	82.5	1.13**	1.03
APL	79.4	-	72.9	-	1.09*
Education					
Uneducated	88.5	1.19**	81.6	1.10	1.08*
Educated	74.2	-	74.2	-	1.00
Total	81.1	-	75.7	-	1.07*

Note: *p<.05, **p<.01. Source: Kottathara Baseline Survey, 2003

Table 12 Prevalence of chronic illness among elderly men and women (60 years and older), by social group, Kottathara, 2003

Characteristic	Female		Male		Relative risk Female / Male
	Incidence (%)	Relative risk	Incidence (%)	Relative Risk	
Social group					
Other ST/SC	71.6	1.00	61.9	0.97	1.16
OBC	68.8	0.96	66.3	1.04	1.04
FC	71.3	-	63.8	-	1.12
Poverty status of household					
BPL	70.0	0.99	69.0	1.11	1.01
APL	70.7	-	62.3	-	1.13**
Education					
Uneducated	72.0	1.04	71.1	1.14	1.01
Educated	69.1	-	62.6	-	1.10*
Total	70.5	-	64.2	-	1.10*

Note: *p<.05, **p<.01. Source: Kottathara Baseline Survey, 2003

6. Environmental Determinants of Health

Ninety-six per cent of households in Kottathara Panchayat have access to drinking water from either a public or private well, or pipe, with no difference between BPL and APL households. Close to 90 per cent of households have a toilet inside their house; 21 per cent of BPL households, and only 5 per cent of APL households have no toilets. And just over 50 per cent of the households reported that their house is in good or very good condition. BPL households reported their house to be in poor condition almost two times more than that for households above the poverty line (60 per cent and 34 per cent respectively). Households that do not have access to safe drinking water are predominantly from other ST/SC, and almost three quarters of Paniyas perceive that their house is in poor or very poor condition, and 50 per cent of Paniyas have no toilets.

Health status is examined by only housing conditions as access to safe drinking water and sound sanitation is almost universal. Table 13 shows that both men and women whose houses were perceived to be of poor condition reported poorer perceived health and a higher prevalence of chronic illness compared to individuals from houses in good condition. This pattern applies to both working age adults and elderly men and women (Table 13).

Table 13 Condition of housing and health among working age group and elderly, Kottathara 2003

	Housing condition of working age adults				Housing condition of elderly			
	Poor		Good		Poor		Good	
	M	F	M	F	M	F	M	F
Number	1798	1841	2776	2750	223	279	357	366
Poor health								
% Poor health	18.4	23.0	11.0	16.2	86.5	83.5	68.9	79.2
Relative risk	1.67**	1.42**			1.26**	1.05		
Relative risk ratio (M/F)	1.25**		1.47**		0.97		1.15**	
Chronic illness								
% Chronic illness	14.2	21.5	10.3	15.5	73.1	77.3	58.7	65.3
Relative risk	1.38**	1.39**			1.25**	1.18**		
Relative risk ratio (M/F)	1.51**		1.50**		1.06		1.11	

Note: **p<.01. Source: Kottathara Baseline Survey, 2003

7. Household Health and Hygienic Practices

Households were asked to estimate the frequency with which they practiced each of the following habits: washing their hands before having food, using a toilet, and boiling drinking water and/or avoiding drinking water that was not boiled. Hand washing and use of toilet was regularly practiced by almost all households across the social groups. Specifically, 99 per cent of households reported that they regularly washed their hands before having meals, and *among the households with a toilet* 99 per cent reported regular use of toilets. Boiled drinking water was regularly used by 85 per cent of households. Twenty-one per cent of households below poverty line compared to 11 per cent of above poverty line households did not boil their water regularly. Among social groups, the Paniyas adopt this practice less regularly compared to other social groups by a factor of two (Figure 2).

The practice of drinking boiled water regularly has a beneficial effect on the health status of adults of working age. There is a 50 per cent higher risk of reporting poor health status by those not drinking boiled water compared to those who regularly drink boiled water. This does not vary between male and female. However, such a pattern does not seem to exist among the elderly (above 60 years) (Table 14).

Figure 2 Percentage of households not drinking boiled water by social group, Kottathara 2003

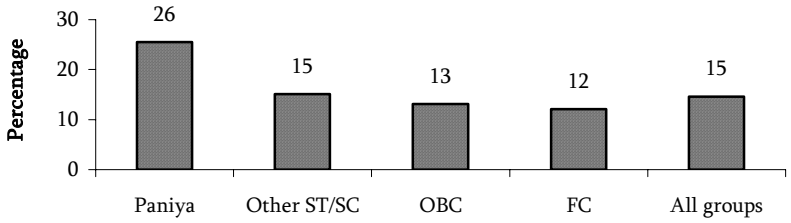


Table 14 Drinking boiled water and health conditions of persons in working age group and elderly, Kottathara 2003

	Drinking boiled water among working age adults				Drinking boiled water among elderly			
	Not regular		Regular		Not regular		Regular	
	M	F	M	F	M	F	M	F
Number	615	612	3959	3979	75	85	505	560
Poor health								
% Poor health	19.7	26.7	13.0	17.9	72.0	77.6	76.2	81.6
Relative risk	1.36**	1.49**	-	-	0.95	0.95	-	-
Relative risk ratio (M/F)	1.36**		1.38**		1.08		1.07*	
Chronic illness								
% Chronic illness	13.2	19.3	11.6	17.7	58.7	70.6	65.1	70.5
Relative risk	1.14	1.09	-	-	0.90	1.00	-	-
Relative risk ratio (M/F)	1.46**		1.53**		1.20		1.08	

Note: *p<.05, **p<.01. Source: Kottathara Baseline Survey, 2003

The association between drinking boiled water and perceived low poor health is not evident for chronic illness. The relative risk is close to one for working age adults as well as elderly (Table 14).

By and large, a social gradient to poor health seems to exist for groups other than the Paniyas. The poorer social groups report poorer health. This seems to hold among males and females and for working age adults as well as elderly. The relationship is strong in the case of perceived health but weak, or non-existent in the case of chronic diseases. The relationship seems to exist through poor housing condition and unhealthy habits like not boiling drinking water.

8. Chronic Disease in Kottathara

A sample of 543 households from among the 3,352 households of Kottathara Panchayat was selected for clinical examination in 2006. Trained junior public health nurses under close supervision carried out the clinical examination. The results from this survey are presented in Table 15.

Table 15 Percentages of adults found to be under weight, having enlarged thyroid gland and having hypertension, Kottathara 2003

Social Group	Population above 5 with an increase in volume of Thyroid Gland (manual palpation)		Population above 40 years with hypertension		Population above 16 underweight (BMI < 18.5)	
	Male	Female	Male	Female	Male	Female
Paniya	1.7	15.7	22.9	21.3	40.2	68.6
Other ST/SC	2.5	14.0	23.4	22.9	37.7	46.7
OBC	0.4	5.0	18.8	15.7	27.0	28.0
FC	2.2	7.5	20.8	19.4	21.1	20.7
Total	1.6	10.2	21.1	19.5	30.2	40.6
Number	1034	1108	360	400	765	839

Source: Kottathara Health Survey, 2006

It is evident from Table 15 that the Paniyas are no different from the rest of the population in terms of the prevalence of hypertension. As regards thyroid enlargement, the scheduled caste and tribes women are worse affected compared to other backward caste and forward castes. Within the broader group of SC/ST, the Paniya women are the worst affected. A much higher proportion of Paniya adults are, however, underweight. The general impression that Paniyas are the most deprived, the vast majority of whom rarely get two square meals a day is reinforced by the large proportion of adults being underweight. Two out of three Paniya women are underweight compared to one in five among the forward caste or one in two among the other SC/ST women.

With regard to the prevalence of chronic diseases, perception can be compared with clinical examination results to assess the magnitude of perception bias. It is seen that the Paniya perceive lower prevalence of chronic diseases than other social groups but clinical examination reveals comparable prevalence of chronic diseases between the Paniyas and other groups. Thus, the perceived good health of Paniyas cannot be taken at their face value and it needs to be inferred as a perception bias.

Thus, one of the dimensions of ill health, namely prevalence of chronic diseases, where perception is known to yield extremely low values when clinical examinations reveal more realistic higher values, showed that Paniyas are no different from the others. If at all they are worse off. Thus, the reported good health of Paniyas cannot be taken at face value and it needs to be inferred as a perception bias. And if it is a perception bias then something needs to be done to improve their health and provide them with better health care.

9. Conclusion

The Panchayat studied is a multi-caste and multi tribe society and the differences among them and within the tribal group are wide. The expected poverty-ill health relationship does not show up when we compare the reported ill-health of the extremely deprived group–the Paniyas–with the rest of the population. Obviously, there is a problem with the perception of ill health among the Paniyas. If we had included the Paniyas in the broad Scheduled Tribes the relationship would have got completely masked.

When the Paniyas are excluded from the analysis, the poverty-ill health relationship becomes evident. The households with poor housing condition, less education, and wage labour show poorer health status compared to these with good housing conditions, well educated and engaged in non wage labour occupations. Further, hygiene practices and personal habits (e.g. not boiling drinking water) exacerbate the ill health effects of poverty.

Thus, perception does not seem a problem among social groups other than the Paniyas in Kottathara community. Poorer population groups do report worse health. This must be the case for the Paniya as well but perception seems not to reflect the reality of the Paniyas. This is confirmed by the results from the clinical examination study of chronic diseases which showed that the Paniyas experienced as much chronic disease and malnutrition as other social groups.

This study points to two important issues. First, while studying broad social groups, such as the scheduled tribes in India, researchers need to be sensitive to the highly heterogeneous nature of such groups. Second, the reported measures of health need to be placed within the larger social context before drawing any policy conclusions.

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9

Poverty and Mortality in Rural Cameroon: Perceptions and Realities

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1. Introduction

Cameroon is located in Central Africa. Its latitudinal location gives a variety of natural conditions from the equatorial forests in the south to the semi desert landscape around Lake Chad. After independence in 1960, there was sustained high economic growth brought about by agricultural production. Oil exploitation came to reinforce this growth from the beginning of the 1980s, making Cameroon a development model in sub Saharan Africa. But the second half of this decade was to become grave. The inability to service foreign debt interest or to pay internal debt, forced the government to approach the International Monetary Fund (IMF) for assistance. This intervention required draconian reforms and engagements collectively described as structural adjustment (Courade, 1994).

This was the beginning of an era in which the state was to considerably reduce its scope of activities, even withdrawing from some very vital sectors. The result was a generalised growth in poverty and a degradation of the educational and health care systems. In the Western Highlands of Cameroon (administratively the North-west and West provinces), the Arabica coffee culture introduced by the colonial administration in the 1930s greatly dominated the landscape and economic activity. State withdrawal, the demise of coffee from 1989, and the devaluation of the African Financial Community (CFA) *franc* in 1994 shocked the material existence of

local communities, as well as their internal structures, their norms and values. Cameroon's rural sector is in search of a new source of livelihood to lead it out of this economic quagmire. Food crops which for a long time were meant for home consumption, are now highly market orientated in favour of urban growth and opening up of sub regional markets. Local and sub regional food demands are so significant and pressing that the question of whether the Cameroon's Western Highlands, traditionally renowned for food crop production, will be able to live up to the challenge. Would this area continue to satisfy its own needs? The result is the introduction of new forms of production which seem to undermine social relations.

The results of the Cameroon Household Surveys (CHS) of 1996 and 2001 have overturned the considerations and the certainties that guided public opinion. Against all expectations, this region considered economically viable was classified by the survey results as being amongst the poorest in the country. In a country where wealth is essentially derived from the diversity of the natural and social milieu, the question arises as to whether misleading generalisations could be caused by the use of one survey to evaluate a complex phenomenon such as poverty. Outside of a few and universally accepted criteria for measuring poverty, are there no other pertinent indicators of poverty? Is there no better way to understand the ideals of the population's existence at each stage in their recent history for specific social groups, (based on their modes of life, their beliefs, their profound aspirations and projects and their perception of the world)?

It is therefore necessary to look specifically at the Western Highlands to analyse the parameters taken into consideration to evaluate poverty within the socio-economic context. There must be factors which hinder the positive influence of economic growth on the living conditions of the population, and thereby negatively affect its health status. This chapter examines the link between poverty and mortality within the framework provided by the following hypotheses:

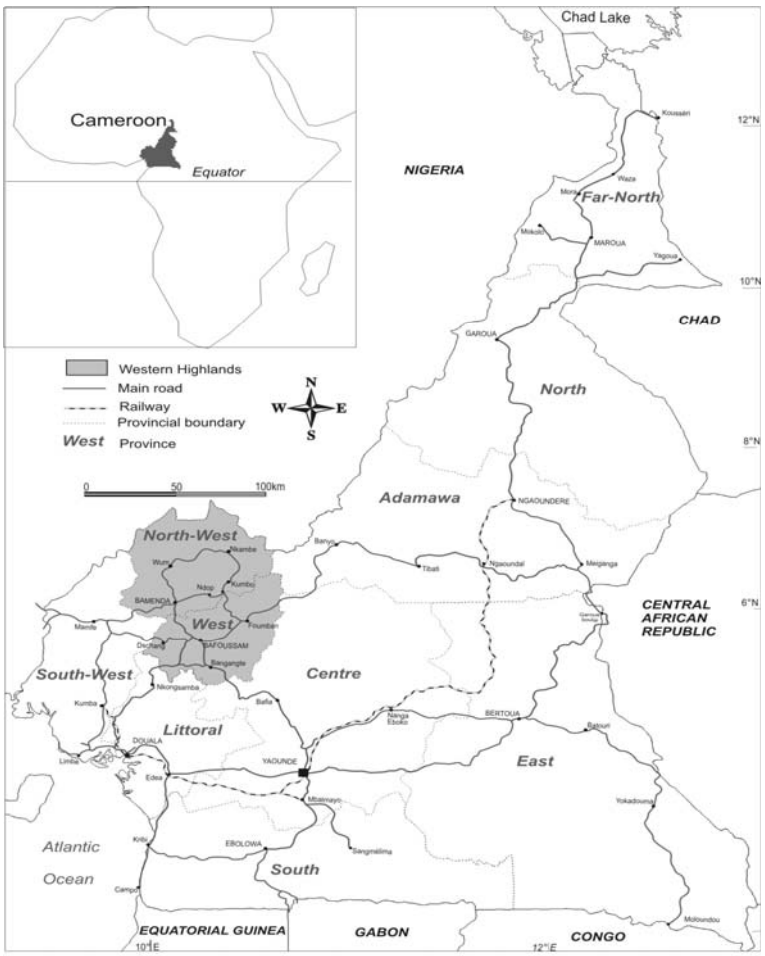
- Studies on poverty should take into consideration regional parameters. In the Western Highlands, poverty is more psychological than material.

- High food production in the Western Highlands is highly market-oriented leaving virtually nothing for family subsistence, leading to the prevalence of malnutrition;

- Persistence of the economic crisis due to the sustained fall in prices of coffee in the world market have led to poverty and a rise in mortality in the Western Highlands;

- Peasants in the Western Highlands invest in livelihoods other than those that ameliorate their living conditions, resulting in the persistence of high mortality.

Figure 1 Location of the Western Highlands, Cameroon



This study seeks to contribute to our understanding of the disturbing situation of increasing poverty and mortality in the Western Highlands of Cameroon. The study is based on data collected from the population

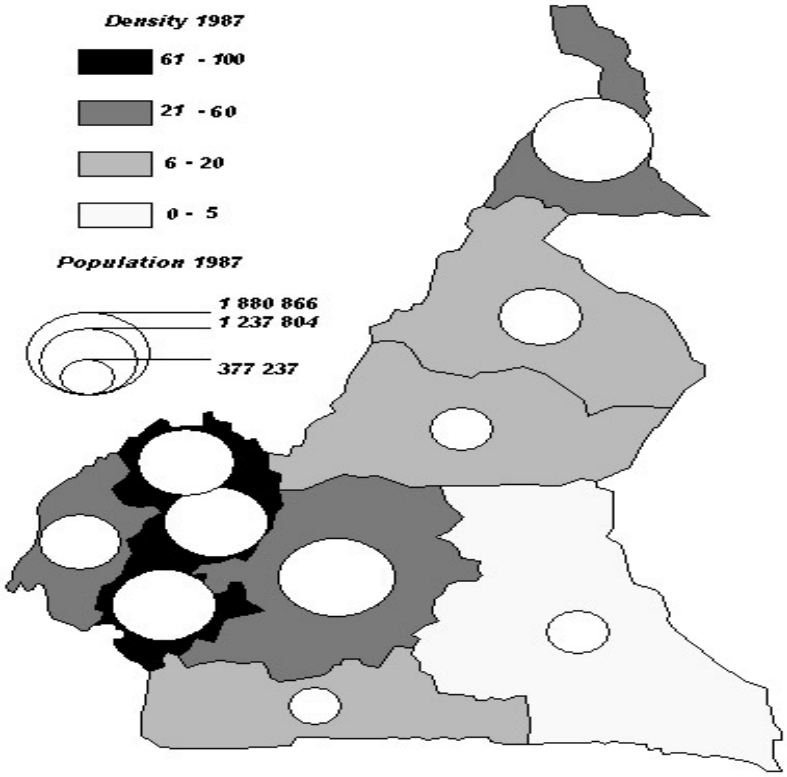
through various surveys at the national level on their living conditions and environment and on field observations.

The first section gives an overview of the evolution of socio-economic context in Cameroon and the case of the Western Highlands. The second deals with concepts of poverty developed by organisations and researchers, and the approaches used in surveys in Cameroon. The third section examines the linkage between poverty and mortality, pointing out other characteristics that can lead to poverty and therefore to mortality.

2. The Socio-Economic Context

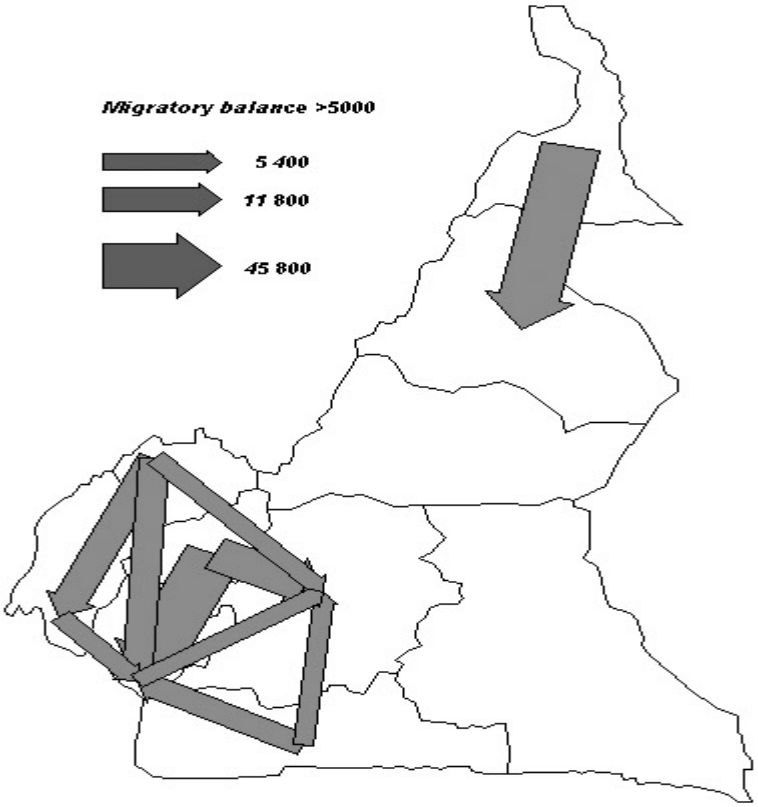
Until the middle of the 1980s, Cameroon's economy grew at a rate of about seven per cent per annum. Some regions like the Western Highlands were distinguished by their substantial contribution to this growth. It was the undeniable 'breadbasket' of the country thus an area of prosperity. However the Bamileke and other Grassfield populations living in the Western Highlands of Cameroon developed a form of social organisation which has enabled them to respond to different and complex challenges in the course of their history: high population concentration on a small land surface, active participation in the cash economy by the cultivation of coffee since the 1930s, the maintenance of its food self-sufficiency and the supply of the cities with food. Rural population densities are amongst the highest in Africa. According to the Population and Housing Census of 1987, Cameroon had an average population density of 23 persons/km^2. The North West and West provinces were the most densely populated with 72 persons/km^2 and 96 persons/km^2 respectively. In certain areas, the densities surpass 1,000 persons/km^2 (Ducret and Fotsing, 1987). This situation is at the root of the massive out-migration from this area (Figure 3) to neighbouring rural areas (the Mungo region in the Littoral, the Mount Cameroon region in the South West) and above all towards the urban areas (Yaoundé in the Centre and Douala in the Littoral).

Figure 2 Population distribution and density by province in Cameroon, 1987



For over twenty years now, the historical equilibrium has been deeply shaken by the multifaceted crises in rural areas (and in towns) characterised by a resurgence of poverty. The price of Arabica coffee, which for long constituted the main source of monetary income for the peasant fell from 475 CFA francs per kilogram in the 1988-1989 coffee season to 250 CFA francs at the beginning of the next season, a fall of 47 per cent. The decline in income from the sales of coffee led to an increase in food crop production. The products of the Western Highlands are now sold as far away as in Bangui, in the Central African Republic, Brazzaville in Congo, Libreville in Gabon and Bata in Equatorial Guinea. Consequently, the Western Highlands already known as the breadbasket of the country has taken centre stage in the sub region giving its agriculture a real commercial outlook (Kuete *et al.*, 2003).

Figure 3 Inter-province migratory balance in Cameroon, 1987



Tables 1 and 2 show that the Western Highlands produce a number of food crops. Only a small proportion of this produce is consumed in the region. Between 55 and 98 per cent of the food crops are destined for sale in the immediate rural markets, in the cities of Douala, Yaoundé, Bafoussam and Bamenda, and in the regional markets of the Central African sub region. The low household consumption of food crops produced and the reinvestment of income generated from their sales on non-food items notably real estate business, socio-cultural and traditional ceremonies, luxurious good is inimical to health protection and promotion in the region. This is a situation of food insecurity in the Western Highlands of Cameroon where over 60 per cent of the population consumes mainly energy giving foods, explaining in part why anaemia is rampant. Results drawn from Cameroon Household Surveys show that more than 60 per cent of households representing 66 per cent of Cameroon's adult population take less

than 2400 calories per day and 13 per cent of the households (17 per cent of the adult population) do not exceed 1,200 calories per day. Only 12 per cent of households consume more than 2,400 calories per day.

Table 1 Production (in tons) and marketing of agricultural products in the Western Highlands, Cameroon

Places	Total production	Percentage national production	Percentage of produce marketed
North-west			
Irish potatoes	91,277	72.4	60.0
Beans	53,450	30.6	60.0
Tomatoes	975	0.2	60.0
Carrots	1,455	12.5	95.0
West			
Irish potatoes	29,208	23.2	75.0
Beans	55,900	32.0	55.0
Tomatoes	287,300	83.1	85.0
Carrots	1,625	13.9	98.0
National			
Irish potatoes	126,090		
Beans	174,848		
Tomatoes	345,385		
Carrots	11,639		

Source: UNDP (2000), National Institute of Statistics 2006, Ojuku (2005).

Table 2 Destination of different marketed agricultural food products in the Western Highlands, Cameroon

	Produce Destination	Percentage Flow
Internal	Cameroon:	
	- Douala	45
	- Yaoundé	30
	- Others	25
Export	Gabon	55
	Equatorial Guinea	30
	Central African Republic	10
	Chad	5

Source: Field data, 2005

Analyses indicate that the consumption of fish, dairy products, eggs and protein rich foods in general is very low in the region. Ignorance and customs dictate priority to quantities and not quality of the food they consume. In the face of persistent economic crises in the country over the last two decades, eating habits have been greatly modified to cope with the situation. The number of meals consumed per day has been reduced to increase the quantity of produce reserved for the market. In some households of the Western Highlands the best of the produce harvested is reserved for the market or preserved for gifts to the urban-based elite or

visitors. These practices may have contributed to malnutrition which tends to be severe especially amongst children. Morbidity and mortality are thus appreciably high in the region.

3. The Concept of Poverty

Poverty is often defined in terms of living below a minimum level of income, such as a dollar a day per person. But poverty is also a lack of adequate food, shelter, health, education, and influence over decisions that affect one's life. Today, a significant part of the world's population is affected by poverty. Of the six billion people living in the world today, one billion receive eighty per cent of global income, while more than one billion barely survives on less than one dollar a day (World Bank, 2004). Poverty is also a moral question and refers to unacceptable hardship (Piachaud, 1981). Thus there are diverse views on defining the concept of poverty, but even greater differences on how to measure it. Poverty may refer to material conditions and the economic or social position of the poor.

The Human Development Report for Cameroon in 1998 suggests that poverty involves much more than the restrictions imposed by a lack of income. It also entails a lack of basic necessities to lead full and creative lives-as when people who suffer from poor health are excluded from participating in making decisions that affect their communities or have no right to guide the course of their lives. Such deprivations distinguish human poverty from income poverty.

It is obvious today that reducing the level of poverty has become a universal priority. In 2000, world leaders gathered at the Millennium Summit committed themselves to halving poverty by 2015. According to Guzman (2005), the concept of poverty can be tackled from three main perspectives: poverty as deprivation or absolute poverty based on subsistence, a minimum standard needed to live; poverty as exclusion or relative poverty based on a comparison of poor people with others in society; and poverty as dissatisfaction also known as subjective poverty.

In each approach, different methods of measurement lead to the acquisition of different statistical data that can be used to elaborate policies. In order to get these data, surveys and inquiries are undertaken. Considering the economic crisis that Cameroon experienced from 1984 to 1985, with all

its consequences on the wellbeing of the population, different surveys or inquiries have been undertaken in this country and elsewhere in sub-Saharan Africa (Burkina-Faso, Cote d'Ivoire, and Togo), under the auspices of the World Bank, the International Monetary Fund and other international organisations which are seeking to improve the welfare of the population. In Cameroon, we can cite the Demographic and Health Surveys (DHS) of 1991 and 1998 and the Cameroon Household Surveys (CHS) of 1996 and 2001. The main aim of these surveys was to put in place the bases for the monitoring and the evaluation of the household conditions of life in general and of the poverty alleviation programme in particular. To measure poverty, these surveys had taken into consideration the calculation of the poverty line and the indicator of wellbeing. These surveys used relative poverty and absolute poverty, and used the questionnaire prepared by the World Bank and adapted it to the Cameroonian situation.

The relative poverty line shows that the lower part of income distribution is affected by inequality but does not exactly measure poverty. The absolute poverty measure was preferred for the surveys because relative poverty is subjective. The measure of absolute poverty is based on the poverty line which takes into account the minimum necessities. It is "calculated by identifying a basket of basic needs and evaluating the cost of these needs at the market prices of the country" (Guzman, 2005). During the Cameroon Household Survey (CHS), the FAO's 2400 calories per day index for defining extreme poverty line was used based on the calorie needs per day of an adult aged fifteen years and above. For comparison, the CHS also used the World Bank poverty line based on a minimum daily income arbitrarily put at US$1 per day.

Income and consumption are indicators of wellbeing that are often used to measure monetary poverty. The income of the household is defined as the total recurrent earnings in cash or in kind, and regularly received by the household or by its different members at an interval of time less than or equal to one year. The notion of recurrence is fundamental to this definition and not all cash proceeds received are considered to be income. The use of income as an indicator of the measurement of wellbeing leads to problems of under estimation, and fluctuation over time.

In contrast, the use of the level of consumption presents two advantages. On the statistical side, households show no systematic tendency to

underestimate it. It presents fewer temporal variations compared to income and provides an annual basis for establishing the wellbeing of man. The concept of final consumption used to establish wellbeing refers to all expenditure, monetary or non-monetary, undertaken by the household or by one of its members on its behalf.

This final consumption and the income measures used in different surveys in Cameroon have taken into consideration many elements. Amongst these are income, monetary expenditure and absolute poverty, but have neglected important expenditures in the West and North West provinces such as marriages, death and funeral ceremonies, and house construction. It is therefore questionable why the same questionnaire should be used in the poverty survey throughout the country when we know that, "across different countries, regions, communities or even families, the identity of the poor, the degree of their poverty, and its causes, will differ" as argued by Jean Olson Lanjouw in the UNDP Technical Support Document on poverty reduction in 1997.

4. Monetary Poverty in the Western Highlands

The poverty profile takes the poverty line to be at 232,547 CFAF per capita per year. Any individual whose annual income and expenditure falls below this sum is considered poor. In this definition, the subjectivity of the notion of poverty is evident because this line can vary over time and space. In the Western Highlands, at least 46 per cent of the population is poor compared with 40 per cent at the national level. There are also wide disparities within this region. For example, the proportion of the poor in the West province represents 40 per cent of its population whereas it is 53 per cent in the North West province. However, it should be noted that the North West has the highest level of poverty after the Far North province. The poor who live in the Western Highlands represent 27 per cent of the poor in Cameroon. In other words, three out of every ten poor people in Cameroon are in the Western Highlands.

The intensity of poverty is an indicator which allows us to determine the amount of income that must be transferred to a poor person to move him out of this situation. The choice between the intensity and the incidence of poverty is too strategic for poverty reduction. The intensity of poverty in the Western Highlands is 34 per cent higher than the national

average of 32 per cent. In other words, to take someone who lives in the Western Highlands out of poverty, his annual income needs to be supplemented to the tune of CFA 79,765 whereas at the national level, the poor need the sum of CFA 73 950 to escape poverty.

Table 3 The incidence, intensity and severity of poverty (in per cent) in the West Highlands in 2001

Regions	Population	Poor	Incidence of poverty*	Intensity of poverty**	Severity of poverty***
West	1,782,467	935,409	52.5	39.8	20.4
North west	1,866,674	752,781	40.3	27.5	10.4
West highlands	3,649,141	1,688,190	46.3	34.3	15.9
Cameroon	15,472,559	6,217,058	40.2	31.8	13.8

Notes: * Percent of poor people; ** Ratio between the average expenditure of the poor household and the poverty line; *** It expresses the distribution of the poor household around the average national expenditure of the poor households. It's calculated as the ratio between the regional situation (gap between regional and national average expenditure of the poor household) and the national average expenditure of the poor household.
Source: CHS (2001)

In the context of this study, poverty has not been defined in relation to the social context. This might have led to misleading survey results since Cameroon has many cultures and regions. Furthermore, the items that constitute a minimum food basket for household consumption such as maize, groundnut and fish are not the most consumed foods in the West and North West provinces. In these provinces, evaluating expenditure, especially on non-food items to ascertain poverty would have been preferable because expenditure generates the flow of services from which material and social well-being is derived. In the region, marriages, death and funeral ceremonies are the mains occasions during which households expend huge sums of money. On these occasions organisers display their wealth by providing food and drinks in large quantities to those invited. If expenditure on these socio-cultural ceremonies which are to a large extent an obligation for each family or household was considered in the surveys, the region would probably not have featured amongst the poorest in the country.

5. Mortality Implications of Monetary Poverty

In developing countries, the link between poverty and mortality is evident. The incidence and effects of this poverty on human development in sub-Saharan Africa in general and the Western Highlands of Cameroon in particular are not a new phenomenon. However, the magnitude and speci-

ficities of poverty and mortality, their alarming increase and impact on the economic development process of Cameroon presents a growing urgency for action. Generally mortality relates inversely with the level of economic development: when the level of economic development is high, mortality rate tends to be low, and vice versa. The Western Highlands occupies a central position in agricultural production in Cameroon being an almost undisputed breadbasket for the southern part of the country and even by extension, for the central African sub region. Paradoxically, different surveys (CHS 1996 and 2001) have shown that the region displays significantly higher levels of rural poverty than the other regions in the country (Table 3). Given the economic background of the region, this observation is an anomaly when we know that human development indices are higher in countries of higher economic production than those of lower economic production. Social and health indicators in this region are also precariously weak as a logical consequence of the poverty trend observed. There is no gainsaying the strength of the link between poverty and mortality world wide. The UNICEF (1990) has observed that there is a general correlation between per capita Gross National Product (GNP) and the major health indicators. Because food, clean water, and safe sanitation are still the most powerful determinants of mortality, a job and an income are the best possible guarantees that these would be met. Health cannot therefore be dissociated from economic circumstances and the availability of basic services. It is worthwhile finding out the mortality implications of Cameroon's poverty status.

Although mortality and GNP are intricately linked, high levels of GNP are not necessarily accompanied by a fall in mortality and low income levels do not also directly lead to high mortality. Suitable health policies and health care planning and delivery, education and lifestyle changes must accompany rising incomes for mortality decline to occur. This is illustrated by Table 4 in which the plateau (which includes Western Highlands) and forest regions with the highest poverty indices in the country, do not have correspondingly highest morbidity and infant mortality rates. The city of Douala, with the lowest poverty index (19.7) has the highest morbidity, and the forest region with the lowest average household income, does not experience the highest infant mortality rate. Paradoxically, the northern savannah provinces experience the highest infant mortality rates, though households are not the poorest and the poverty index is not the highest.

Table 4 Relationship between poverty, morbidity and mortality in Cameroon

Region	Household income	Poverty index	Scope of poverty	Morbidity	Infant mortality (‰)
Yaoundé	442,000	29.6	16.7	29.7	51.5
Douala	552,500	19.7	12.8	30.7	51.5
Other towns	358,500	21.4	12.6	24.9	-
Forest	165,600	63.8	41.2	20.3	87.0
Savannah	219,300	56.7	36.7	12.3	103.2
Plateaux	188,000	66.0	41.5	20.6	54.2
Cameroon	275,300	50.5	32.0	20.7	79.9

Source: Human Development Report 1998, pp. 33 and 35

Several causes explain the high mortality in the Western Highlands region. The first of these causes is malnutrition. Access to food is perhaps the most basic of all human needs. The lack of adequate food increases people's susceptibility to disease because it weakens their immune systems (Streeten, 1995). Streeten further stresses that prolonged malnutrition amongst babies and children leads to reduced adult stature; severe malnutrition is associated with altered brain chemistry and decreased brain size. Malnutrition is not only a matter of inadequate calories and protein nor is it only the imbalance between calories and proteins. In the Western Highlands, food production is fairly adequate in terms of tonnage but the types of foods produced are mainly those yielding calories and not protein. Amongst the main staple food crops are maize, cocoyam, beans and Irish potatoes. The food situation of the region indicates that the populations generally grow protein-deficient food crops. The few protein-rich foods grown locally like beans and soya beans, and a host of vegetables yielding vitamins are mainly market oriented. The uncontrolled trade in foodstuffs causes severe food inadequacy. Many peasants sell so much of their food crops that their food stocks run out before the end of the calendar year. A field survey in the North West of Cameroon in 2000 indicated that only about 33 per cent of the population enjoys food self-sufficiency all year round (Ndi, 2001). The need to escape the coffee quagmire and to integrate into the monetary economy and new policy instruments of the Central African Economic and Monetary Union (CEMAC) facilitating intra-regional trade in the Central African sub-region, have encouraged a rapid growth in the export of agricultural produce to other countries in the sub-region. The high prevalence of anaemia is caused in part by malnutrition, common in the region, where it featured amongst the first ten killer diseases in 1997 (MINPAT/PNUD 1999). Anaemia can be caused by iron or folic acid deficiency or by hookworm, malaria or sickle cell disease. In Cameroon, over 66 per cent of the

population experiences nutrition deficiencies as a result of the lack of adequate access to necessary foods. Malnutrition is also caused by the unavailability of food in different regions needed due to poor distribution systems (MINPAT/PNUD 1999). In the Western Highlands, the problem is not the lack of financial resources but the improved use of money gained from food crops sale.

The second cause is the distribution of the population. The linkage between poverty and mortality in the Western Highlands can also be explained in terms of the location of the population of this region. The proportion of people living in urban areas is 38.81 per cent in the North West and over 52.87 per cent in the West province (UNDP, 1998). Poverty and mortality vary between rural and urban locations. Poverty has been most common in rural locations over the last two decades (UNDP, 1998). Illiteracy rate is twice as high in rural as in urban areas. In the Western Highlands the rate of literacy was 54.16 per cent and it is significantly higher in the North West, 61 per cent. Poverty and mortality are intricately linked because the poverty condition affects the population's socio-economic wellbeing by depriving it of access to education, healthcare, proper nutrition, and shelter. Table 5 shows the linkages between residence, poverty and mortality in the Western Highlands of Cameroon.

Table 5 Residence, poverty and mortality in the Western Highlands

Provinces	Residence	Poverty index	Aggregate	IMR*
North-west	Urban	0.16	0.42	55.9
	Rural	0.26		
West	Urban	0.14	0.35	52.5
	Rural	0.21		

Note: *IMR: Infant Mortality Rate per 1,000.
Source: Compiled from "Indicateurs socio-economiques de base au Cameroun", 2002 and the UNDP, 1998, p.34.

In table 5 it is clear that poverty level is distinctly higher in the rural areas in both the North West and the West provinces. Within the region, the poverty index of the North West is higher than that of the West province and in that pattern, and the infant mortality rate is higher in the North West than in the West. The high poverty profiles observed in this region could have been caused in part by the predominant rural nature of the population.

The third cause, the illiteracy rate especially of the mother is an important determinant of poverty and consequently mortality in the Western

Highlands of Cameroon. Studies have shown that education is strongly associated with better health and nutrition, high child survival rates, and lower fertility (UNICEF 1990). World Bank studies have consistently shown that economic returns from education are higher than for most other investments. For example, four years of primary education are associated with an average increase of over ten per cent or more in farm productivity (World Development Report, 1981). In Table 6 the literacy rate is correlated with the infant mortality rate by province in Cameroon.

Apart from the three Northern provinces, the illiteracy rate tends to be significantly higher in the North West (74.5), West (76.1) and East (64.3) provinces. It is lower in the Centre, South, South-west, and Littoral provinces. Educated mothers are likely to have smaller families and healthier children, who themselves are likely to be better educated than the children of uneducated women (UNICEF 1999). This is simply because educated women are more aware of the health, educational and environmental challenges incumbent in raising children, than uneducated women who are poor, exist only under the shadows of their husbands and do not have the capacity to take decisions affecting their families. However, though having lower literacy rates compared with the Centre, South, South-west and Littoral, the North-West and West provinces have relatively lower infant mortality rates. This seems anomalous but could be explained by the increased prevalence of non-formal education by civil society organizations, and the significant impact of medical missionary activities in these regions. Surveys have shown that the level of education affects infant mortality rate: it is about 50 per thousand live births among children whose mothers have acquired a secondary education or more; 74 per thousand in children whose mothers have had primary education and over 104 per thousand in children born of illiterate mothers (MINPAT/PNUD, 1999).

The decline in the quality and quantity of health care delivery also explains the high mortality rate in the Western Highlands of Cameroon. This fall is explained by the economic crisis that hit Cameroon in the mid 1980s, when the state started withdrawing from the provision of basic health care in the form of essential drugs and the recruitment of health workers. Since 1980, the percentage of the national budget allocated to health has never been more than the 5.21 per cent of the 1992-1993 financial years (MINPAT/PNUD, 1999). The pressure of population on health facilities is very high in the North West province. In fact the pressure is only higher in the

Far North. Table 7 shows the level of pressure of population on health facilities in the Western Highlands and in Cameroon.

Table 6 Literacy and infant mortality rate in Cameroon, 2002

Province	Literacy (%)	Infant mortality (‰)
Far North	24.4	98
North	32.5	98
Adamawa	39.6	98
East	64.3	83
Centre	82.6	83
South	88.2	83
South West	81.7	60
North West	74.5	60
West	76.1	72
Littoral	80.7	72
Average	64.5	80.7

Source: Compiled from: Indicateurs socio-économiques de base au Cameroun, 2002.

Table 7 The Population health facility ratio in the regions of Cameroon in 1998

Province	Health districts	Number of health facilities	Uncovered population	Population facility ratio
Adamawa	6	53	83,570	1/8689
Centre	22	216	328,398	1/4578
East	12	76	26,200	1/4712
Far North	22	138	270,839	1/11282
Littoral	18	79		
North	11	73		1/6876
North West	14	121	177,830	1/9084
West	16	164	84,937	1/8405
South	6	87	20,953	1/3075
South West	13	101	55,691	1/6484

Source: Etudes Socio-économiques Régionales au Cameroun, 1999. P.B 45

The population size exerts a relatively high pressure on health facilities in the West and North West provinces. This indicates low levels of accessibility to health care. For an acceptable health care coverage, the World Health Organization prescribes a population/medical doctor ratio of 6000/MD. Few areas meet this prescription in the region. For example, the ratio was 19,450 in the North West province in 1997. Some health districts were much worse. The population/doctor ratio in the Santa health district was 43,615/MD, 45,150/MD in the Ndop health district, 39,782/MD in the Nkambe health district, 39,596 in the Wum health district and 85,405 in the Batibo health district. The urban areas tended to do better as is the case with the Bamenda health district, 6,278/MD. The acceptable nurse to population ratio as prescribed by WHO must fall in the range of 1:3000–5000. Poor facilities and inadequate numbers of health personnel are also causes of high mortality in this region, because many patients seek

medicine and service from drug hawkers, road side pharmacies and herbalists, whose ability to dispense satisfactory health care is questionable. There is also a large number of traditional practitioners, whose services are of very doubtful quality.

The reverence in which certain socio-cultural practices like elaborate marriage and funeral celebrations are held have led to a misplacement of health priorities in most parts of the region. People spend significant sums of money almost on a weekly basis on these celebrations for various reasons including tradition, custom, and pride. They do not spend similar amounts of money on their nutrition or their health because of the belief in the food custom which is quite rife in the region.

6. Conclusion

The debate on poverty, its causes and consequences has been enriched with new approaches and measurements. The aim of this debate was to elaborate efficient policies to reduce poverty throughout the world. As far as Cameroon is concerned, several surveys have been undertaken to understand the dynamics of poverty in the country and to seek efficient policies to eradicate it. These surveys have largely ignored the social context within which poverty is assessed, especially in the case of the Western Highlands of Cameroon where the psychosocial priorities of the population have not been taken into consideration. This has lead to the over-estimation of poverty in the region.

Looking at agricultural production (foods crops) in this area, it is paradoxical to conclude that its population is poor. The demise of coffee in the region favoured food crop production, reinforced by the new customs code of the Central African Economic and Monetary Community (CEMAC) which exempted food products from customs duties. We would have expected that the varieties and quantities of food produced would guarantee food security. The paradox however, has been that almost all the food produced is sold for cash income. The high mortality rate observed in the Western Highlands is not exclusively due to poverty but also to other local practices. The income earned is spent neither on food nor on health but on status seeking activities (marriage, death, funeral), and building of houses. The evaluation of poverty can not reveal the realities if these aspects are not taken into consideration.

It follows that the mortality and morbidity rates observed in the Western Highlands are not primarily due to poverty but largely due to psychosocial causes. The results of recent health surveys show an upsurge of malnutrition-related diseases in certain communities. This may be explained by the illiteracy of the population, marketing of food crops and the misuse of the income gained. Health has become precarious, characterised by recourse to self medication, road-side drug vendors and traditional practitioners. Visits to hospitals occur only when most patients are terminally sick resulting in high mortality.

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10

Poverty, HIV/AIDS and Mortality in Karnataka, India

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1. Introduction

Current estimates place the number of people living with HIV in India at approximately five million. HIV/AIDS is now considered a major threat to India. The sentinel site[1] data show that the epidemic has now spread from urban to rural areas and from individuals with risky behaviour to the general population. It is predicted that India will soon emerge as the country with the largest HIV burden in the world. HIV/AIDS is an unprecedented global development challenge that has already caused too much hardship, illness and deaths (UNAIDS 2004). Three sets of factors strongly influence the course of the emerging HIV/AIDS epidemic in different parts of India i.e., sexual contact, contaminated blood and patterns of injectable drug use. The epidemic that has emerged in India is primarily one of heterosexual transmission, fuelled by an active sex industry. According to the National AIDS Control Organization (NACO), about 85 per cent of the infection occurs from sexual contacts (both heterosexual and homosexual), 4 per cent through blood transfusion and another 8 per cent through injecting drugs. About 89 per cent of the reported cases are occurring in the sexually active and economically productive age group of 18-49 years (Anand *et al.*, 1999).

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[1] In order to measure the extent of HIV infection, National AIDS Control organization, estimates in different sites known as "sentinel sites" across the country among high and low-risk groups. High-risk groups are patients at sexually transmitted disease (STD) clinics and intravenous drug user (IDU) clinics. Women treated in antenatal clinics (ANCs) form the low-risk group. About 400 samples are being collected from each site.

The factors such as labour migration and the mobility of people in search of employment from economically backward to more advanced region, low literacy level leading to low awareness among the potential high risk groups, gender disparity, Sexually Transmitted Infections (STIs) and Reproductive Transmitted Infections (RTIs) among both men and women are responsible for the spread of the epidemic across the country. The effects of stigma attached to HIV/AIDS are devastating. People living with HIV/AIDS denied access to treatment, service and support and hinder effective responses.

HIV/AIDS like all other communicable diseases is linked to poverty. The highest HIV prevalence rates are found in poor countries and poverty increases the vulnerability to HIV/AIDS and exacerbates the devastation of the epidemic (Collins and Rau, 2000). The demographic consequences of HIV/AIDS are clearly recognised in the recent past in Africa and in other developing countries like India. HIV/AIDS especially affects mortality rates of the working age population and through the mother-to-child transmission the epidemic also affects child mortality (FAO, 1994).

Poverty also deprives individuals of the means to cope up with HIV/AIDS. The poor often lack the knowledge and the awareness that would enable them to protect themselves from the virus and once infected, they are less able to gain access to care and life-prolonging treatment (United Nations, 2005). Over 300 million people in India live in poverty and even more are illiterate (44 per cent for males and 24 per cent for females as per 2001 census). Added to this is the fact that India has a large and thriving sex industry, estimated to number around 100,000 sex workers in each metropolitan city (UNAIDS, 2006). The poor and uneducated persons are more likely to contract sexually transmitted diseases (STD) and other infections since they are deprived of the right to information on high risk behaviour, and are not literate enough to understand prevention messages and have less access to quality services (Anand *et al.*, 1999). Given the growing number of HIV/AIDS cases and the cost involved just in treating opportunistic infections, developing countries like India will have increasingly great difficulty in finding the resources to meet the challenge. Karnataka is one of the six states in India where HIV prevalence is high. The average prevalence in this state is 1.52 per cent among the adult population. It has been estimated that half a million persons are already living with HIV (Menon, 2004). HIV estimates from the available sentinel surveillance and

VCTC (Voluntary Counselling and Testing Centre data revealed that the prevalence ranges from 1 to 2 per cent among antenatal care (ANC) attendees and 10 to 20 per cent among STD centre attendees (KSAP 2004). Poverty and poverty-associated factors including the practice of the *Devadasi*[2] system in the state are believed to be major contributors to the high prevalence rate (Blanchard *et al.*, 2004). Several studies conducted in Karnataka, including studies by the PRC, Dharwad (Blanchard *et al.*, 2004; Halli *et al.*, 2005) revealed that the highest prevalence rate was observed in rural areas among the economically productive population aged 18-49 years. The loss of productive years in prime ages causes serious economic repercussions at the household level (Mahal, 2004). Due to high illiteracy and prevailing superstitious beliefs, the plight of infected households is aggravated by prejudice and segregation from society.

There have been very few studies on the linkages between HIV/AIDS related mortality, morbidity and poverty, and poverty-associated factors. This chapter investigates in detail the relationship between the course of the HIV epidemic and premature (adult) mortality in the context of poverty. Survey data collected by the Population Research Centre, Dharwad have been used to address the linkages (Blanchard *et al.*, 2004).

2. Poverty and HIV/AIDS

How does poverty affect the prevalence of HIV/AIDS? To what extent is poverty correlated with risk taking behaviour? What is the nature of the linkages between poverty, AIDS and mortality? To analyse these questions we have developed a conceptual framework based on a review of the literature.

HIV/AIDS is not just a biomedical problem; it also has socio-cultural dimensions. The HIV pandemic affects not only individuals, but also devastates households and communities, and society at large. In almost all the context the poor and marginalised people are disproportionately vulnerable

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[2] It is a common custom among the scheduled caste (SC) community to dedicate an unmarried girl to serve the God/Goddess in order to ward off evil effects on the family. These girls are called *Devadasis*. These girls remain unmarried throughout their life. They clean the temple, light the lamps and provide sex to the priests and upper caste men.

to HIV/AIDS and its consequences. This is particularly true for women because of biological and socio-cultural factors. The HIV/AIDS pandemic increases the vulnerability especially among the poor segments of the population in various ways. At the micro level, premature adult mortality resulting from HIV/AIDS causes a decline in those adult workers in a family and thus a fall in production and income especially in the rural agricultural sector. Several studies have shown that higher prevalence rates are observed in rural areas in economically most productive ages 18-40 years. It is not only the cost in monetary terms for controlling opportunistic infections[3] but also the loss of productive years in prime age groups has enormous economic repercussions for individuals and families.

Consequently, HIV/AIDS tends to cluster and often more than one family member is affected and dies of the disease. Bearing the medical costs and the provision of care for sick family member becomes a huge burden on the family. This invariably leads to reduced household saving and disinvestment. Many families are forced to sell or pawn the meagre jewellery they might have, and land and other assets, leaving the surviving family members without any means of support. In most cases children are left with very few resources to meet their basic needs like clothing, housing, food (nutrition) and schooling. In the absence of household resources, many are forced to borrow to manage their household expenditure thereby leaving the siblings with debt burden. Older children are often taken out of school by parents, not only to reduce pressure on the family budget but also to help with the care of a sick member of the household. HIV/AIDS prevalence increases the likelihood of child labour particularly among girls either on the family farm or as wage labour. Further decline in income is caused by fewer crops and reduced livestock production. It is accompanied by an increase in medical expenses which leads to poverty. Whatever assets and savings the family might have at the onset of the disease are subsequently spent, leaving the surviving family members with little means to support themselves. When men infected with HIV/AIDS die, they leave behind their widows and dependent children in abysmal conditions. In this context any natural

[3] Opportunistic infections are infections which occur on account of declining immunity or resistance power because of HIV infection. One the most commonly observed Opportunistic Infection among HIV patient is Tuberculosis.

disaster such as flooding and drought can have a compounding effect on the situation.

As a coping strategy, in the absence of alternative opportunities, to earn a livelihood for themselves and their households, many people involve themselves in activities which further make them vulnerable to HIV/AIDS and this in turn results in an increase in the HIV/AIDS associated mortality. The two main coping strategies are: seasonal labour migration (Halli et al, 2006); and resorting to sex work. Sex work is largely poverty-driven and is likely to foster risk taking behaviour, which encourages un-protected sex with multiple partners. People whose livelihood strategies expose them to high risk behaviour are less likely to take seriously the threat of infection. Within this context we have also focused our discussion about other underlying contextual factors that are linked to poverty and non-poverty driven behaviours.

In light of the above discussion, this paper analyses the linkages between poverty linked HIV/AIDS (morbidity) and associated mortality. In doing so, (i) it discusses the anecdotal evidence on HIV/AIDS related deaths from household data; (ii) it estimates the prevalence of HIV and the potential impact on mortality; and finally (iii) it discusses the underlying causes and consequences of the HIV epidemic in the area.

3. Data and Methodology

The data used here came from a number of recent studies conducted in 2003 by the Population Research Centre, Dharwad in collaboration with the India Canada Collaborative HIV/AIDS Project (ICHAP) (Blanchard *et al.*, 2004). The main objective of this study was to understand the levels and determinants of HIV infection in the ICHAP Demonstration Project Area in the Bagalkot district. The study was conducted in 10 villages and 20 urban blocks of 3 taluks (Bagalkot, Jamakandi and Mudhol) in the Bagalkot district of North Karnataka. A stratified random sample of 6703 (3,403 rural and 3,300 urban) male and female respondents in the reproductive age group 15-49 years were selected for the survey. Of the total selected, 4,949 persons were interviewed and blood samples were collected from 4008 respondents to test for HIV infection.

Since the Community Based HIV/AIDS Prevalence Study involved interviewing unmarried men and women on sensitive issues including sexual behaviour patterns and sexual networks, it was implemented with close cooperation and involvement of the community in three phases. In the first stage, a meeting of the District-level Steering Committee, set up by ICHAP, was held in Bagalkot at the district headquarters prior to the implementation of the survey, wherein the nature and objectives of the study and the proposed study design was discussed with the steering committee. Subsequently, a team of researchers visited the selected villages and urban blocks to canvas community support for the study. Village-level committees were formed in each of the 10 villages selected for the study. In this initial meeting with the village committee, the objectives, methodology and processes of the study were shared. Meetings were also organized at the street/Oni levels and the nature and objectives of the study were discussed (Ramesh *et al.*, 2004).

In the second stage, a complete census of all households and individuals in the sample areas was carried out with an objective of preparing a sample frame for the selection of individuals for the final survey. A total 11292 households (9171 in rural areas, and 2211 in urban areas) were enumerated in the study area. Information on socio-economic and demographic background of the households and the details about the incidence and nature of morbidity and mortality was obtained for each member. Each household was asked to indicate: whether any of its usual residents or visitors to the household suffering from an illness that lasted for more than two weeks died during the 24 months prior to the survey date. Details regarding age at death and cause of death were collected for every such death (Ramesh and Satihal, 2004)

In the final phase, each of the sample respondents was interviewed to collect data on a number of factors such as socio-economic and demographic characteristics, behavioural characteristics, knowledge and attitudes about STD, HIV/AIDS and sexuality, his/her attitude towards persons living with HIV/AIDS, treatment of HIV/AIDS and difficulties encountered due to limited means of income with the help of a questionnaire. A blood sample was also taken from each respondent.

In order to further consolidate and substantiate the quantitative findings and understand the facilitating factors leading to exposure to

HIV/AIDS in detail, the data collected from two other studies were also used: "The Hidden Epidemics: HIV/AIDS in Rural Karnataka-A situation Assessment of Bagalkot district" and "Female Sex work in Karnataka: Patterns and Implications for Karnataka" in 2003. The main objectives of the study were to gain an in-depth understanding of the community with regard to socio-cultural, economic, health and sexual behaviour patterns especially in relation to HIV/AIDS and to identify specific vulnerable locations and populations. These studies used qualitative methods of data collection, in-depth interviews, key informant interviews and focus group discussions.

4. Anecdotal Evidence on Poverty, HIV/AIDS and Mortality

When we were conducting various surveys on Reproductive health and Child health, Health and Family Welfare during 1995-2000 in rural northern Karnataka State, we observed that a lot of people were dying due to HIV/AIDS. Most of these deaths were observed in poverty stricken households. In order to make a systematic assessment and understanding the magnitude of HIV infection and its antecedents in Northern Karnataka, a research team from PRC, Dharwad visited the town of Bagalkot (one of the district headquarters of Northern Karnataka) and a neighbouring village (Arakere) in 2003 (Ramesh and Satihal, 2003). During their visit, preliminary discussions were held with the local health care providers and the members of the community who were considered to be adversely affected by HIV/AIDS. It was revealed in the discussion that health care providers and community workers seemed to perceive that HIV infection was 'rampant' in the district. However, there was variation in the reporting of the spread of the disease by health functionaries and village leaders, while some over-estimated, and others understated the prevalence. The District Health and Family Welfare officer said that many private practitioners in the town brought to his notice that they had come across many HIV positive cases. According to him the majority of the infected people were migrant labourers, agricultural labourers and people working in the flesh trade (Devadasi's and Commercial Sex workers – both hidden and open) who tend to be in chronic poverty.

The research team also visited doctors of five leading private nursing homes. Each of the Nursing Homes visited reported to have tested at least

one patient a day as HIV positive. When asked about the possible reasons for the high and increasing prevalence of HIV infection in the region, the doctors indicated the possible influences. The Devadasi system leads to prostitution and general poverty leading to seasonal out-migration. The research team's visit to the village was much more revealing. The village leader was concerned that a considerable proportion of the young people in his village (with a total population of about 4000) might already be infected with HIV. The local health workers from the concerned PHC also reported that a large number of the village youth had been tested HIV positive and about 200-300 women from the village were commercial sex workers working in major cities of Maharashtra. Although Devadasi-prostitution is a feature mainly among the lower castes (Scheduled castes and Scheduled tribes) in the village, HIV infection was found in both the high and low caste groups.

The discussions with the doctors in Bagalkot also revealed that while prostitution was the main reason for the spread of HIV infection in the area, HIV infection in different parts of North Karnataka spread because of different socio-economic and cultural factors unique to that area. For instance, in Mudhol Taluk of Bagalkot district, HIV infection was more among people who regularly migrate to coastal Karnataka, Goa and Maharashtra for seasonal work. On the contrary, the increased HIV infection in the Saundatti and Athani taluks of the Belgaum District was mainly due to the prevailing traditional Devadasi system, which is different from the prostitution prevalent in some taluks of Bagalkot.

5. Empirical Evidence on Poverty Linked HIV and Mortality

5.1. HIV Prevalence: Evidence from Census, and Behavioural and Biological Surveys

In the census conducted prior to main survey in the study area, details regarding age at death, month and year of death as well as causes of death were collected for every death in the study area during the reference period. The analysis of data on reported illness showed that HIV/AIDS was nearly 1 per cent among all reported chronic illness (Table 1).

Table 1 Per cent distribution of persons who are reported to be suffering from a chronic illness by nature of illness, according to sex and place of residence, North Karnataka, 2003

Reported nature of illness	Rural			Urban		
	Male	Female	Total	Male	Female	Total
Accident	2.7	3.3	3.0	1.3	0.0	0.7
AIDS	1.0	0.5	0.7	0.0	0.7	0.3
Appendicitis	0.5	0.7	0.6	0.7	0.7	0.7
Arthritis	0.5	1.2	0.8	0.7	0.0	0.3
Asthma	6.9	6.6	6.7	6.7	4.2	5.6
Back pain	0.0	0.9	0.5	0.7	0.7	0.7
Body ache	2.0	3.5	2.8	3.4	3.9	3.6
Blood pressure	4.9	8.0	6.5	13.4	34.8	24.3
Cancer	0.7	1.2	1.0	0.0	0.0	0.0
Cough	3.0	2.4	2.4	1.3	0.7	1.0
Diabetes	7.6	1.0	5.8	26.2	7.7	16.8
Dysentery	0.7	0.5	0.6	0.7	0.0	0.3
Fever	6.6	8.2	7.5	0.7	1.9	1.3
Fits	2.7	1.9	2.3	1.3	1.3	1.3
Heart problem	3.4	3.1	3.3	3.4	3.2	3.3
Jaundice	0.7	0.5	0.6	0.0	0.0	0.0
Joint pain	1.2	1.9	1.6	0.7	0.0	0.3
Mental illness	4.9	3.1	4.0	1.3	2.6	2.0
Nerve problem	2.2	1.9	2.0	0.7	0.0	0.3
Paralysis	9.1	3.8	6.4	10.1	2.6	6.3
Piles	1.0	0.9	1.0	0.0	0.0	0.0
Polio	2.5	1.2	1.8	0.0	0.7	0.3
Skin disease	3.7	1.7	2.6	3.4	2.6	3.0
Stomach ache	3.0	3.3	3.1	4.7	3.2	4.0
Tuberculosis	2.7	2.1	2.4	1.3	2.6	2.0
Teku (heavy breathing, palpitation)	9.8	11.1	10.5	5.4	6.5	5.9
Typhoid	1.2	0.7	1.0	0.7	0.0	0.3
Ulcer	1.5	0.7	1.1	0.7	0.7	0.7
Vata	0.7	0.0	0.4	0.0	0.7	0.3
Vayu	1.2	2.6	1.9	1.3	3.2	2.3
Waist pain	0.3	1.4	0.8	0.7	1.3	1.0
Weakness	1.0	2.4	1.7	0.7	5.2	3.0
White discharge	0.0	1.4	0.7	0.0	0.0	0.0
Other	10.1	13.7	11.9	8.1	8.4	8.2
Total per cent	100.0	100.0	100.0	100.0	100.0	100.0
Number	407	425	832	149	155	304

Source: Blanchard *et al.* (2004)

This is an underestimate when compared with Sentinel Surveillance data for Bagalkot district (2.3 per cent)(KSAP 2004). However, HIV/AIDS was reported as a cause of death for a substantial number of deaths (overall 6 per cent); further, about 17 per cent of deaths in the age group 15-49 was attributed to AIDS (Tables 2 and 3) in both rural and urban areas. During the field visit, it was also observed that, although many deaths were due to HIV/AIDS, respondents reported different causes of death such as asthma, jaundice, *Galishaka (evil effects)*, because of the stigma associated with

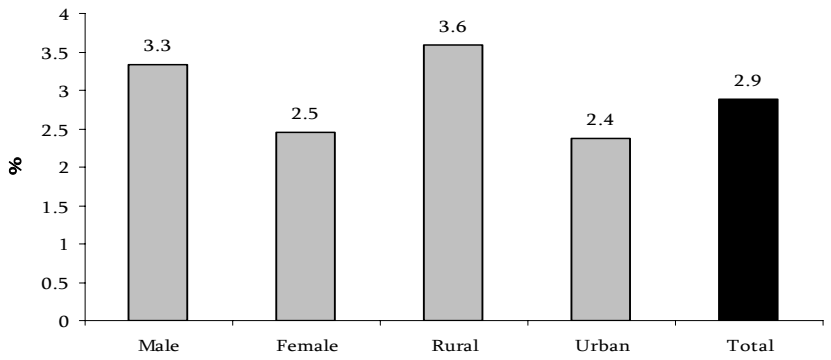
HIV/AIDS (PLWHIV). This indicates that HIV/AIDS will play a crucial role on adult mortality in future.

Table 2 Estimated crude death rates (per 1,000 population) by residence and age, North Karnataka, 2003

Characteristic	Crude death rate
Place of residence	
Rural	9.26
Urban	8.28
Age	
<14	10.07
15-49	5.55
50+	36.34
Total	9.07

The behavioural and biological data obtained from 4008 male and female respondents aged 15-49 years indicate that 2.9 per cent of the general population is infected with HIV. The differentials in the HIV prevalence by socio economic and demographic characteristics discussed below supports the hypothesis that poverty and poverty-associated variables are linked to HIV. The overall prevalence of HIV among the study respondents who gave blood samples was 2.9 per cent (Figure 1). In comparison, according to the 2003 Sentinel Surveillance among the women attending ante-natal clinics in Bagalkot district, the prevalence ranges from 2.0 per cent in District Hospital to 4.3 per cent in the Jamkhandi Sub-Divisional Hospital (KSAP 2003). HIV prevalence in rural areas was about 50 per cent higher than that in urban areas (3.6 per cent compared with 2.4 per cent).

Figure 1 HIV prevalence in % by sex and residence



Within the rural areas, HIV prevalence was the highest among those aged 30-39 years. Prevalence was also high among widowed, divorced, separated or deserted (8.4 per cent), and among those who had only the primary school qualification (6.5 per cent), agricultural and non-agricultural labourers (6.8 and 7.6 per cent, respectively), low-caste Hindus (7.9 per cent), and among those who had sex with more than one partner (10.3 per cent) (Table 4).

In urban areas (Table 5), on the other hand, HIV prevalence was relatively higher in the age group 25-29 years (4.0 per cent). In terms of literacy and education, the prevalence in urban areas was similar at 3.2 per cent for the illiterate and for those who have completed up to secondary education. Among students, the HIV prevalence was over one per cent. In terms of caste, both the high-caste Hindus (2.9 per cent) and low-caste Hindus (3.0 per cent) had higher prevalence than others. HIV prevalence among those who ever had sex with more than one partner was almost twice as high as that among those who did not (4.4 per cent compared with 2.2 per cent).

Table 3 Per cent distribution of deaths during the two years preceding the census by reported cause of death, according to place of residence and age at death, North Karnataka, 2003

Cause of death	Residence			Age at death		
	Total	Rural	Urban	<14	15-49	50+
Cardio vascular	12.28	11.06	18.04	7.65	12.36	13.68
Paralysis	8.33	8.79	6.19	0.55	3.16	13.85
Cancer	7.26	7.59	5.67	1.09	8.33	8.55
Aging	6.36	6.29	6.70	0.00	0.00	12.14
Fever	5.82	6.07	4.64	7.65	8.05	3.93
Accident	5.65	5.86	4.64	6.01	7.18	4.62
AIDS	5.65	5.64	5.67	0.55	16.95	0.51
Tuberculosis	4.66	4.99	3.10	1.09	5.46	5.30
Asthma	3.76	4.12	2.06	1.64	0.29	6.50
Maternal causes	3.14	3.47	1.55	0.00	1.44	0.00
Neonatal	2.87	3.04	2.06	32.24	0.00	0.00
Diabetes	2.60	2.39	3.61	0.55	2.87	3.08
Jaundice	2.51	2.60	2.06	2.19	4.31	1.54
Alcoholism	1.97	1.74	3.09	0.00	4.02	1.37
Suicide	1.43	1.30	2.06	0.00	4.02	0.17
Fits	1.34	1.52	0.52	4.92	0.86	0.51
Diarrhoea	1.25	1.41	0.52	2.73	0.29	1.37
Typhoid	1.08	1.19	0.52	1.09	2.59	0.17
Other	14.60	14.10	16.99	23.49	17.25	10.92
Cause not known	7.44	6.83	10.31	6.56	0.57	11.79
Total per cent	100.0	100.0	100.0	100.0	100.0	100.0
Number of deaths	1116	922	194	183	348	585

Note: Other causes of death include: mental illness, evil eye, snake/scorpion bite, sepsis, haemorrhage, liver ailment, etc.

Table 4 HIV prevalence in rural area (percentage tested HIV positive, by selected background characteristics), North Karnataka, 2003

Characteristic	Male		Female		Total	
	Per cent	Number	Per cent	Number	Per cent	Number
Bagalkot Taluk	0.50	199	2.17	230	1.40	429
Mudhol Taluk	8.00	275	3.73	241	6.01	516
Jamkhandi Taluk	3.04	461	3.49	458	3.26	919
Level of significance of χ^2	*Pr<.01*		*Not significant*		*Pr<.01*	
Village						
Kaladagi	0.68	148	2.09	191	1.47	339
Kirasur	0.00	44	3.03	33	1.30	77
Mudavinkoppa	*	7	*	6	*	13
Mirji	4.00	50	2.08	48	3.06	98
Shirol	9.25	173	2.72	147	6.25	320
Vantigodi	7.69	52	(8.70	46	8.16	98
Kumbarhal	1.72	58	0.00	44	0.98	102
Hunnur	4.29	233	2.50	240	3.38	473
Navalagi	1.63	123	3.88	129	2.78	252
Naganur	2.13	47	11.11	45	6.52	92
Level of significance of χ^2	*Pr<.01*		*Pr<.05*		*Pr<.01*	
Age :						
15-19	0.55	182	3.19	188	1.89	370
20-24	4.21	190	4.09	171	4.16	361
25-29	6.37	157	1.79	168	4.00	325
30-34	6.62	136	2.96	135	4.80	271
35-39	6.09	115	4.39	114	5.24	229
40-44	1.27	79	2.67	75	1.95	154
45-49	1.32	76	3.85	78	2.60	154
Level of significance of χ^2	*Pr<.05*		*Not significant*		*Not significant*	
Marital status						
Currently married	4.73	613	3.03	725	3.81	1,338
Marriage dissolved	*	10	7.34	109	8.40	119
Never married	1.92	312	0.00	95	1.47	407
Level of significance of χ^2	*Pr<.01*		*Pr<.05*		*Pr<.01*	
Literacy and education						
Illiterate	5.36	317	3.67	572	4.27	889
Primary	5.13	78	8.89	45	6.50	123
Middle	2.78	144	2.17	138	2.48	282
Secondary	3.40	206	1.68	119	2.77	325
Secondary+	2.63	190	0.00	55	2.04	245
Level of significance of χ^2	*Not significant*		*Not significant*		*Not significant*	
Occupation:						
Cultivator	2.94	340	3.31	242	3.09	582
Agricultural labourer	6.61	121	6.88	189	6.77	310
Non-agricultural labourer	8.08	99	*	6	7.62	105
Business	4.17	168	1.10	91	3.09	259
Salaried employment	3.70	108	3.13	32	3.57	140
Housework	*	1	2.13	329	2.12	330
Student	0.00	74	0.00	28	0.00	102
Other work	*	24	*	12	(0.00)	36
Level of significance of χ^2	*Not significant*		*Not significant*		*Pr<.01*	

Table 4 HIV prevalence in rural area (percentage tested HIV positive by selected background characteristics), North Karnataka, 2003 *(Continued)*

Characteristic	Male		Female		Total	
	Per cent	Number	Per cent	Number	Per cent	Number
Religion						
Hindu	4.42	814	3.31	785	3.88	1,599
Muslim	0.00	96	0.79	126	0.45	222
Other	4.00	25	*	18	9.30	43
Level of significance of χ^2	*Not significant*		*Pr<.01*		*Pr<.01*	
Caste						
High-caste Hindu	3.00	300	1.41	283	2.23	583
Middle-caste Hindu	4.70	362	2.51	359	3.61	721
Low-caste Hindu	6.04	149	9.72	144	7.85	293
Non-Hindu	1.61	124	2.10	143	1.87	267
Level of significance of χ^2	*Not significant*		*Pr<.01*		*Pr<.01*	
Travel due to work						
No	3.10	548	3.05	886	3.07	1,434
Yes	5.17	387	6.98	43	5.35	430
Level of significance of χ^2	*Not significant*		*Not significant*		*Not significant*	
Total	3.96	935	3.23	929	3.59	1,864

Notes: [1] Either had sex with a non-regular partner in the last 1 year, or ever had sex with more than one partner, or ever paid/received money for sex. *Percentage not shown; based on less than 25 cases. ( ) Based on 25-49 cases. Pr<.01: Pearson χ^2 is significant at .01 level. Pr<.05: Person χ^2 is significant at .05 level

Table 5 HIV prevalence in urban area (percentage tested HIV positive, according to sex and selected background characteristics), North Karnataka, 2003

Characteristic	Male		Female		Total	
	Per cent	Number	Per cent	Number	Per cent	Number
Bagalkot Taluk	1.37	292	0.65	306	1.00	598
Mudhol Taluk	4.62	195	2.69	186	3.67	381
Jamkhandi Taluk	3.02	562	2.33	602	2.66	1,164
Level of significance of χ^2	*Not significant*		*Not significant*		*Pr<.05*	
Town						
Bagalkot	1.37	292	0.65	306	1.00	598
Mudhol	3.09	97	3.26	92	3.17	189
Jamkhandi	2.76	181	5.03	199	3.95	380
Rabkavi-Banahatti	3.48	345	1.08	372	2.23	717
Terdal	0.00	36	0.00	31	0.00	67
Mahalingpur	6.12	98	2.13	94	4.17	192
Level of significance of χ^2	*Not significant*		*Pr<.01*		*Pr<.05*	
Age						
15-19	1.56	192	1.00	201	1.27	393
20-24	0.00	217	2.43	206	1.18	423
25-29	5.77	156	2.58	194	4.00	350
30-34	3.42	146	2.07	145	2.75	291
35-39	5.88	119	0.68	147	3.01	266
40-44	3.33	120	1.82	110	2.61	230
45-49	2.02	99	3.30	91	2.63	190
Level of significance of χ^2	*Pr<.05*		*Not significant*		*Not significant*	
Marital status						
Currently married	3.86	622	1.26	793	2.40	1,415
Marriage dissolved	*	14	10.75	93	10.28	107
Never married	1.21	413	0.48	208	0.97	621
Level of significance of χ^2	*Pr<.05*		*Pr<.01*		*Pr<.01*	
Literacy and education						
Illiterate	6.06	165	2.03	395	3.21	560
Primary	2.53	79	0.00	35	1.75	114
Middle	1.83	164	4.05	173	2.97	337
Secondary	4.73	275	1.57	255	3.21	530
Secondary+	0.55	366	0.85	236	0.66	602
Level of significance of χ^2	*Pr<.01*		*Not significant*		*Pr<.05*	
Occupation						
Cultivator	*	24	*	13	5.41	37
Agricultural labourer	*	23	2.94	34	3.51	57
Non-agricultural labourer	1.60	125	7.41	27	2.63	152
Business	3.26	522	2.24	223	2.95	745
Salaried employment	2.01	199	3.75	80	2.51	279
Housework	*	4	1.61	622	1.60	626
Student	2.27	132	0.00	95	1.32	227
Other work	*	20	*	1	*	21
Level of significance of χ^2	*Not significant*		*Not significant*		*Not significant*	
Total	2.86	1049	1.92	1094	2.38	2,143

Table 6 HIV prevalence among total respondents (percentage tested HIV positive, according to sex and selected background characteristics), North Karnataka, 2003

Characteristic	Male		Female		Total	
	Per cent	Number	Per cent	Number	Per cent	Number
Rural	3.96	935	3.23	929	3.59	1,864
Urban	2.86	1,049	1.92	1,094	2.38	2,144
Level of significance of χ^2	*Not significant*		*Not significant*		*Pr<.05*	
Taluks						
Bagalkot	1.06	491	1.24	536	1.15	1,027
Mudhol	6.44	470	3.23	427	4.91	897
Jamkhandi	3.03	1,023	2.78	1,061	2.90	2,084
Level of significance of χ^2	*Pr<.01*		*Not significant*		*Pr<.01*	
Village/Town						
Kaladagi	0.68	148	2.09	191	1.47	339
Kirasur	0.00	44	3.03	33	1.30	77
Mudavinkoppa	*	7	*	6	*	13
Mirji	4.00	50	2.08	48	3.06	98
Shirol	9.25	173	2.72	147	6.25	320
Vantigodi	7.69	52	8.70	46	8.16	98
Kumbarhal	1.72	58	0.00	44	0.98	102
Hunnur	4.29	233	2.50	240	3.38	473
Navalagi	1.63	123	3.88	129	2.78	252
Naganur	2.13	47	11.11	45	6.52	92
Bagalkot (urban)	1.37	292	0.65	306	1.00	598
Mudhol (urban)	3.09	97	3.26	92	3.17	189
Jamkhandi (urban)	2.76	181	5.03	199	3.95	380
Rabkavi-Banahatti (urban)	3.48	345	1.08	372	2.23	717
Terdal (urban)	0.00	36	0.00	31	0.00	67
Mahalingpur (urban)	6.12	98	2.13	94	4.17	192
Level of significance of χ^2	*Pr<.01*		*Pr<.01*		*Pr<.01*	
Age						
15-19	1.12	374	1.95	389	1.54	763
20-24	1.77	407	3.11	377	2.41	784
25-29	6.04	313	2.25	362	4.00	675
30-34	4.81	282	2.46	281	3.64	563
35-39	5.97	234	2.13	261	3.94	494
40-44	2.60	199	2.12	185	2.37	385
45-49	1.75	175	3.52	169	2.89	344
Level of significance of χ^2	*Pr<.01*		*Not significant*		*Not significant*	
Marital status						
Currently married	4.25	1,235	2.02	1,519	3.02	2,754
Marriage dissolved	*	24	9.07	202	9.38	226
Never married	1.48	725	0.35	303	1.14	1,028
Level of significance of χ^2	*Pr<.01*		*Pr<.01*		*Pr<.01*	
Literacy and education						
Illiterate	5.63	482	2.92	968	3.82	1450
Primary	3.70	157	4.58	80	3.99	237
Middle	2.23	308	3.30	311	2.77	619
Secondary	4.22	481	1.60	374	3.06	855
Secondary+	1.17	556	0.71	291	1.01	847
Level of significance of χ^2	*Pr<.01*		*Not significant*		*Pr<.01*	

Table 6 HIV prevalence among the total respondents (percentage tested HIV positive, according to sex and selected background characteristics), North Karnataka, 2003 *(Continued)*

Characteristic	Male		Female		Total	
	Per cent	Number	Per cent	Number	Per cent	Number
Occupation						
Cultivator	3.37	364	3.10	255	3.26	619
Agricultural labourer	6.19	144	6.17	223	6.18	367
Non-agricultural labourer	4.16	224	6.26	33	4.44	257
Business	3.45	690	1.95	314	2.98	1,004
Salaried employment	2.53	307	3.59	112	2.82	419
Housework	*	5	1.77	951	1.76	956
Student	1.55	206	0.00	123	0.96	329
Other work	2.51	44	*	13	1.97	57
Level of significance of χ^2	*Not significant*		*Pr<.01*		*Pr<.01*	
Religion						
Hindu	3.87	1,632	2.63	1,638	3.25	3,270
Muslim	0.67	315	1.17	349	0.93	664
Other	2.53	37	7.32	37	4.97	74
Level of significance of χ^2	*Pr<.05*		*Pr<.05*		*Pr<.01*	
Caste						
High-caste Hindu	3.73	708	1.58	703	2.65	1,411
Middle-caste Hindu	3.79	671	2.27	699	3.01	1,370
Low-caste Hindu	4.19	251	7.24	240	5.68	491
Non-Hindu	1.10	354	1.53	382	1.32	736
Level of significance of χ^2	*Not significant*		*Pr<.01*		*Pr<.01*	
Travel due to work						
No	3.33	1,269	2.36	1947	2.74	3,216
Yes	3.32	715	5.00	77	3.49	792
Level of significance of χ^2	*Not significant*		*Not significant*		*Not significant*	
Total	3.33	1,984	2.46	2,024	2.89	4,008

Notes: [1] Either had sex with a non-regular partner in the last 1 year, or ever had sex with more than one partner, or ever paid/received money for sex. *Percentage not shown; based on less than 25 cases. ( ) Based on 25-49 cases
Pr<.01: Pearson χ^2 is significant at .01 level. Pr<.05: Person χ^2 is significant at .05 level

5.2. HIV Prevalence by Sex

However, the male-female differences in prevalence was much higher in urban than in rural areas (male prevalence was 68 per cent higher than the female prevalence in urban areas, compared with only 38 per cent in rural areas). HIV prevalence among males was relatively higher in rural areas (4.0 per cent) in the age group 25-29 (6.0 per cent), among the illiterate (5.6 per cent), and agricultural labourers (6.2 per cent), low-caste Hindus (4.2 per cent), and among those who ever had sex with more than one partner (7.1 per cent). HIV prevalence among females was very similar to that obtained for males. However, prevalence was higher in the age groups 20-24 years (3.1 per cent) and 45-49 age years (3.5 per cent) and among those who were widowed, divorced, separated or deserted (9.1 per cent).

5.3. HIV Prevalence by Taluk

HIV Prevalence was highest in Mudhol Taluk (4.9 per cent), followed by Jamkhandi (2.9 per cent) and Bagalkot (1.2 per cent). Prevalence among both the male and female respondents was highest in Mudhol Taluk (6.4 and 3.2 per cent, respectively). Compared to the other two Taluks, Mudhol Taluk has the highest rural as well as the urban prevalence of HIV (6.0 and 3.7 per cent, respectively). Higher prevalence in Mudhol and Jamakandi taluks is mainly attributed to high number of active traditional sex workers in the area. In the urban areas, HIV prevalence was relatively higher in Mahalingpur (4.2 per cent), Jamkhandi (4 per cent) and Mudhol (3.2 per cent) towns. While none from the small sample from Terdal tested positive, 1 per cent of the respondents in Bagalkot town were HIV positive. Among the urban males, HIV prevalence was highest in Mahalingpur (6.1 per cent). HIV prevalence among the urban females was highest in Jamkhandi town (5.0 per cent).

Age-specific prevalence rates among males were relatively higher in the age groups 25-39 years, with a peak of around 6 per cent in the age group 25-29 years and 35-39 years. The prevalence among females, however, did not vary much across different age groups, although it peaked around 3 per cent in the age groups 20-24 years and 45-49 years. HIV prevalence varied significantly by marital status of the person: it was highest among persons who were widowed, divorced, separated, or deserted (9.4 per cent) and lowest among the never married (1.1 per cent). Persons whose marriage was disrupted had the highest prevalence in both the rural and urban areas (8.4 and 10.3 per cent, respectively). Focus group discussions, in-depth interviews revealed that single women (widowed, divorced/separated/deserted) are at higher risk of exposure to risky sexual behaviour. Most of these women, especially the poor were involved in commercial sex. HIV prevalence was lowest at 1 per cent among those who had studied beyond secondary level, and this was true for among both the males and females. Although the prevalence in this group in urban areas was less than 1 per cent, it was 2 per cent in rural areas. Prevalence was relatively higher among the illiterate (3.8 per cent) and those who had completed only the primary level of education (4 per cent).

HIV prevalence also varies substantially by the occupation of the respondent. Six per cent of agricultural labourers were HIV positive, and this

proportion was 4 per cent among the non-agricultural labourers, around 3 per cent among the cultivators, persons engaged in business, and salaried employment. Prevalence was around 2 per cent among the housewives and around 1 per cent among students. Among both males and females, prevalence was relatively higher among the agricultural (6.2 per cent each among males and females) and non-agricultural labourers (4.2 and 6.3 per cent among males and females, respectively). Agricultural and non-agricultural labourers were particularly vulnerable in rural areas with a prevalence of 6.8 per cent and 7.6 per cent, respectively. In urban areas, however, prevalence seemed to be around 3 per cent in several of the occupation groups (agricultural and non-agricultural labourers, business and salaried employment).

HIV prevalence varied significantly by religion: it was the lowest among Muslims (0.9 per cent) and highest among other non-Hindus, consisting mostly of Jains (5.0 per cent). Hindus had a prevalence of 3.3 per cent. Religious differences in prevalence were significant for both the males and females. The Jains in rural areas seem to be particularly at high risk, with 4 out of 43 respondents (9.3 per cent) testing HIV positive. The higher prevalence among the agricultural and non-agricultural labourers is associated with the higher rate of extramarital relationship, paid or unpaid, in this group.

There were significant caste differentials in HIV prevalence, with low-caste Hindus having the highest prevalence (5.7 per cent), followed by middle-caste (Raddis, Marathas, Devangas, Ganigers) Hindus (3.0 per cent), high-caste (Lingayats and Brahmins) Hindus (2.7 per cent) and non-Hindus (1.3 per cent) (Table 6). While men belonging to different castes did not differ much in terms of HIV prevalence, women belonging to lower castes had a significantly higher prevalence (7.2 per cent) than others. HIV prevalence did not vary much by caste in urban areas. This reiterates that poverty is linked with HIV/AIDS, especially in rural areas, as most of the low caste groups were poor. In rural areas, frequent travel due to work seemed to be associated with a relatively higher HIV prevalence. Five per cent of the rural respondents, who reported that they travel regularly for work, were HIV positive compared with 3 per cent of those who did not travel for work. The association was not significant. Thus, it is evident that most of the poor migrate to neighbouring towns and states in search of jobs and are at high risk of acquiring HIV/AIDS.

6. Conclusions and Recommendations

The quantitative and qualitative data and our field experience showed that seasonal labour migration, the traditional *Devadasi* custom and other local factors linked to poverty facilitate the transmission of HIV/AIDS in the study area. Seasonal out migration and mobility are widespread in the study area and in most parts of north Karnataka districts. This is largely due to the poverty resulting from recurring droughts and erratic rainfall. Under such conditions, even farmers with fertile land are unable to raise crops. The majority of the small farmers and landless labourers face considerable hardships and are forced to migrate over summer months to cities such as Kolhapur, Mumbai, Goa, Ratnagiri and Pune where they work at brick kilns and on construction sites. This increases the chances of exposure to commercial sex and thus to the risk of acquiring HIV/AIDS (Satihal et. al., 2005). The construction of Almatti Dam and the rehabilitation programs resulted in sudden increase in money in the hands of people. This combined with illiteracy led to excessive alcohol consumption and pleasure seeking behaviour including commercial sex.

The *Devadasi* system is widely prevalent in the study area. In the northern part of Karnataka, it is a common custom among the scheduled caste (SC) community to dedicate an unmarried girl to serve the God/Goddess in order to ward off evil effects on the family. These girls are called *Devadasis*. Locally Devadasis are known by several names such as *Basavi, Kasabi, Patradavalu, and Jogati* (Tarachand, 1991). These girls remain unmarried throughout their life and provide sex besides cleaning the temple and lighting the lamp. There is a belief that the custom of *Devadasi* has degenerated over the years and has become an institution to provide prostitution. Driven by poverty, social and psychological insecurity, a few women are also engaged in overt prostitution to earn a living. It is generally alleged that most of the Devadasis end up at commercial brothels in cities and towns. On average there are about 5-10 devadasis in each village with a population of about 2-3 thousand. It is to be noted that this tradition was mostly found among the SC community; however, today sex work is reported among other non-*Devadasi*, upper and lower caste women for various reasons including having alcoholic husbands, widowhood, or abandonment and poverty. More than half of the sex workers in the villages migrate to Solapur, Sangli-Miraj, Karad, Kolhapur, Satara, Mumbai and Pune in Ma-

harastra and to Goa. Usually sex work in the study area is home based. However, field team discussions with sex workers revealed an increase in lodge based sex work, especially during *shandy* (market) days and in urban commercial areas.

Other local situations and socio-cultural beliefs of masculinity and femininity and illiteracy have contributed significantly to unsafe sexual behaviour. The existing stigma, discrimination and denial of services to HIV affected people, and poor knowledge about HIV/AIDS, and illiteracy among the population in the region provides a conducive atmosphere for the rapid spread of the epidemic. With the current prevalence rates (nearly 3 per cent of HIV in the adult population) and deaths due to HIV/AIDS (6 per cent), the HIV/AIDS continues to spread. Hence the HIV epidemic is likely to have serious repercussions for the future mortality, especially among the poor and marginalized community in the absence of adequate preventive (Vaccine), promotional and curative measures in the study area. Experts estimate that HIV/AIDS will soon emerge as a major factor in determining mortality levels in the study area as well as in other parts of India where similar conditions prevail.

HIV prevention programmes need to recognise this and strategically tailor the intervention programmes considering the economic, social, demographic and cultural factors that influence people's behaviour in the study area. The data also suggest that certain community level or village level factors have an effect on HIV prevalence independent of individual level factors. The key challenges for the future include reducing poverty, illiteracy, addressing cultural beliefs, and improving the health infrastructure and health services. There is also a need to create awareness about HIV/AIDS to change people's attitude towards HIV/AIDS and to minimise existing stigma and discrimination and further spread of the disease.

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Part IV

NEIGHBOURHOOD AND REGIONAL CONTEXTS

11

Mapping Child Mortality Inequalities in Sub-Saharan Africa: Contextual Influences of Prenatal Environment

Ngianga-Bakwin KANDALA

1. Introduction

Poor environment or a polluted neighbourhood might exacerbate the problems of poor health and the consequent pressure of childhood diseases, predisposing children in those areas to high mortality risks. Understanding the link between child survival, health, geographic location, and poverty is crucial for developing countries. This paper contributes to this by using the Demographic and Health Surveys (DHS) household survey data to analyse the impact of poverty and poor location on childhood mortality in sub-Saharan Africa.

Malawi, Nigeria, Tanzania and Zambia are among the Sub-Saharan African countries most affected by child mortality. The under-five child mortality rates of 183 per 1000 live births for Malawi, 183 for Nigeria, 165 for Tanzania, 202 per 1000 live births for Zambia are among the highest in the world (World Bank, 2003). The large area covered by these countries together with geographic, socioeconomic and ethnic differences lead one to expect substantial spatial variation in childhood mortality risk. One contributory cause is a country's poverty level or poor environment, which is concentrated in rural areas or slums in big cities. Poverty or poor environment might exacerbate the problems of poor health and prevalence of childhood diseases, hence high mortality risks. These effects are clearly not just an aggregation of individual characteristics. There are also location effects. Quantifying the location effects on child survival is important to our

understanding of the processes that generate health or mortality inequality. Many DHS surveys in Sub-Saharan Africa include questions on child mortality and poverty status; they provide a unique opportunity to explore the interrelationship.

Poverty status is measured in the DHS surveys in terms of assets or wealth, rather than income or consumption. Ownership of consumer items such as a radio or car, as well as characteristics of the dwelling such as floor or roof type, toilet facilities and water source are items that measure the concept of poverty in these setting and this concept has been used by the World Bank to allocate households and thus their members into poverty quintiles, using Principal Components Analysis (PCA) (Filmer and Pritchett, 2001).

Because relatively little is known about such links, the question of quantifying the location and poverty effects on child survival is the most important research question in this Chapter. Knowledge about how location or poor environment affects childhood survival is not just of academic interest; it has important public-health implications. By identifying groups or settings in which mortality risk is high, preventive actions can be made more effective. As Malawi, Nigeria, Tanzania and Zambia attempt to meet the Millennium Development Goals (MDGs), including those for child survival, the main causes of inequality in overall child mortality and within countries need to be addressed. Poor prenatal conditions, poor access to health care, and infections (HIV/AIDS) account for 8 per cent of all under-five deaths in the region (Global Health Council, 2006).

In this chapter, we use household data first to map the district-level variations of childhood mortality in Malawi, Nigeria, Tanzania and Zambia, four sub-Saharan African countries using the recent DHS. We then use geo-additive models to explain differences across the districts in childhood mortality using the household socioeconomic characteristics that are observed in our data, while allowing for country-specific factors. This modelling technique allows us to see the degree to which the spatial variation in the raw data is reduced – or increased – when we take into account the differences in observed household poverty levels and characteristics that are associated with childhood mortality. Examples of issues we raise are: to what extent do household socioeconomic status (poverty level), education, household sanitation, and rural/urban residence explain variation in child

mortality? Is there unexplained variation in the rate of childhood mortality? Does the spatial pattern of childhood mortality correlate with poverty status? Do household and neighbourhood living standards and the overall district or state poverty level influence child mortality risk? Do the typical numbers of households per cluster seen in the DHS data give some support for the hypothesis of spatial concentration of poverty and mortality in these countries?

2. Data and Methods

The data are from the recent Demographic and Health Surveys from Malawi (DHS, 2000), Nigeria (DHS, 2003), Tanzania (DHS, 2004) and Zambia (DHS, 2002). We use appropriate statistical techniques to explain differences in the risk of child mortality at district level in these countries. We did this by using the household socioeconomic characteristics observed in our data, and consider non-linear effects of some covariates. Time to the occurrence of child's death may differ by age group. Thus, it is desirable to investigate separately the risk of death of a child in the first month (possibly due to genetic factors) and in the remaining months (possibly linked to poor environment or poverty). We will use flexible methods to quantify the effect of area level poverty on mortality and to allocate these spatial effects to structured and unstructured (random) components. This will draw on Bayesian geo-additive methods of spatial statistics, taking advantage of advances in Geographic Information Systems (Fahrmeir and Lang, 2001; Kandala *et al.*, 2006; Kandala and Ghilagabar, 2006). The modelling of the structured and unstructured components is done jointly in one estimation procedure that thereby simultaneously identifies socioeconomic determinants, and the spatial effects that are not explained by these socioeconomic determinants. In this way, we are able to identify regional or district patterns of mortality that are either related to omitted socioeconomic variables that have a clear spatial pattern or point to districts poverty level or even epidemiological or environmental factors.

3. Model Selection: Geo-Additive Discrete-Time Survival Model

An essential task in the model building process is the comparison of a set of plausible models, for example rating the impact of covariates and assessing if their effects are time-varying or not, or comparing geo-additive models with simpler parametric alternatives. We adopt the measure of

complexity and fit suggested by Spiegelhalter *et al.* (2002) for comparison and select the model that takes all relevant structures into account while remaining parsimonious.

In this analysis, we apply a novel approach by exploring regional patterns of childhood mortality and possible non-linear or time varying effects of other factors within a simultaneous, coherent regression framework using a geo-additive discrete-time survival model. The model used for this investigation has been described elsewhere (Fahrmeir and Lang, 2001; Fahrmeir, Kneib, and Lang, 2004; Kandala, 2002; Kandala and Ghilagabar, 2006).

In social sciences research it is worth mentioning some potential advantages of this method over more conventional approaches using, say, discrete-time Cox models with time-varying covariates and fixed (or random) districts effects or standard 2-level multilevel modelling with unstructured spatial effects. In the conventional models, it is assumed that the random components at the contextual level (district in our case) are mutually independent. In practice, these approaches specify correlated random residual (see, for instance, Langford *et al.*, 1999) which is contrary to the assumption. Further, the independence assumption has an inherent problem of inconsistency. If the location of the event matters, it makes sense to assume that areas close to each other are more similar than areas that are far apart. Moreover, treating groups (in our case districts) as independent is unrealistic and leads to poor estimates of the standard errors. Standard errors for between-district factors are likely to be underestimated because we are treating observations from the same districts as independent, thus increasing the apparent sample size; standard errors for within district factors are likely to be overestimated. On the other hand, DHS data are based on a random sample of districts which, in turn, introduces a structured component. Such a component allows us to obtain estimates for areas that may have inadequate sample sizes or are not represented in the sample.

In an attempt to highlight the advantages of our approach in a spatial context and to examine the potential bias incurred when ignoring the dependence between aggregated spatial areas, we will fit several models with and without the structured and random components in our illustration below.

4. Data Set and Choice of Variables

We use the recent DHS data sets from Malawi (MDHS 2000), Nigeria (NDHS 2003), Tanzania (TDHS 2004) and Zambia (ZDHS 2001-2). For details on the data collection, sampling procedure and summary report, see [www.measuredhs.com]. Each record represents a child born within 5 years before the interview date and consists of survival information and a list of covariates. Individual data records were available for 10367 children in Malawi, 6026 children in Nigeria, 8564 children in Tanzania and 6877 children in Zambia who survived their first month of life. Of these, 1559 children in Malawi, 843 in Nigeria, 712 in Tanzania, and 880 in Zambia had died before their fifth birthday.

Our response variable is defined as

$$y_{it} = \begin{cases} 1: & \text{if child } i \text{ dies in month } t \\ 0: & \text{if child } i \text{ survives beyond time } t \end{cases}$$

On the basis of previous work, we have selected the following array of theoretically relevant variables as covariates of childhood mortality:

- mother's age at birth of the child (in years);
- duration of breastfeeding, time-dependent;
- district in Malawi, Nigeria (states), Tanzania (regions), Zambia (regions): spatial covariate; and
- a vector of categorical covariates including:
- child's gender (male versus female);
- asset index (second, third and fourth quartiles of household income versus first quartile);
- residence (urban versus rural);
- mother's and partner educational attainment (up to primary versus secondary and higher versus no education);
- place of delivery (hospital versus other (reference);
- preceding birth interval (long birth interval, > 24 months versus short interval, ≤ 24 months);
- antenatal visit during pregnancy (at least one visit versus none);

- marital status of mother (single versus married); and
- household's size (medium, large versus small size).

The last levels of each covariate were selected as baseline (reference) levels. Most of these are variables that have been found to be associated with childhood mortality in developing countries (Millard, 1994; Brockerhoff, 1993; Madise and Diamond, 1995; Kandala, 2002; Cleland and Sathar, 1984; Adebayo and Fahrmeir, 2005; Kandala and Ghilagabar, 2006; Sastry, 1997). Unfortunately, the surveys do not generate an income variable and we therefore rely on household assets as a proxy for the income of the households, which has been found to be quite reliable by Filmer and Pritchett (2001).

Preliminary results of the DHS data sets in these four countries indicate geographic variation in under-five mortality rates. In Malawi, for instance, in addition to the DHS report (National Statistical Office (Malawi) and ORC Macro, 2001), Census results also indicate geographic variation in the rates of infant and under-five mortality with highest mortality rates in the Southern region followed by the Central region and the lowest in the Northern region. The present study's main aim is to shed light on such regional and district variations and advance our knowledge of district-level socioeconomic and demographic determinants of under-five mortality in the four countries. We have, therefore, included an indicator of household poverty (asset index) and geographic location (as a proxy for district infrastructure or environment) among our covariates.

5. Statistical Method

To study the probability of a child dying in month *t*., we compared a simpler parametric probit model and a probit model with spatial and dynamic effects:

$$pr\left(y_{it} = 1 \mid x_{it}^{*}\right) = \phi\left(\eta_{it}\right)$$

In other words, we model the conditional probability of a child dying, given the child's age in months, the district where the child lived before she or he died, and a number of covariates, with the following predictors:

M1: $\eta_i = f_0(t) + X'_{it}\,\gamma$.

M2: $\eta_i = f_0(t) + f_1(x_{i1}) \ldots + f(t)X_{it} + f_{str}(s_i) + X'_{it}\,\gamma$.

The fixed effects in model M1 include all covariates described above with constant fixed effects. Thus, all continuous covariates such as mother's age at birth were categorized, and duration of breastfeeding was included as dichotomous (0, 1) variable in M1.

The effects of $f_0(t)$, f_1 and $f(t)$ are estimated using P-spline prior and we investigated the sensitivity to the choice of different priors for the non-linear effects (second-order random walk prior) and the choice of the hyper-parameter values a and b. Markov random field priors were used for $f_{str}(s)$ and $f_{unstr}(s_i)$ were not incorporated in final models because of the absence of local variability and small number of neighbouring districts. The analysis was carried out using BayesX-version 0.9 (Brezger, Kneib, and Lang, 2005), a software for Bayesian inference based on Markov Chain Monte Carlo simulation techniques.

We introduced a time-varying effect for duration of breastfeeding as it carries survival information of the corresponding child as it can never exceed its survival time. Instead of using duration of breastfeeding in months, we generated a binary covariate process, which is equal to one during the months the child was breastfed and zero otherwise. For instance, for a child that survived only ten months and was breastfed in all ten months, the duration of breastfeeding is equal to ten while the corresponding covariate process is equal to one for each of these ten months and undefined thereafter. If, on the other hand, the child survived more than ten months but was not breastfed after ten months for some other reasons like illness of the mother, then duration of breastfeeding is still equal to ten, but the covariate process is equal to one for each of the first ten months and equal to zero thereafter until end of the observation. Temporal and spatial variations in the determinants of child mortality are also assessed.

Common choices for binary response models are grouped Cox model and probit or logit models. We preferred a probit model because in this case the binary response model in Equation [3] can be written equivalently in terms of latent Gaussian utilities which lead to very efficient estimation algorithms. Further, because survival time in the DHS data set is recorded in months and the longest observation time for this study is limited to 60 months, the data naturally contain a high amount of tied events. Thus, a probit model for discrete survival data is a reasonable choice. A constant hazard within each month is assumed.

At the exploratory stage, we fitted a probit model with constant covariate effects (M1) for the effects of breastfeeding and mother's age with a view to compare them with the dynamic probit models (M2). Model M2 was superior to model M1 (result not shown here) not only in terms of the DIC but because it also accounts for the unobserved heterogeneity that might exist in the data, all of which cannot be captured by the covariates. Therefore, we reported only results of model M2.

While all four countries do relatively poorly on the reported socioeconomic indicators, there are significant differences between the countries as well. In particular, households in Nigeria and Zambia appear to be better off in terms of access to electricity, radio, and in female educational attainment, showing that income and education levels were higher in Nigeria and Zambia. These two countries are also more heavily urbanised than the other two. Malawi and Tanzania are more similar, with Malawi doing somewhat worse on access to electricity. Malawi also has worse educational attainment at the lower levels but slightly higher among the highest levels, than Tanzania. We carefully checked if missing data, especially for important covariates such as preceding birth interval and education, were correlated with poorer districts but we found no evidence of such a correlation.

6. Results

The estimates of fixed effects of the covariates in model M2 are given in Table 1, and the nonlinear effects of baseline time hazard, mother's age, and time-varying effect of breastfeeding are also shown in Figure 1 to Figure 3. The residual spatial effects of districts or regions are shown in the maps of Figure 4.

The fixed effects are mostly as expected. For all four countries, they indicate that survival chance is associated with the economic wealth of the household. Children from poor families (first quintile) have a higher risk compared to those from rich families (third and fourth quintiles).

Compared to the first quintile (poorest of the poor), children in household in the third quintile are at a lower risk of under-five mortality in Malawi and Zambia. This is indicated by the fact that the corresponding posterior mean of the third quintile for Malawi, -0.134, is negative and the 2.5 percent and 97.5 percent quintiles are both negative, indicating that the effect is

statistically significant. We also observed the same tendency of third and four quintiles to be associated with lower under-five mortality risk in Nigeria and Tanzania but the effect did not reach statistical significance – this being indicated by the opposite signs of the posterior quintiles. This asset index variable captures the role of economic wealth of the household and communication infrastructure. For example, ownership of a radio facilitates acquisition of child care or nutritional information allowing a more effective allocation of resources to produce child health care.

Other factors associated with lower under-five mortality risk in Malawi were the antenatal visits during pregnancy, the long preceding birth interval (greater than 25 months) and living in a household with many siblings. In Nigeria, the results show that the mother's partner's education rather than mother's own education is associated with lower under-five mortality. Other factors that are significantly associated with lower under-five mortality in Nigeria are living in urban area, antenatal visits during pregnancy and living in large households. In Nigeria, children living in urban areas seem to be at lower risk of under-five mortality compared to their counterparts in rural areas. The effect of urban areas in all four countries may be captured by the district effect since the boundaries of the maps do not show urban and rural areas.

The results also show that children of single mothers are at a higher risk of dying than those of married mothers in Tanzania. It appears that in all four countries, children of mothers seeking antenatal care are at lower risk of dying than their counterparts (the effect in Tanzania is in the expected direction but it did not reach the level of statistical significance). We suspect that this is due to selection in the propensity to make use of health inputs, and a more appropriate modelling may be needed before we can draw valid conclusion. The results also show that a short birth interval significantly reduces a child's chance of survival in all four countries.

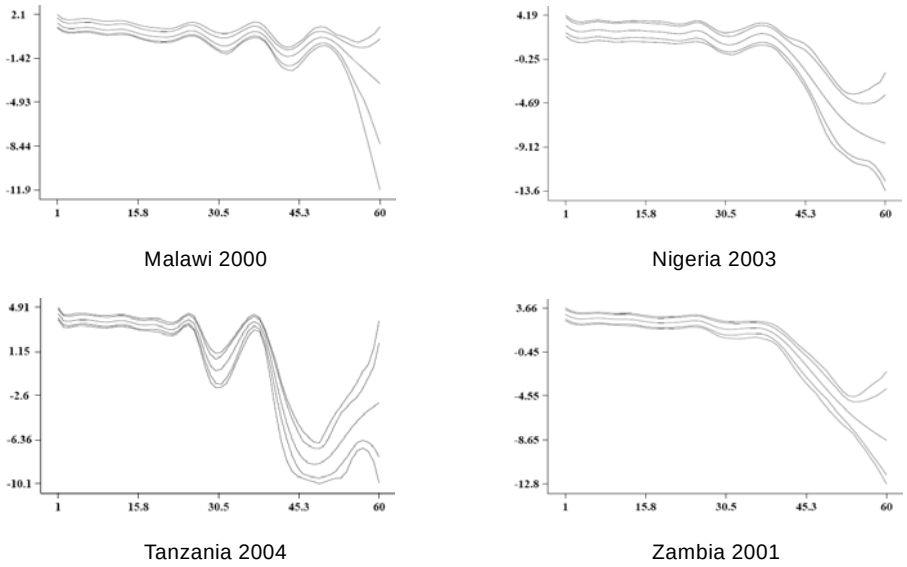
Table 1 a Estimated posterior means fixed effects for Malawi and Nigeria

	Malawi				Nigeria			
Variable	Mean	Std. Error	2.5% quintile	97.5% quintile	Mean	Std. Error	2.5% quintile	97.5% quintile
Constant	-2.751	0.295	-3.452	-2.270	-4.977	0.606	-5.982	-3.910
Mother's education (Ref: No education)								
Having education	0.053	0.044	-0.037	0.135	0.138	0.066	0.018	0.275
Partner's education (Ref: No education)								
Having education	0.026	0.051	-0.076	0.123	-0.147	0.063	-0.266	-0.016
Place of residence (Ref: Rural)								
Urban	-0.108	0.065	-0.248	0.014	-0.193	0.063	-0.320	-0.066
Sex of Child (Ref: Female)								
Male	0.002	0.035	-0.070	0.074	0.029	0.048	-0.063	0.128
Antenatal visit (Ref: No visit)								
Some visits	-0.284	0.086	-0.451	-0.109	-0.180	0.066	-0.314	-0.056
Asset Index (Ref: 1st quintile)								
2nd quintile	0.024	0.055	-0.081	0.138	-0.091	0.078	-0.252	0.050
3rd quintile	-0.134	0.051	-0.235	-0.035	-0.003	0.069	-0.137	0.130
4th quintile	-0.123	0.061	-0.243	0.003	-0.087	0.079	-0.241	0.070
Preceding birth interval (Ref: <25 months)								
25+ months	-0.132	0.042	-0.216	-0.050	-0.081	0.054	-0.183	0.031
Marital status (Ref: Married)								
Single	-0.030	0.054	-0.137	0.074	0.144	0.119	-0.086	0.368
Place of delivery (Ref: Home and others)								
Hospital	0.029	0.041	-0.056	0.104	0.015	0.075	-0.129	0.165
Household size (Ref: Small size)								
Medium size	-0.290	0.045	-0.382	-0.205	0.191	0.075	0.066	0.350
Large size	-0.318	0.055	-0.432	-0.212	0.247	0.079	0.121	0.423

Table 1 b Estimated posterior means fixed effects for Tanzania and Zambia

	Tanzania				Zambia			
Variable	Mean	Std. Error	2.5% quintile	97.5% quintile	Mean	Std. Error	2.5% quintile	97.5% quintile
Constant	-6.336	0.323	-6.903	-5.657	-4.666	0.361	-5.295	-3.997
Mother's education (Ref: No education)								
Having education	-0.103	0.061	-0.230	0.008	-0.016	0.066	-0.139	0.108
Partner's education (Ref: No education)								
Having education	-0.024	0.064	-0.141	0.103	0.158	0.087	-0.002	0.334
Place of residence (Ref: Rural)								
Urban	-0.051	0.069	-0.192	0.077	0.094	0.062	-0.030	0.212
Sex of Child (Ref: Female)								
Male	0.082	0.052	-0.017	0.186	0.060	0.051	-0.036	0.162
Antenatal visit (Ref: No visit)								
Some visits	-0.024	0.157	-0.307	0.308	-0.326	0.088	-0.479	-0.145
Asset Index (Ref: 1st quintile)								
2nd quintile	0.003	0.070	-0.136	0.139	-0.048	0.062	-0.168	0.081
3rd quintile	0.033	0.066	-0.105	0.165	-0.142	0.071	-0.289	-0.004
4th quintile	-0.088	0.074	-0.226	0.057	-0.201	0.066	-0.335	-0.078
Preceding birth interval (Ref: <25 months)								
25+ months	-0.084	0.064	-0.200	0.049	-0.205	0.054	-0.304	-0.092
Marital status (Ref: Married)								
Single	0.163	0.076	0.010	0.301	0.219	0.057	0.110	0.330
Place of delivery (Ref: Home and others)								
Hospital	0.074	0.053	-0.023	0.179	-0.068	0.058	-0.182	0.044
Household size (Ref: Small size)								
Medium size	-0.111	0.070	-0.240	0.029	-0.052	0.076	-0.220	0.092
Large size	-0.089	0.084	-0.255	0.076	-0.041	0.080	-0.229	0.098

Figure 1 Estimated Nonparametric Effect of Baseline Time (child's age): Shown are the Posterior Means within 80 percent and 95 percent Confidence Interval for Malawi (DHS 2000), Nigeria (DHS2003), Tanzania (DHS 2004) and Zambia (DHS 2001).

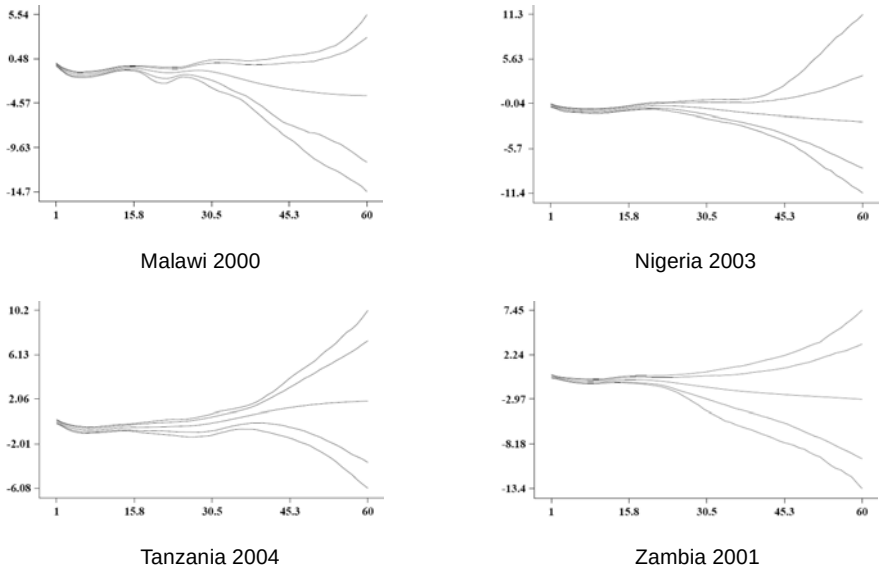


Baseline effects

The estimated baseline effects were almost similar in all four countries although the effect in each country starts at a different level. The most pronounced effects of the baseline time effects on child survival occur during the first month of life (Figure 1), although the excess risk persists throughout the first 12 months.

Figure 1 also shows that the baseline effects peak at months 24, 36, and 48 in Malawi, Tanzania and Nigeria but it is not apparent in Zambia. These observed peaks are caused by the large number of deaths reported at these time points. It is, therefore, plausible to suspect that this is a "heaping" effect due to incorrect reporting of large numbers of deaths at these ages, which would appear to reflect digit preference in reporting deaths at 2, 3 and 4 years. The nonlinear approach used for the baseline effect has been able to pick the effect of poor quality of the mortality data which would have gone unnoticed if modelled parametrically.

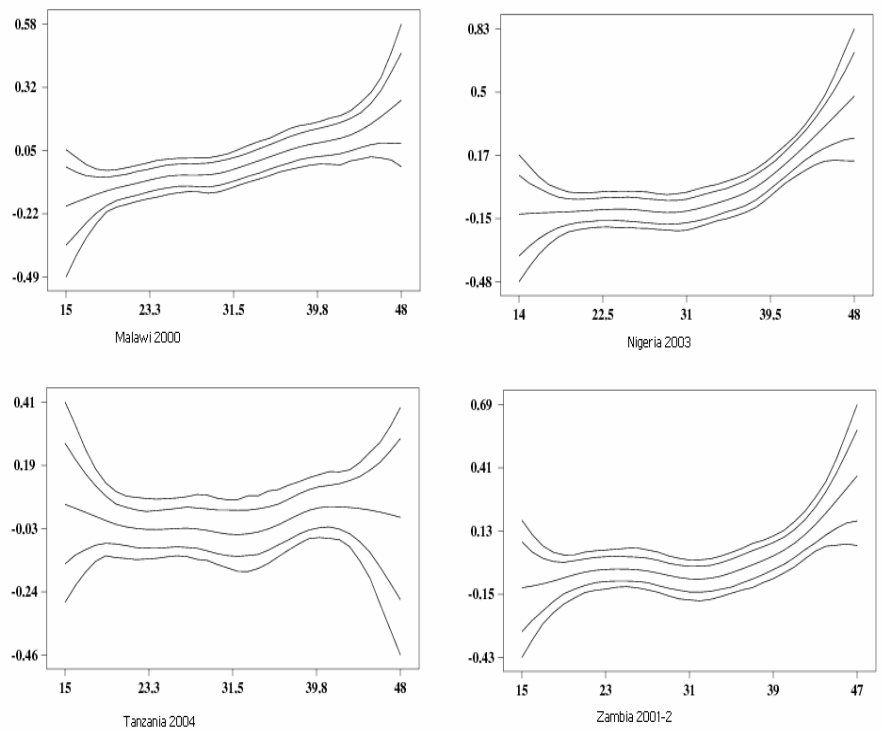
Figure 2 Estimated Nonlinear of Time-varying Effect of Breastfeeding in Malawi (DHS 2000), Nigeria (DHS2003), Tanzania (DHS 2004) and Zambia (DHS 2001).



Time-varying effects

It is evident from Figure 2 that breastfeeding in all four countries only reduces mortality risk in the early months of life. Breast-feeding is associated with lower risk of mortality in the first 7-8 months using 95 per cent confidence interval. At the mean value this could be the first 10 months and months 42-60 but given the wide range of the 95 per cent confidence interval at the end of observation period (mainly, due to fewer number of cases), the results for 42-60 months should be interpreted with caution. Breastfeeding in old age in these settings is an indication of lack of alternative food to keep the child strong and healthy. However, for reasons due to illness of the mother and lack of milk, exclusive breastfeeding is only practiced in the first few months after birth though exclusive breastfeeding is recommended for the first six months of life by WHO [WHO, 1998].

Figure 3 Estimated Nonlinear Effect of Mother's Age at Child's Birth in Malawi (DHS 2000), Nigeria (DHS2003), Tanzania (DHS 2004) and Zambia (DHS 2001).



As shown in Figure 3, the survival chance of children is associated with the mother's age at birth of the child. There is an increased risk of under-five mortality for older mothers (more than 35 years) compared to their counterparts. For all four countries, Figure 3 also shows that mortality risk to children of mothers aged 35-40 is lower than those of mothers aged 40-45. In Tanzania, children of younger mothers (younger than 20 years old) experienced a higher under-five mortality risk.

Spatial effects

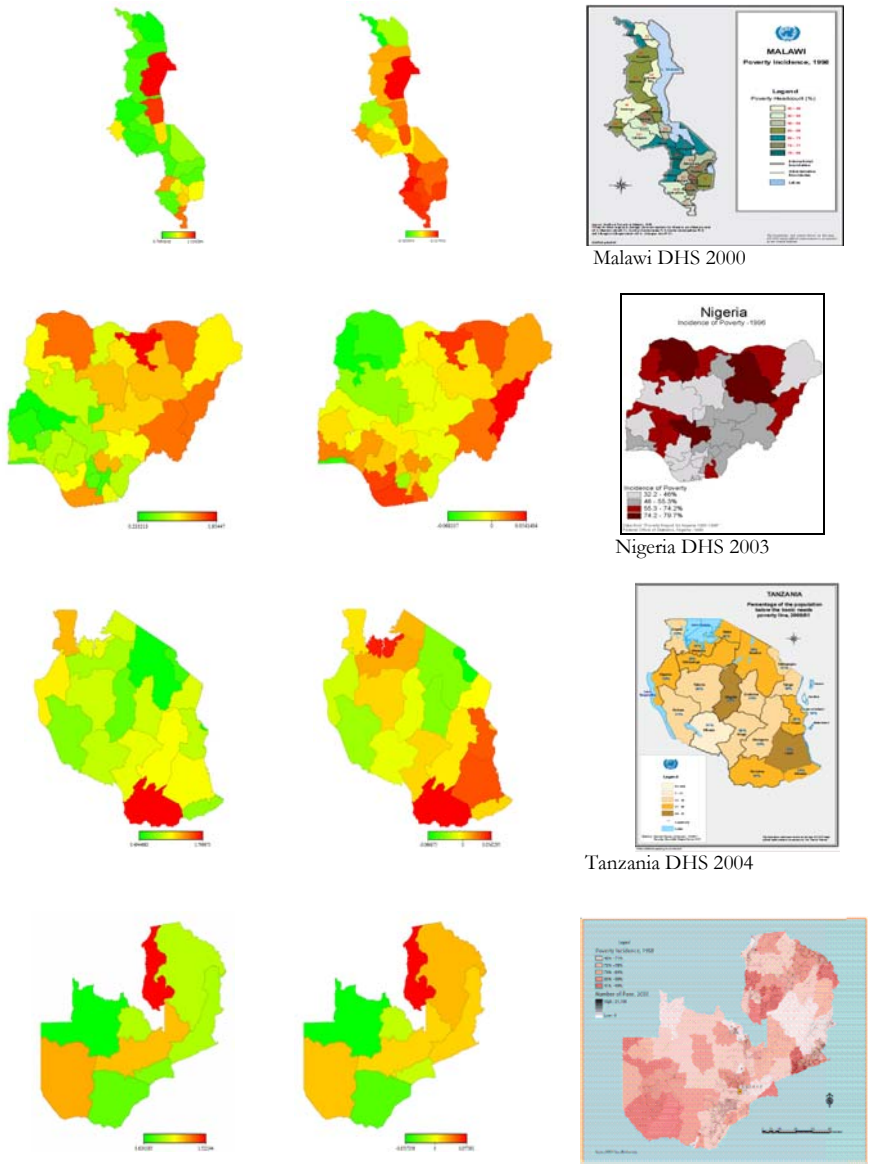
Posterior means of the estimated residual spatial effects for all four countries are shown in Figure 4 (middle of the graphs). The left and right panels show respectively the crude mortality rates and the poverty maps generated by the World Bank (1995, 2000). By showing the maps side by side, we hope to compare the unexplained residual spatial effect obtained

after controlling for household resources, mother's characteristics and individual child's attributes with the crude under-five mortality rates. Finally, we should be able to determine whether the remaining unexplained residual spatial effects are correlated with the poverty maps in order for us to see whether the unexplained residual spatial effects can be attributable to poverty or unmeasured covariates or even due to environmental, cultural or epidemiological factors.

All maps show a strong spatial pattern. We report here for all four countries only the structured spatial effects $f_{str}(s)$ with black *colour* showing districts with high under-five mortality and shades of grey colour showing districts with lower under-five mortality. After controlling for covariates, the residual spatial effects for all countries show a clear and strong spatial structure and the covariates explain part of the spatial structure though, the unexplained residual spatial effects still remain large.

We discuss now the residual spatial effect shown in Figure 4 (middle) for each country in more detail. In Malawi, the structured spatial effects (Figure 4 middle) suggest that chances of survival are better in the north (Chitipa and Karonga) and some districts in the centre (Kasungu and Ntchisi) compared to the south. Districts with higher under-five mortality are Nkata-Bay in the north-east and most of the districts in the south of the country. What emerges from the structured spatial effects is that the major urban centres are associated with a higher risk of childhood mortality compared to other areas, probably because these big urban areas are surrounded by high risk districts and the rise of the phenomenon of slum settlement in urban areas despite the tendency of urban areas to enjoy better access to health services than rural areas (UNICEF, 1993). This is the case for the second largest city Blantyre in the south. Nsanje district has the highest under-five mortality risk. A comparison between the crude under-five mortality rates (Figure 4 left) and the estimated residual spatial effect (in the middle of Figure 4) indicated that, after controlling for fixed effects and other factors, a clear spatial pattern of under-five mortality risk has emerged with the residual effects.

Figure 4 Crude Under-five Mortality Rates (left), Estimated Posterior Mean Residual Spatial Districts Effects (middle) and Poverty Rate (right) in Malawi, Nigeria, Tanzania and Zambia.



Malawi DHS 2000

Nigeria DHS 2003

Tanzania DHS 2004

Zambia DHS 2001

Black coloured – high risk,
Shades of grey coloured – low risk

In Nigeria, the unexplained residual spatial effects reveal that significant high under-five mortality rates are associated with Akwa-Ibom (in the south-east), Ekiti (in the south-west), Rivers and Bayelsa districts (in the south-south), Adamawa (in the north-west) and Yobe (in the north) districts of Nigeria. On the other hand, Zamfara, Sokoto, Imo and Lagos districts are associated with significantly low under-five mortality rates. The results are insignificant in other districts, among them the Federal capital Territory-Abuja.

These variations can partly be attributed to environment risks, which in turn influence exposure to disease. For instance, high under-five mortality rates in the south-eastern state, where the country generates its major income from petroleum, are associated with incessant oil spillage which has become an annual event in that part of the country (Adebayo and Fahrmeir, 2005). Pollution in these areas has greatly hampered the effort of local communities to farm. Also, in this environment, water-born diseases are inevitable. Together with air pollution this often results in the outbreak of diseases such as diarrhoea, fever, cholera, respiratory illnesses, and food insecurity.

A very likely cause of high mortality rates in the north-eastern and north-western regions is incessant communal, ethnic and religious clashes (Adamawa and Bauchi) (Adebayo and Fahrmeir, 2005). Other causes of high mortality rates in these districts can be associated with malaria and malnutrition. Further reasons for spatial variation of mortality risk which are not covered by health factors and cannot be attributed to the physical environment, might be caused by socioeconomic factors not included as explanatory variables in the current models. The higher poverty level found in the north-east (Adamawa) is correlated with high under-five mortality found the north-east districts. This observation is also true for the Akwa-Ibo district.

In Tanzania, what emerges from the residual spatial effect (middle of Figure 4) is that under-five mortality is highest in the Mwanza and Ruvuma districts compared to the rest of the country. On the other hand, under-five mortality rates are lower in the north-east districts (Arusha, Dodoma and Kilimanjaro) and the eastern districts (Kigoma). Other districts, among them the capital Dar es Salam, have insignificant results. Given that the southern districts all are at a significantly lower elevation than the rest of the

country, it is likely that climatic and associated disease factors (e.g. malaria) are responsible for this pronounced regional pattern. Residual spatial effects have been attenuated but not removed after controlling for covariates and a clear spatial pattern has emerged with the south and north districts having higher under-five mortality rates and the west and east districts having lower under-five mortality rates. The highest under-five mortality rates found in Mwanza and Ruvuma are correlated with high poverty rates in the two districts (poverty rates of 41 per cent for Ruvuma and 43 per cent for Mwanza). We noticed that the residual spatial effect show the poverty-mortality link (general poverty level) in Tanzania more than the asset index generated from the TDHS (household poverty level).

In Zambia, the residual spatial effects (middle of Figure 4) show that the highest under-five mortality rates are found in the Luapula district. North-western and southern districts are among those with lower under-five mortality rates in the country. Compared with the crude under-mortality rates (Figure 4 left panel), the residual spatial effect show a north-south divide with lower under-five mortality in the south and higher under-five mortality rates in the north. There is an obvious correlation between a district's poverty level and the observed crude and residual under-five mortality rates. In terms of income poverty, the World Bank found poverty to be lowest in the Central parts of the country. In addition, poverty was also much lower along the main trunk road and railroad lines even outside the central part of the country. In terms of deprivation (based on a mean score of various service items), the World Bank also found the Luapula province among the worst off; it also surprisingly included the Central province and the North-western Province among the worst-off regions. While we also find the Luapula province to be among the highest under-five mortality rates in the country, our analysis shows a clearer geographic pattern with the Northern provinces being associated with high under-five mortality risk and the North-western and Southern province being associated with lower risk.

7. Discussion

After controlling for the spatial dependence in the data, the determinants in the fixed part of the model show the importance on child survival of the following: mother's age and paternal education; household economic

status; residence; the length of the preceding birth interval; the antenatal attendance; household size; and marital status of mother. The findings are generally as expected and are consistent with the literature.

Children of highly educated "rich" father living in urban areas in large households are at lower risk of dying than other children (Cleland and Sathar, 1984; Kandala et al, 2006, Kandala and Ghilagaber, 2006, Adeboya and Fahrmeir, 2005). Children born after a short interval (less than 25 months) are at higher risk of dying than other children. The adverse effects of short birth intervals are well documented and generally point to elevated mortality risks for children born after intervals of less than 25 months. Maternal depletion is one of the pathways through which short preceding birth intervals affect child survival. These findings point to the potential for childhood mortality reduction that could result from successful efforts to improve and maintain adequate birth spacing in Malawi, Nigeria, Tanzania and Zambia.

An interesting finding from this study is the fact that, children living with both parents in Tanzania are at lower risk of dying than other children. Children living with the two parents may benefit from extra care from both. Alternatively couples may benefit from economies of scales for child care as well as in expenditures. The results also show higher rural mortality. Rural areas in Sub-Saharan African are under-developed and have fewer public services per capita and higher levels of poverty compared with urban areas. As a result, living in rural areas provides no access to better nutrition and health care and increases the risk of death. We have established in this analysis that mortality is sensitive to low economic status and low levels of parental education especially during the early months of life. Similarly, in a study of variations in African mortality, Desai and Alva (1998) cite much lower levels of female education in each country. Studies using WFS and DHS data have shown that about half of the education-mortality association is accounted for by the economic condition of the household.

In this analysis, we find that household size is associated with child survival. In larger households, mortality is significantly lower in Malawi, Tanzania and Zambia but not in Nigeria. Given that the household size in the survey includes family member and relatives, this effect of lower mortality risk may be a reflection of rich households attracting additional mem-

bers. Also, there may be the inter-temporal selection effect that small households may be small due to past mortality.

The higher risk associated with older and younger maternal age is very pronounced. Mother's age at birth has important health and social implications. The relationship varies across socio-cultural settings depending on levels and age patterns of fertility. Part of the negative association of mortality risk of children between a younger and older mother's age at birth and child survival may be attributed to the tendency for young and older mothers to be socially and economically disadvantaged (World Bank, 1995) and the fact that younger mothers do not often use obstetric and antenatal services as much as older mothers (Kandala *et al.*, 2006).

The time-varying effects of breastfeeding points to the importance of breast milk for the child after birth, as recommended by World Health Organization (WHO), that a child should receive breast milk exclusively after birth until 6 months of age (WHO, 1998). However for several reasons (for example illness, AIDS/HIV or death of the mother), many children are given foods other than breast milk. Breastfeeding in early infancy (before 12 months) protects the young child from infection, provides an ideal source of nutrients, and is a cost-effective and safe form of feeding. It fosters mother-to-child bonding, and lowers the risks of early childhood death. From a policy point of view, breastfeeding prevents subsequent closely spaced pregnancy (WHO, 1998). The large confidence intervals observed in the graphs are due to few numbers of deaths occurring in the end of observation period. Results at the end of the observation period do not provide any reliable information on the dynamic effects of breastfeeding and should therefore, be interpreted cautiously.

This study has shown sizeable district-specific geographical variations in the level of under-five mortality in all four countries which need to be investigated in further work. Over and above the impact of household poverty level and other fixed effects, there appear to be unexplained residual spatial effects in all four countries that have a strong spatial structure. It is likely that climatic factors and associated diseases are responsible for this pronounced district pattern. Food insecurity associated with drought and flooding in Malawi and Nigeria, which is a result of hazardous effect of climate variation are among possible explanation for these negative effects. Population density which can affect child's physical environment and

susceptibility to infection may be another risk factor. We have also established that the patterns of these residual spatial effects are correlated with poverty and deprivation in each country (World Bank, 1995, 2000).

While some of these effects have been identified in univariate analysis, this study has shown that these subtle influences remain in a multivariate context, controlling for a range of fixed effects and using a flexible approach to modelling these influences. This study has shown that a simple standard 2-level model with unstructured spatial effects (which assumes independence of districts sampled) is unrealistic and leads to an insignificant area effect. The spatial effects have no causal impact but careful interpretation can identify latent and unobserved factors which directly influence mortality rates. This geo-additive discrete-time survival approach thus appears to be able to discern subtle influences on under-five mortality and identifies district-level clustering of under-five mortality in four Sub-Saharan African countries. It could also be of value for a flexible modelling of other determinants of survival in developing countries, a subject to be addressed in our future work.

A limitation of this study relates to the measurement of poverty using the DHS data. Many of the household wealth indices use assets that are more likely to be found in urban areas than in rural areas. Thus, most of the rural households will be in the lowest wealth category even if they have other indicators of wealth (e.g. livestock or farm machinery). The consequence of this misclassification would be to lower the mortality risks of rural households. Another limitation with household wealth indices derived from DHS is that they are based on current status data so that they might not capture the true level of household wealth during the infancy of children born several years before the survey. However, since these analyses are restricted to births within five years of the survey, this bias will not be substantial.

The clustering of under-five mortality within countries could be an indication of the extent of regional differences in health provision. For this purpose, maps of crude mortality rates and posterior mean estimates of residual spatial effects were computed (Figure 4 left panel). The crude estimates without controlling for covariates show large regional differences. This may be due to regional or district level differences in the provision of educational opportunities. Economic opportunities offered by urban areas

may be a major factor for the urban-rural differences. Exposure to infectious diseases in one region may also exhibit some differential in child mortality. Access to child care may be another important factor.

We then compared the crude estimate with the estimated posterior mean of spatial effects (residual geographical effects) after controlling for confounders to appreciate the impact of education, household wealth and environmental factors associated with mortality in the four countries. Figure 4 shows the spatial distribution of crude under-five mortality rates (left), the residual spatial posterior mean and the poverty assessment by the World Bank (1995, 2000). The four maps capture different dimensions of mortality. It suggests there is a strong correlation between poor child survival and poverty status in all four countries (Figure 4) after controlling for possible confounders. A more in-depth study of the correlation is needed. This may be related to the impact of economic decline and adjustment policies which have hit most of these countries and some major urban areas particularly hard (World Bank, 1995).

8. Concluding Remarks

In this study we have shown that variation in childhood survival probability in all four countries is spatially structured. It implies that adjusted mortality risks are similar among neighbouring districts, which may partly be explained by general health care practices, household poverty level, and the prevalence of common childhood diseases. Another possible explanation is that of the residual spatial variation induced by variation in unmeasured district-specific characteristics. In the light of this, a simple standard 2-level model with unstructured spatial effects which assume independence among districts is bound to yield estimates that lead to incorrect conclusions with regard to child survival.

From a methodological point of view, different types of covariates, such as categorical covariates with fixed effects, metric covariates with nonlinear, time-varying effects and spatial covariates are all treated within the same GLM framework by assigning an appropriate prior. For planning purposes, in constructing estimates of under-five mortality rates that include small scale spatial information we suggest a straightforward idea: maps could be used for targeting development efforts at a glance, or for exploring relationships between welfare indicators and other variables. For example, a

mortality map could be overlaid with maps of other types of data, say on malnutrition, population density, environmental risks, and diseases prevalence. The visual nature of the maps may highlight unexpected relationships missed by the standard approaches.

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Poverty and Early Childhood Mortality: Household and Neighbourhood Effects in Urban Egypt

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1. Introduction

According to United Nations (2003) forecasts, by the year 2030 the world's population will exceed today's total by some 2 billion persons. Of these, some 1.9 billion are expected to reside in the cities and towns of Africa, Asia and Latin America. Cairo, the largest city of the Middle East, with an estimated population of 10.8 million in 2005 is projected to grow to 13.1 million by 2015. Other large Middle East cities are also expecting significant growth: for example, Beirut is anticipated to house 2.2 million people in 2015 and Amman some 1.5 million. Urban growth will pose daunting challenges to the effective management of health services, infrastructure, and public amenities, especially for the urban poor.

Despite decades of attention to developing-country poverty, surprisingly few data sets give health and mortality researchers much purchase on the concept of living standards. Although exceptions exist–notably the World Bank's Living Standards Measurement Surveys–surveys with detailed information on children's health and survival chances have not often gathered comparably detailed data on household incomes and consumption expenditures. Researchers interested in household poverty and children's health and survival have often been forced to make use of a grab-bag of proxy indicators for living standards.

The past decade has seen a lively debate in the literature on the merits of the alternative statistical techniques for measuring living standards that

use such proxies. We explore one of the more promising approaches for distilling the proxies into a living standards index, termed MIMIC models, which are a variant of confirmatory-factor analysis. The MIMIC approach requires that variables serving as *indicators* of living standards be distinguished from those serving as *determinants* of living standards. In this way the method brings a helpful theoretical structure to the estimation of living standards indices and imposes a measure of discipline on the empirical results.

We will draw upon data recently collected in the 2003 Egypt Interim Demographic and Health Survey (EIDHS), which provides detailed information on child health, nutrition, and mortality, and includes a large supplementary sample of slum-dwellers in Greater Cairo. We focus on two measures of early childhood chances of survival: (1) infant mortality; and (2) child mortality. To understand the effects of living standards on mortality and health outcomes, the MIMIC approach is applied to the urban households of the EIDHS, and used to develop urban-specific rankings of living standards. We then explore whether relative living standards for households make a difference to their children's chances of survival. We also investigate whether living standards in the neighbourhood affect child mortality, taking neighbourhood to be represented by the sampling cluster in which the household resides.

The Chapter is organised into four sections. Section 1 sketches the theory of neighbourhood effects and reviews related empirical evidence. Section 2 provides an overview of models and statistical issues in measuring living standards. This section also compares living standards and poverty measures for households with summary measures that are calculated at the sampling cluster level. The aim here is to understand how closely household and neighbourhood living standards are linked. The EIDHS data and specification of the infant and child mortality models are presented in Section 3. The multivariate results for the mortality measures are also included in this section, with a comparison of models based only on household living standards factors with those based on both household and neighbourhood factors. The paper concludes with a discussion of the policy implications of the major findings.

2. Household and Neighbourhood Effects: An Empirical and Theoretical Review

Neighbourhood and related contextual effects could influence health and other demographic outcomes through multiple pathways. Substantial research effort has been given to theories of social epidemiology, which emphasize how local reference groups, local behavioural models, and other forms of social comparison and information exchange can hinder (or encourage) appropriate health-seeking behaviour. The recent Panel on Urban Population Dynamics (2003) volume provides an extensive review of the theory, with attention to the implications for neighbourhood poverty (or living standards) and individual demographic behaviour in the cities of developing countries. Montgomery and Hewett (2004) briefly summarise this panel's argument and review more recent research concerned with neighbourhood effects on health. Among others, Sastry (1996) has explored the links between *local services* and demographic outcomes, another mechanism by which neighbourhood characteristics can make a difference.

In the United States and other high-income countries, where most people live in cities, there is extensive research and programmatic interest in the effects of household and neighbourhood living standards on demographic outcomes. This research has been stimulated by the writings of Wilson, Coleman, and others on social interaction, exclusion, and social capital in poor U.S. neighbourhoods (Wilson, 1987; Coleman, 1988; Massey, 1990; White, 2001; Sampson *et al.*, 2002)). Yet very few researchers have empirically explored the neighbourhood effects in the cities of developing countries. Montgomery and Hewett (2004) investigates whether, in a set of 85 developing-country cities, the health of women and children is affected by both household and neighbourhood standards of living. Their analysis shows that both household and neighbourhood standard of living can make a substantively important difference to health. Szwarcwald *et al.* (2002) examines a type of multilevel model in Brazil, in which infant mortality and adolescent fertility rates at the census-tract level are posited to depend on the proportion poor and the dispersion of poverty rates in the larger geographic areas within which tracts are nested. The authors find that higher levels of infant mortality and adolescent fertility at the tract level are associated with higher mean poverty rates in the larger areas.

3. Defining Neighbourhoods and Slums

The geographical units in which surveys are fielded have boundaries that need not correspond closely, or indeed at all, with the sociological boundaries of neighbourhoods as determined by patterns of social interaction, contagion, and social comparison.[1] In this paper, as in most of the literature on neighbourhood effects, the definitions of neighbourhood are forced upon us by the nature of the available data. Demographic and Health Surveys collect data within sampling clusters, and we will refer to these clusters as "neighbourhoods" (See Montgomery and Hewett (2004) for a discussion on the extent to which DHS sampling clusters represent neighbourhoods.)

The United Nations Millennium Declaration has singled out slum neighbourhoods of developing countries as especially deserving of attention.[2] However, no consensus has yet been reached among researcher as to how "slum neighbourhoods" are to be defined. Very little knowledge exists of the relationship between urban poverty overall and the living standards of slum populations. For instance, the proportion of the developing-country urban poor who live in slums is not known; neither is the proportion of slum dwellers that are poor in terms of income or other socioeconomic criteria (Montgomery and Hewett, 2004).

In Cairo, slums are typically defined as unauthorised settlements on areas which were not intended for housing and residence purposes, such as the unplanned areas (which lack basic services and adequate sanitation facilities) that have emerged in agriculture zones, government areas, and unsettled areas in the absence of planning and in violation of existing laws. Although there is broad agreement on the main characteristics of slums, there are no clear boundaries of slum areas in Cairo. Three main lists of

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[1] See Wellman and Leighton (1979) for a discussion on the lack of overlap between social interactions taking place in neighborhoods and those taking place in individual social networks.

[2] The United Nations Millennium Declaration specifies a target of achieving by 2020 "significant improvement in the lives of at least 100 million slum dwellers" under the broader goal of ensuring environmental sustainability (See www.un.org/millenniumgoals for further information on the Millennium Declaration and its associated goals, specific targets, and research programs.)

slum communities within urban Greater Cairo have been compiled.[3] These lists were developed by the Ministry of Health and Population, the Ministry of Local Communities, and the Central Agency for Public Mobilization and Statistics (CAPMAS).

The EIDHS Greater Cairo slum sampling frame drew upon the CAPMAS list of slums, mainly to be consistent with the non-slums sampling frame which was also obtained from the CAPMAS. An area was included in the CAPMAS slum list if it was unplanned, the majority of its buildings were constructed without permits, streets were unstructured, and it lacked basic services–including health, education, and sanitation facilities. In other words the main definition of Egyptian slums, in the DHS sample as well as in much previous research and government reports, is based on the legal characteristics of these places. In what follows, we will carefully examine the associations between neighbourhood living standards as measured through the MIMIC approach and the formal designation of slums adopted by CAPMAS.

4. Statistical Approach: The MIMIC Model

It may be useful to preview our MIMIC approach by situating it among the various strategies that have been applied to the problem of measuring living standards with collections of proxy variables.

Table 1 Classifying the approaches to measuring living standards

	Non-Statistical Approaches	Statistical Approaches
Loosely Structured	Counts of all durables owned	Principal components or factor analysis of durables alone
Tightly Structured	Judgment-based weighted indexes of durables	MIMIC specifications

Table 1 presents one scheme for doing so, in which we distinguish highly-structured and less-structured approaches, and also draw a distinction between approaches that are statistically-based and those that rely solely on the judgment of the investigator. In separating determinants from indicators, the MIMIC approach brings more structure to bear on the problem than do the comparatively unstructured principal components or simple

[3] Greater Cairo includes the three governorates of Cairo, Giza, and Kalyubia.

factor-analytic methods. But judgment-based approaches, in which detailed knowledge of local conditions is applied to form weights for each consumer durable or indicator, are also highly structured and they also bring outside information to bear on the problem of defining living standards.

The specifications to be explored here take the form of equation systems in which a given mortality variable, denoted by *Y*, is the main object of interest. As discussed above, in our application *Y* will represent one of two measures of early child mortality. For the infant and child mortality models, we write the main structural equation in latent variable form as

$$Y^* = W'\theta + f\delta + \varepsilon \qquad (1)$$

with the observed dependent variable $Y = 1$ if $Y^* \geq 0$ and $Y = 0$ otherwise. The determinants of Y^* include a vector of explanatory variables *W* and an unobservable factor *f* that we will take to represent the household's standard of living. Another unobservable, ε, serves as the disturbance term of this structural equation.

We posit a model of the factor f such that $f = X'\gamma + u$, the value of *f* being determined by a set of exogenous variables *X* and a disturbance *u*. Although *f* is not itself observed, its probable level is signalled through the values taken by $\{Z_k\}$, a set of *K* indicator variables. These are binary indicators in our application, and it is conventional to represent them in terms of latent propensities Z_k^*, with $Z_k = 1$ when $Z_k^* \geq 0$ and $Z_k = 0$ otherwise. We write each such propensity as $Z_k^* = \alpha_k + \beta_k f + v_k$, and, upon substituting for *f*, obtain *K* latent indicator equations,

$$\begin{aligned} Z_1^* &= \alpha_1 + X'\gamma + u + v_1 \\ Z_2^* &= \alpha_2 + \beta_2 X'\gamma + \beta_2 u + v_2 \\ &\vdots \qquad\qquad\qquad\qquad (2) \\ Z_K^* &= \alpha_K + \beta_K X'\gamma + \beta_K u + v_K. \end{aligned}$$

In this set of equations, the β_k parameters show how the unobserved factor *f* takes expression through each indicator.[4] Whether *f* is actually inter-

[4] Note that no β_1 coefficient appears in the first of the indicator equations: It has been normalized to unity. Further normalizations are also required. In latent variables models such as these, the sizes of the variances σ_u^2

pretable as a living standards index depends on the signs that are exhibited by these parameters.

The full equation system thus comprises the child mortality equation (1) and equations (2) for the living standards indicators. In setting out the model in this way, with latent factors embedded in structural equations, we follow an approach that has been recommended by several researchers (notably Sahn and Stifel, 2000; McDade and Adair, 2001; Tandon *et al.*, 2002; Ferguson *et al.*, 2003). Filmer and Pritchett (1999, 2001) have developed an alternative approach based on the method of principal components.

Although useful in descriptive analyses and very easy to apply, this method is perhaps best viewed as a data-reduction procedure whose main virtue is the ease with which the researcher can collapse multiple indicators into a single index. The principal components approach is otherwise rather limited–it does not cleanly separate the determinants of living standards from the indicators of living standards, and it lacks a firm theoretical and statistical foundation. As a result, the method is not readily generalizable to structural, multiple-equation models such as ours (Montgomery *et al.*, 2000; Montgomery and Hewett, 2004).

Here, we will take a two-step approach to estimating the full equation system. Assuming that the disturbances are normally distributed, we estimate the parameters α, β and γ of the indicator equations (2) by the method of maximum likelihood, using routines that we have written for this purpose. An estimate $\hat{f} = E[f \mid X, Z]$ of the factor is derived from these indicator equations alone. The predicted $\hat{f}$ is then inserted into the structural equation (1) just as if it were another observed covariate. Conventional statistical methods are applied to estimate the parameters θ and δ of the structural model.[5]

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and $\sigma^2_{v_k}$ are not identifiable. For the indicator equations, we apply the normalization rule $\beta^2_k\sigma^2_u + \sigma^2_{v_k} = 1$ so that the variance of $\beta_k u + v_k$ equals unity in each equation.

[5] As in other two-step models with "generated regressors," the standard errors of the estimators $\hat{\theta}$ and $\hat{\delta}$ should be corrected for the use of an estimated $\hat{f}$ in the second step. We employ robust standard errors, which should adequately address this and other

5. Modelling the Living Standards Factor

With the living standards factor specified as $f = X'\gamma + u$, how should the *X* variables of this equation be chosen and what relation, if any, should they bear to the *W* variables that enter the main mortality equation? How are the *X* variables, posited as determinants of living standards, to be distinguished from the {*Zk*} variables that serve as indicators of living standards? In Table 2 we present our classification scheme and give descriptive statistics on the indicators and determinants.

As Montgomery *et al.* (2000) note, there is little consensus in the literature about how best to define and model the living standards measures found in surveys such as those fielded by the DHS programme, which lack data on consumption expenditures and incomes.

With proper consumption data lacking, we think it reasonable to define the set of living standards indicators {*Zk*} in terms of the consumer durables and housing-quality items for which data are gathered. Using these indicators, we construct what McDade and Adair (2001) have termed a "relative affluence" measure of living standards. Access to electricity is now all but universal in urban Egypt, so this determinant can be excluded from our statistical analysis. Few urban households in Egypt own dishwashers so it was necessary to exclude this indicator as well.

Producer durables are deliberately excluded from the {*Zk*} set of indicators, because while they may help determine final consumption, producer durables are not themselves measures of that consumption. They are a means to an end, or, to put it differently, producer durables are better viewed as inputs in household production functions, rather than as measures of the consumption drawn from household production. By this logic, producer durable variables should be included among the *X* covariates–we have included of a house or land, ownership of animals, and possession of a sewing machine. We have also made use of a variable measuring security of housing tenure, as expressed in household perceptions of the likelihood of eviction. (To judge from the responses, relatively few urban Egyptian

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sources of heteroskedasticity. See Montgomery and Hewett (2004) for a fuller account of statistical issues and estimation techniques.

households feel themselves to be at risk of eviction, a situation quite unlike what is seen in other urban areas of the developing world.)

Although city size may be only a distant proxy for the many other factors that determine consumption–among them, access to multiple income-earning possibilities and heterogeneous labour and product markets–we include dummy variables for Cairo, Alexandria, and Kalyubia to account for such effects, relegating other urban towns and small cities to the omitted (reference) category.

It is not unreasonable to liken adult education to a producer durable, education being a type of long-lasting trait that produces a lifetime stream of income and consumption. On these grounds we include the age of the household head and measures of adult educational attainment for all adults in the household in our specification of the X determinants. In doing so, we are mindful of the "dual roles" played by education in demographic behaviour (Montgomery *et al.*, 2000; Montgomery and Hewett, 2004). Education is both a determinant of living standards and a conceptually separable influence on behaviour via its links to social confidence, to the ability to process information, and to the breadth and nature of individual social networks. In short, education measures belong with the W variables of the schooling equations as well as in the set of X variables that act as determinants of living standards. Model identification is not threatened by variables that are common to both X and W, but we hope to strengthen the empirical basis for estimation by using a summary measure of education for adults in the living standards model (the proportions of all adults in the household having various levels of completed education) and a more detailed specification, involving levels of the head's education, in the children's schooling models. The sex and age of the household head is also included among the determinants of living standards.

Table 2 Mean values of household living standards variables, urban sample (N = 8462)

Proportion of households owning	
Car, van, or truck	0.098
Bicycle or motorcycle	0.143
Radio with cassette	0.889
Television	0.954
Satellite dish	0.081
Telephone	0.584
Mobile phone	0.234
Video	0.223
Computer	0.089
Electric fan	0.929
Air conditioner	0.044
Refrigerator	0.903
Freezer	0.043
Gas or electric stove	0.786
Automatic clothes washer	0.278
Other clothes washer	0.800
Water heater	0.594
Adequate living space [a]	0.530
Good flooring [b]	0.129
Mean values of determinants	
Owns dwelling	0.514
Feels Little Risk of Eviction [c]	0.959
Owns land	0.045
Owns animals	0.118
Has sewing machine	0.097
Proportion of Adults with Primary Schooling	0.162
Proportion with Secondary Schooling	0.473
Proportion with Higher Schooling	0.171
Head's Age (*years*)	45.86
Head is a Man	0.874
Household lives in Cairo	0.356
Lives in Alexandria	0.070
Lives in Giza	0.106
Lives in Kalyubia	0.144

Notes: [a] Household defined to have adequate living space if the number of persons per room is less than the (weighted) median value for all urban households of about 1.25 persons per room. [b] Household has flooring covered with parquet or polished wood, ceramic or marble tiles, or wall-to-wall carpeting. [c] Household either owns its own dwelling, or reports no or very little risk of eviction.

6. Estimates of Urban Living Standards

Table 3 summarizes the estimated $\hat{\beta}_k$ factor loadings on the indicators of living standards, and also presents the $\hat{\gamma}$ estimates on the determinants. As can be seen in the table, the $\hat{\beta}_k$ coefficients are always positive and statistically significant. This is encouraging, in that it supports the interpretation of the factor as an expression of the household's standard of living. The table also presents a summary of $\hat{\gamma}$, the effects of the X determinants. These effects are very much in line with expectations. The adult education variables are strongly and positively associated with living standards in urban areas; and, consistent with age profiles of productivity, we find that urban living standards increase with the head's age up to about age 57, and decrease thereafter.

Among the producer durables, ownership of a home and land are positively associated with living standards, but ownership of animals is negatively associated. Other producer durables–possession of a handcart and sewing machine–are positively and significantly associated with living standards. Interestingly, although some 95 per cent of urban Egyptian households believe themselves to be at little risk of eviction from their homes, this variable is positively associated with living standards. The city-specific dummy variables suggest that with other things held equal, living standards are generally higher in Cairo and Giza (and weakly so in Alexandria) by comparison with Egypt's towns and secondary cities. On the whole, the results presented in Table 3 provide good statistical support for the proposition that the proxy variables collected in the Egyptian DHS can be interpreted as indicators of the household's standard of living.

To make use of the estimated factor scores derived from this model, we convert the scores into percentile form, giving each household a ranking that accords with its relative position in the distribution of all urban scores. (Sampling weights are used to correctly characterise the full urban distribution.) We label this percentile the household's "Relative" standard of living, with the reference group being composed of all other urban households.

Table 3 Estimates of the indicator and determinants coefficients of the MIMIC living standards model, urban Egyptian households

	Coefficient	Z value
Coefficients $\hat{\beta}_k$ *of the indicators*		
Bicycle or motor cycle [a]	0.191	6.803
Radio	1.105	30.693
Television	1.398	33.698
Satellite	1.129	29.523
Telephone	2.052	42.021
Mobile phone	1.182	32.744
Video	1.392	38.144
Computer	1.773	41.640
Electric fan	1.282	35.127
Air conditioner	1.178	28.255
Refrigerator	1.597	39.383
Freezer	1.227	33.150
Gas or electric stove	0.822	29.039
Automatic clothes washer	1.571	39.955
Other clothes washer	0.393	18.368
Water heater	1.578	39.731
Adequate living space	1.778	42.159
Good flooring	0.953	27.695
Coefficients $\hat{\gamma}$ *of the determinants*		
Own dwelling	0.032	7.331
Little Risk of Eviction	0.346	25.796
Owns land	0.238	21.896
Owns animals	-0.103	-14.696
Has sewing machine	0.288	30.201
Proportion of adults with primary schooling	0.103	16.678
Proportion of adults with secondary schooling	0.425	38.103
Proportion of adults with higher schooling	0.846	40.905
Head's age [b]	0.055	31.353
Head's age, squared	-0.48^{-3}	-29.253
Head is a Man	0.240	25.766
Household lives in Cairo	0.105	19.166
Lives in Alexandria	0.046	5.123
Lives in Giza	0.115	15.115
Lives in Kalyubia	-0.066	-9.206
ρ	0.227	21.014

Note: For specification of variables, see Table 1 and text.

[a] The β coefficient on ownership of a car, van, or truck has been normalized to unity.

[b] According to the age coefficient estimates, the positive effect of head's age on household living standards rises to a peak at age 57 and then declines.

7. What Does the Slum Designation Mean?

In what follows, households falling into the lowest quartile of the urban factor scores will be termed "relatively poor" and those in the uppermost quartile termed "relatively affluent." To classify the neighbourhoods (i.e., sampling clusters) in which households are, we take simple averages of

the "Relative" variable across households residing in the cluster, and also compute the cluster proportions poor and affluent.

Table 4 Average household percentiles, proportions relatively poor and proportions affluent by cluster, slum and non-slum clusters

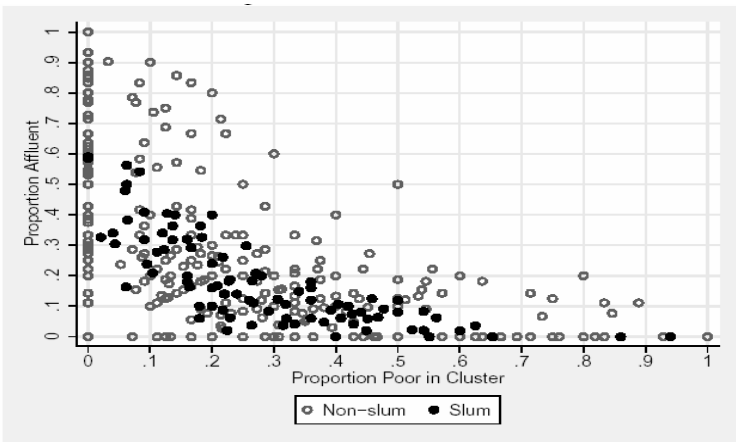
	Slum	Non-slum
Average household score in percentiles	46.4	54.3
Average proportion of poor households	28.0	23.4
Average proportion of affluent households	18.6	31.5

We generate several graphs showing how the designated slum clusters compare with other clusters in their proportions poor and affluent, and also in terms of the average percentiles. The differences between the slum and non-slum clusters, although perceptible, are not especially striking. Figure 1 depicts the proportions poor and affluent in all urban clusters, with the clusters termed "slums" shown in the dark circles. Were the slum clusters almost uniformly poor (in relative terms), they would all be found grouped in the lower right portion of the figure. It can be seen at a glance that on average these slum clusters do contain lower proportions of affluent households, as would be expected, but it is not obvious that they contain much greater proportions of poor households. Table 4 quantifies things by providing the mean values for slum and non-slum clusters (calculated with sample weights) for the average living standards percentiles of all households in the cluster, and the proportions of relative poor and affluent households. There are differences apparent, to be sure, and these are in the expected direction, but the differences are not as large as we would have anticipated. At least in terms of our consumption-based measure of living standards, then, the slum/non-slum differences are small enough that they cast some doubt on the value of the slum designation.

We have undertaken further empirical exploration of the slum/non-slum differences, and also examined the extent of heterogeneity evident within both types of clusters. An important question is whether cluster averages and proportions are well predicted by the poverty status of individual households, and, reversing the direction of inquiry, whether cluster characteristics are good predictors of the poverty status of households. The results (details not reported here) show considerable heterogeneity in the poverty composition of clusters, and document positive but surprisingly low correlations between individual household poverty and proportions poor in the cluster apart from that household. Likewise, the negative but modest

correlations are found between individual household poverty and the proportion non poor in the cluster.

Figure 1 Proportions of relatively poor and affluent households by cluster, slum and non-slum clusters (weighted means)



8. Early Childhood Mortality: Data and Model Specification

In the following, we focus on two aspects of early childhood mortality: (1) infant mortality or the probability of dying during the first year of life; and (2) child mortality or the probability of dying between the first and the fifth birthday. Each of these variables is measured by a binary indicator, which takes the value 1 if the child died before his first (fifth) birthday in the infant (child) mortality models.

The infant and child mortality models are based on probit regressions for the *i*-th child in household *h* in sampling cluster *c*, which can be expressed as follows:

$$\Pr(Y_{ihc} = 1 | W_{ihc}, \hat{f}_{hc}, \hat{f}_h^c) = \Phi(W'_{ihc}\theta + \hat{f}_{hc}\delta + \hat{f}_h^c\delta_c),$$

where Φ is the standard normal cumulative distribution function, W_{ik} denotes the set of explanatory variables, most of which are measured at the household level, $\hat{f}_{hc}$ is the estimated living standards percentile for the household, and $\hat{f}_h^c$ is the average of these percentiles over all except the *h*-th household in the cluster. The same set of explanatory variables is

included in all the regression models, and robust standard errors are employed throughout.

A small set of socioeconomic controls in addition to the living standards measures is included in the mortality models. We need to control for a number of biomaternal characteristics, to adequately test the household and neighbourhood effect on infant and child mortality. Infant mortality, specifically, tend to be higher among children born to younger mothers. We include a dummy variable for whether the mother was below age 20 at the birth of the child. Also, the effect of high birth order is measured by a dummy variable that takes the value 1 if the child birth order is four or higher. The educational attainment of the mother is summarised in two dummy variables: the first indicates whether the mother has at least some primary or secondary education; the second indicates whether the mother has completed secondary or higher education. Two dummy variables are included to measure whether the mother and the husband are working or not. Residence in a large city or the country's capital is represented by a dummy variable for residence in Greater Cairo. The slum context is represented by a dummy variable for residing in a slum neighbourhood, according to the CAPMAS criteria for defining slums. Descriptive statistics for these variables and early childhood mortality measures are presented in Table 5.

Table 5 Descriptive statistics for mortality and socioeconomic controls. Data on children of age 0–5 years

Variable	All urban non-slums (%)	Greater Cairo Slums (%)
Child & bio-maternal characteristics		
Infant deaths	56	58
Child deaths (age 1-5)	11	11
Male	53	52
Birth order: 4th or higher	24	22
Mother's age at birth of child <20	12	16
Work status		
Mother is working	86	82
Father is working	23	16
Mother's education		
Primary education	15	19
Secondary education	46	44
High education	13	7
Father's education		
Primary education	20	23
Secondary education	44	47
High education	19	10
Household & neighbourhood variables		
Greater Cairo	25	100

9. Regression Results: Models with Household and Cluster Factor Scores

Tables 6 and 7 present the regression results of the infant and child mortality models. (Note that the mortality models are estimated only for children whose mothers are usual residents of the household.) Each model is first estimated with only the household's living standards percentile and the cluster living standards percentile; then re-estimated after adding each set of the socioeconomic variable. The full model is also estimated adding each of the household's living standards percentile, the cluster living standards percentile, and the slum dummy. These sets of consecutive models are estimated in order to weigh the evidence for "neighbourhood effects" and determine whether separate household and cluster effects can be discerned, as well as to examine whether the legal definition of slums effectively identifies poor neighbourhoods.[6]

The tables reveal some clear consistency in the findings across models. The male coefficient is positive and significant in the child mortality models but not in the infant mortality ones. Being a boy negatively affect the child's survival chances after age 1. High birth order does not have a significant effect on either infant or child mortality. Children of mothers below age 20 have higher probability of dying during infancy and before age 5 than those of older mothers. Furthermore, the survival chances during infancy and childhood significantly increase with the mother's and her husband's education level. Husband work significantly decreases infant and child mortality, however children of working mothers have lower survival chances than non-working mothers.

As for the living standards variables, which indicate the household's relative position in relation to other urban households, we find that the household's relative standing exerts a significant and negative influence in the infant and child mortality equations until the parent's education are included in the model. Surprisingly, the sign of the household's living standard variable coefficient switches to positive as the mother and husband

[6] Several interaction terms between the household and neighborhood variables and the socioeconomic variables were also tested, but were not found to be significant (results are not included).

education are included in the equation. This might be due to the trivial collinearity between the education level variables and the household and cluster living standards.

Table 6 Estimates of infant mortality models

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Household & neighbourhood variables						
Household relative living standards	-0.006***	-0.004***	-0.004**	0.007***	0.007***	0.007***
Cluster averages	-0.005*	-0.003	-0.003	-0.002	-0.002	
Greater Cairo					-0.037	-0.055
Designated slum					-0.024	-0.004
Child & biomaternal characteristics						
Male		0.034	0.037	0.071	0.072	0.071
Birth Order: 4th or higher		0.452***	0.424***	0.006	0.004	0.009
Mother's age at birth of child <20		1.002***	0.970***	0.741***	0.743***	0.747***
Working status						
Husband currently working			-1.046***	-0.857***	-0.859***	-0.860***
Mother currently working			0.152	0.384***	0.380***	0.374***
Mother's education (no education omitted)						
some primary or secondary				0.02	0.02	0.019
completed secondary or higher				-0.940***	-0.946***	-0.950***
Father's education (no education omitted)						
some primary or secondary				-0.292**	-0.290**	-0.288**
completed secondary or higher				-0.750***	-0.749***	-0.746***
Constant	0.652***	0.175	1.054***	1.413***	1.451***	1.381***
N	1963	1963	1963	1963	1963	1963
Log Likelihood	-1313.076	-1233.309	-1170.816	-1009.492	-1009.103	-1009.45
Chi-square	47.583	189.873	293.301	603.667	602.072	605.972

Note: * p<0.05; ** p<0.01; *** p<0.001

On the other hand, the cluster-level averages show no significant effects in any of the estimated models. Additionally, adding the CAPMAS slum dummy to the model does not reveal any additional significant effects. Finally, the last column of the table shows that the neither the significance nor the magnitude of the household living standards coefficients is affected by whether or not the cluster measures are included in the full model. (Similar results are also obtained under the other model specifications).

To sum up, the household factor scores has a significant effect on infant and child mortality; however, with all other variables in the specifica-

tion, no additional contribution is made by either the cluster-level averages of living standards or the slum variable.

Table 7 Estimates of child mortality models

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Household & neighbourhood variables						
Household relative living standards	-0.004**	-0.002**	-0.002**	0.007***	0.007***	0.007***
Cluster averages	-0.004	-0.003	-0.004	-0.001	-0.001	
Greater Cairo					-0.127	-0.135
Designated slum					0.016	0.023
Child & biomaternal characteristics						
Male		0.165**	0.147*	0.151*	0.148*	0.148*
Birth Order: 4th or higher		0.291***	0.231**	-0.015	-0.02	-0.02
Mother's age at birth of child <20		0.767***	0.762***	0.643***	0.652***	0.654***
Working status						
Husband currently working			-0.742***	-0.562***	-0.575***	-0.575***
Mother currently working			0.188*	0.325***	0.314***	0.313***
Mother's education (no education omitted)						
some primary or secondary				-0.042	-0.036	-0.037
completed secondary or higher				-0.675***	-0.682***	-0.686***
Father's education (no education omitted)						
some primary or secondary				-0.304***	-0.306***	-0.305***
completed secondary or higher				-0.659***	-0.668***	-0.668***
Constant	-0.895***	-1.280***	-0.639***	-0.416**	-0.349*	-0.378**
N	3787	3787	3787	3787	3787	3789
Log Likelihood	-1278.777	-1224.354	-1182.78	-1080.254	-1078.592	-1078.747
Chi-square	27.533	133.739	193.438	329.264	334.85	330.797

Note: p<0.05; ** p<0.01; *** p<0.00110. Conclusions and Policy

10. Recommendations

This paper examines the role of household and neighbourhood poverty as determinants of early childhood mortality in urban Egypt. It has been conventional to think of the urban poor as slum/dwellers, and this view provides a rationale for geographic targeting of health investments in Egypt and elsewhere. However, this paper highlights that when slum communities are closely inspected, they are often found to be more heterogeneous than the conventional view would indicate. Our analysis shows that the slum/non-slum differences, although perceptible, are not especially striking. Based on our developed measure of household living standard, as measured

by MIMIC factor scores converted to percentiles, the slum clusters on average do contain a lower proportion of affluent households compared to the non-slum clusters, as would be expected, but it is not obvious that they contain much greater proportions of poor households.

We have found evidence that household living standards exert significant influence on children's survival chances in urban Egypt. However, measures of living standards at the level of the cluster produced no additional significance in models of child mortality. In other words, the results show that early childhood mortality in poor households in urban Egypt mostly depends on their own standards of living, and not necessarily on the economic composition of their neighbourhood. With household and neighbourhood living standards controlled in this way, knowing that an area has been designated as a slum (by the CAPMAS definition) does not bring any further insight into the prospects for children's survival chances. Indeed, the slum/non-slum differences are small enough that they cast some doubt on the value of the slum designation for the design of policies. There is good reason to supplement such official slum designations with other classifications of families, such as the one produced by the MIMIC approach of this paper.

Policymakers should pay special attention to the heterogeneity that exists within many urban slums, which could have profound implications for the effectiveness of targeting government health investments on a spatial basis. In mixed slum communities, a considerable portion of the benefits from public health investments could be captured by the better-off families. The possibility of such "leakages" needs to be factored into decisions about the placement of investments. Where children's health is concerned, "slums" as defined in the Egyptian context may not provide an appropriate geographic basis for the targeting of health investments.

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Child Malnutrition in Rural India

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1. Introduction

Around a billion people in the world are currently malnourished. According to the *Copenhagen Consensus Project* (organised by Denmark's Environmental Assessment Institute with the co-operation of *The Economist*) malnutrition is one of the ten biggest challenges facing the world (Behrman, Alderman and Hoddinott, 2004). In the late 1990s about 46 per cent of Indian children aged below three years were stunted; this was down from 52 per cent in the early 1990s (IIPS and ORC Macro, 2000; Mishra, Lahiri and Luthur, 1999). Child malnutrition has several social, economic and health consequences for individuals, families and societies (Martorell, 1999; Smondon *et al.*, 1998; Pelletier *et al.*, 1995; Alderman, Hoddinott and Kinsey, 2003). Some effects of malnutrition in infancy and childhood may not be fully reversible (Hack *et al.*, 2002; Martorell *et al.*, 1992; Martorell, Khan and Schroeder, 1994; Golden, 1994; Satyanarayana *et al.*, 1981). Malnutrition also has a strong and direct influence on the incidence and spread of infectious diseases (Schrimshaw, Taylor and Gordon, 1968). In light of the current and future population size of India, what happens to the level and patterns of child malnutrition in India will have enormous impact on world patterns.

However, a sound empirical base on the determinants of chronic malnutrition in India is lacking. This is primarily due to the non-availability of national level micro data on the nutritional status of children. Only a few national level sample surveys collected detailed data on child nutrition and its potential determinants, including the nutritional status of mothers (IIPS and ORC Macro, 2000; Shariff, 1998; Gaiha and Kulkarni, 2005). The most recent national survey (the second National Family Health Survey or NFHS-2) that included a module on child nutrition was carried out in 1998-

99 covering all the Indian states. This survey also included information on the nutritional status of mothers, child care practices and health care utilization that was not collected in the other national surveys. This allows us to develop and employ a more comprehensive and better-specified model of the relationship between child malnutrition and socio-economic determinants. Moreover, unlike the NFHS-1 that did not collect data on child height from five major states (Andhra Pradesh, Himachal Pradesh, Madhya Pradesh, Tamil Nadu and West Bengal), in the NFHS-2 these data were collected in *all* states giving us the opportunity to examine variations in chronic malnutrition across India. Although there have been a few studies on child malnutrition for India as a whole, this is probably the first major comparative analysis of the determinants of chronic malnutrition in rural India by major states.

In standard explanatory frameworks, child malnutrition is conceptualised as multi-factorial, multi-level and interactive (UNICEF, 1990; Mosley and Chen, 1984). Malnutrition that is common in the developing world results from deficiencies in energy, protein, and vitamins and minerals. It is now well-established that malnutrition can exist in the absence of inadequate food intake. This is due to the fact that mothers' poor child care practices, exposure to disease and non-utilisation of health care services could cause malnutrition even if food security is assured at the household level. In other words: "food, health and care, when considered individually, represent a necessary but not sufficient explanation for the existence of malnutrition in households and communities" (Pelletier, 1998:110).

Studies of child nutrition in India and elsewhere have examined variations in child nutrition in terms of individual factors (both child and mother specific), household factors, and community factors at different levels (e.g. village, district and state) (Mishra, Lahiri and Luther, 1999; Griffths, Matthews and Hinde, 2002; Mishra, Roy and Retherford, 2004; Gaiha and Kulkarni, 2005). The explanatory factors varied from socio-demographic, economic and health factors, to the market prices for food and wages (Handa, 1999; Mishra, Roy and Retherford, 2004; Gaiha and Kulkarni, 2005; Pande, 2003; Desai and Alva, 1998; Alderman and Garcia, 1994; Basu, 1993; Thomas and Strauss, 1992; Thomas, Strauss and Henriques, 1991; Sahn, 1994; Rosenzweig and Schultz, 1982). A number of studies have focused specifically on the role of maternal education in child malnu-

trition (e.g. Thomas, Strauss and Henrique, 1991; Wolfe and Behrman, 1987; Handa, 1999; Gibson, 1999).

Maternal education is believed to positively influence nutritional outcomes for children through different mechanisms. Maternal education can determine the nutritional status of children by influencing directly the type, quantity and quality of food, the feeding and child care practices and the utilisation of ante-natal and post-natal care services. These influences in turn are likely to flow from the empowering, income augmenting, information processing and interactive effects of education (Caldwell, 1979, 1986; Basu, 1997; Mason, 1984; Thomas, Strauss and Henrique, 1991). There is a substantial body of literature that supports the link between maternal education and a number of outcomes including child health, fertility, mortality and contraceptive use (Cochrane, Leslie and O'Hara, 1982; Barrera, 1990; Caldwell, 1979; Basu and Basu, 1991; Jeejeebhoy, 2001; Bicego and Boerma, 1990; Griffths, Matthews and Hinde, 2002).

Household hygiene is an immediate cause of malnutrition among children. Poor household and environmental hygiene exposes children to infections and diseases; and once infected, exposure to an unhealthy hygienic environment can lengthen the duration of a disease (Gaiha and Kulkarni, 2005; Martorell, 1999; Alderman and Garcia, 1994). This in turn can affect the consumption of food and the absorption of nutrients (Sachdev, 1997; Becker, Black and Brown, 1991). It is argued that malnutrition and disease are synergistically linked. In other words, malnutrition and disease are both cause and effect to each other. The absence of proper toilets in a substantial proportion of households in rural India is an important factor leading to poor household hygiene.

In utero development of the baby is another critical predictor of child malnutrition. Low birth weight is considered an important indicator of intra-uterine nutrition; and it is strongly associated with maternal nutrition (Behrman and Rosenzweig, 2004; Li *et al.*, 2003; Hoddinott and Kinsey, 2001; Ruel, 2001; Ashworth, Morris and Lira, 1997). This in turn is a function of mother's childhood nutritional status, access to food, utilisation of health care services, exposure to diseases, life style, the frequency of childbearing and family background (UNICEF and WHO, 2004; Martorell and Ho, 1984). The literature suggests that malnutrition during intra-uterine life is likely to increase the chances of being further malnourished during in-

fancy and childhood (Martorell, 1997; Ramalingaswami, Jonsson and Rohde, 1997; Sachdev, 1997; Martorell, 1995; Henriksen, 1999).

This paper focuses on the importance of maternal education, household hygiene, and children's birth weight on rates of chronic malnutrition (stunting) in rural India. It provides a thick description of variations within rural India in the relationship between chronic malnutrition and maternal education, household hygiene and birth weight. The analysis presented here shows that these factors are indeed significant predictors of chronic malnutrition for rural India as a whole. But more importantly, their significance varies substantially between the major states in rural India. This indicates that policy and programme prescriptions to address chronic malnutrition need to be context-specific.

The chapter is organised as follows. Data sources, definition and derivation of variables used and the methods are presented next. This is followed by a description of the results. The paper concludes with a discussion of the main findings.

2. Data and Methods

Data for this study were drawn from the second Indian National Family Health Survey carried out in 1998-99 (NFHS-2). This is the most recent period for which we have data on nutrition and on a host of covariates. Apart from collecting information on child height from all states (thus enabling the construction of a measure of chronic nutrition), NFHS-2 also included a measure of the nutritional status of mothers. Availability of this information on a national scale enabled us to control for this variable in multivariate analysis for the first time. Evidence from the literature supports the hypothesis that mothers' body-mass index is a strong determinant of children's nutritional status (Martorell, 1999; UNICEF and WHO, 2004). Not controlling for this variable could lead to over-estimation of the effect of other mother or household variables (e.g. mother's education).

The NFHS-2 included just over 90,000 women aged 15-49 in 1998-99. The women were sampled using a complex multi-stage-cluster approach (IIPS and ORC Macro, 2000). We focus on children aged below three years who were living in rural areas at the time of the survey. The analysis pre-

sented here was based on a final sample of 17,571 children aged less than three years.

Three indicators of anthropometric outcomes are generally used to study child malnutrition (Behrman, Alderman and Hoddinott, 2004). The analysis reported here is restricted to just one indicator, chronic malnutrition. Also known as stunting, this measure is derived from the standardised height for age scores by gender. The standardised scores are derived by comparing the observed scores against standard schedule by age and gender provided by the National Centre for Health Statistics (Dibley *et al.*, 1987a, 1987b; Martorell and Habicht, 1986). A comprehensive study of growth performance among affluent children in India showed that the WHO standard is generally applicable to India. The study suggested that the use of the international reference standard in India was justified on scientific and practical considerations (Agarwal *et al.*, 1991). A child is considered chronically malnourished or stunted if its standardised score is more than two standard deviations below the median of the reference population. The child is severely stunted if the standardised score is more than three standard deviations below the median of the reference population schedule.

We focused on stunting or chronic malnutrition as this reflects the cumulative effect of chronic deprivation in nutrition and health (Waterlow, 1972, 1973; Waterlow *et al.*, 1977; WHO, 1986). It also mirrors the effects of recurrent and chronic illnesses. It is generally agreed that inadequate food, poor feeding practices, poor environmental sanitation and hygiene, inadequate and unsafe water supplies are the immediate causes of chronic malnutrition (Martorell, 1985; Sommerfelt and Arnold, 1998; Pelletier, 1998; Gaiha and Kulkarni, 2005).

NFHS-2 collected information on a range of household characteristics, including women's characteristics, utilisation of maternal and child health services, and anthropometric indicators. There was also a separate module to collect village level data on a number of context specific variables. We tested the bivariate relationship between a number of village level factors and the likelihood of being stunted. Surprisingly, most relationships were not significant and thus we included only one village level variable in the analysis (telephone ownership) as a control.

Table 1 provides a description of the variables and the response categories used in the analysis. As can be seen, the variable list is comprised of

individual, household and district level characteristics. District level variables were constructed by cumulating the individual respondents within each district. The 17,571 rural children included in the analysis were spread across 419 districts and 24 states. Some states were combined to provide us with a reasonable sample size. The merging of states was based on geographic proximity and similarities in the prevalence of stunting. Thus Kerala and Tamil Nadu were combined to form one unit; Assam, Meghalaya and Tripura were combined to form another unit; the small north-eastern states of Manipur, Mizoram, Nagaland and Sikkim were grouped into one; and all other states were treated separately. Hereafter we refer to the latter two groupings as Assam and Manipur, for reasons of simplicity. This gave a total of 19 states for which we examined chronic malnutrition.

Table 1 Definition and classification of variables used in the analysis

Variable	Response categories	Description of variable
Individual or household characteristics		
Child stunted	Yes (48.1%) No (51.9%)	When the standardised height-for-age score is less than -2 standard deviations or more
Mother's Education	No schooling (60.9%) Primary schooling (19.6%) Middle school (9.1%) High school and above (10.4)	Highest level of schooling the woman had attained; primary schooling includes up to 5 years of schooling
Economic status	Rich (12.7%) Middle (48.7) Poor (38.6)	A composite index of household economic status was constructed by combining 21 household asset and characteristics variables. For details see IIPS (2000:40-41).
Toilet facilities	No toilet/shared toilet (79.5%) Own flush toilet (7.5%) Own pit toilet (13.0%)	The kind of toilet facilities the household had
Health care utilisation	No care (26.2%) Received vitamin A (28.9%) Received vitamin A, iron folic or/and tetanus injection (44.9%)	A composite indicator derived by combining: (i)when pregnant whether the mother was given any iron folic tablets or syrup, (ii) whether she was given an injection to prevent tetanus, and (iii) whether the child was given a dose of vitamin A.
Baby size at birth	Average/large (74.6%) Small (20.9%) Very small (4.7%)	The size of the baby when he/she was born as reported by the mother.
Birth order of child	First birth (26.8%) Second or third (43.0%) Fourth or fifth (19.4%) Sixth and above (10.8%)	The order of birth of the child
Gender of child	Male (52.3%) Female (47.7%)	

Table 1 Definition and classification of variables used in the analysis *(continued)*

Variable	Response categories	Description of variable
Exposure to mass media	High exposure (9.2); Moderate exposure (19.9); Low exposure (70.9)	Exposure to mass media was derived from the responses of women to three questions: whether she listened to radio at least once a week; whether she watched television at least once a week; whether she went to a cinema at least once a month. If a women responded 'yes' to all three she was classified as having had 'high' exposure; if she responded 'yes' to any two items a woman was coded 'moderate'; and if she responded 'yes' to either one item or no items then she was classified as 'low' exposure
Age of child	Aged 0-11 months (34.2%) Aged 12-23 months (33.1%) Aged 24-35 months (32.7%)	Age of child in completed months
Age of mother	Aged 19 years or less (11.4%) Aged 20-29 years (68.1%) Aged 30 years or more (20.5%)	Age of mother in completed years.
Caste/tribe	Scheduled caste/tribe (36.5%) Other Backward class (29.6%) Other (33.9)	
Religion	Christian (6.3%) Muslim (12.0%) Other (81.7%)	
Phone ownership in village	Fewer than 1 in 20 or none (86.1%) At least 1 in 20 own (13.9%)	Number of households in the respondent's village that had telephone connections
District level characteristics		
Proportion of households with access to water piped into their residence	Low [<10%] (45.8%) Medium [10-29%] (31.8%) High [30+%] (22.4%)	This variable is based on the proportion of households in a district that had access to water piped into their residence.
Proportion of households with access to public tap water	Low [<10%] (51.6%) Medium [10-29%] (30.0%) High [30+%] (18.4%)	This variable is based on the proportion of households in a district that had access to water piped into their street or neighbourhood
Proportion of households with electricity connection		This variable is based on the proportion of households in a district that had electricity connection.
Proportion of children who received vitamin A	Low [<.25%] (41.9%) Medium [25-39%] (42.5%) High [40+%] (15.6%)	This variable is based on the proportion of children in a district who had received a dose vitamin A.
Proportion of mothers or children who received vitamin A, iron folic or/and tetanus injection		This variable is based on the proportion of mothers or children in a district who had received a dose vitamin A, iron folic or/and tetanus injection.
Proportion of households with access to their own flush toilet	Low [<10%] (42.2%) Medium [10-19%] (30.4%) High [20+%) (27.4%)	This variable is based on the proportion of households in a district that had access to their own flush toilet.
Proportion of households with access to their own pit toilet	Low [<10%] (65.2%) High [10-19] (14.3%) High [20+%] (20.5%)	This variable is based on the proportion of households in a district that had access to their own pit toilet.

Most mothers of children included in the analysis had no schooling but about one in five had at least middle school qualifications. Similarly, the majority of mothers had low exposure to mass media such as television or newspapers (see Table 1). A significant proportion of children (39 per cent) were from poor economic background; about 13 per cent were from well-off family backgrounds. An overwhelming majority of rural children (80 per cent) lived in houses that had no toilet facilities or had to share a toilet with others in the community. The rest had access to their own flush toilet or pit toilet.

Over a quarter of rural children were reported to be of small or very small body stature at the time of survey. A similar proportion of children were of fourth or higher birth order. Less than one half of mothers and children (45 per cent) received ante and postnatal health care. Quite a substantial proportion (26 per cent) did not receive any health care services as defined in this paper (Table 1). Over one third of the rural children were of scheduled caste/tribe background. A majority of children also lived in districts with poor sanitation, lack of potable water, and poor overall infrastructure development.

The variables listed in Table 1 were a subset of a large set of co-variates that were examined for their relationship with stunting. The variables that were not significant at the bivariate level were dropped from further analysis. In the survey, information on many indicators of economic well-being, health care utilization, health, women's autonomy, and household hygiene was collected. As many of these indicators were correlated with each other, we either combined a number of them into one composite indicator, or dropped some to provide us with a true set of exogenous predictor variables. Thus, for example, we obtained a composite index for household economic status, health care utilisation and exposure to mass media. We examined individually a number of indicators (not included here) of maternal and child health services but they were either statistically not significant or highly correlated with the ones included in the final analysis.

As the prime variable of interest stunting is dichotomous, logistic multivariate regression models were employed (Hosmer and Lemeshow, 2000). We included a number of derived district level indicators of health infrastructure (access to toilet facilities and utilisation of maternal and health services) and socio-economic development (e.g.

proportion of households with electricity connection and access to tab water). Access to several goods, facilities and services that have an impact on nutrition and health is conditioned by their availability at the community level. Variables representing these factors were included in the multivariate model as controls to minimize confounding. The existence of a drainage system (either underground or open) and distance to schools, health centres, post-offices and banks all at the village level were not associated with the likelihood of being stunted. We also explored the interaction effects between mothers' education and the district level variables on toilet and water facilities. But the interaction terms did not improve the model substantially. These and other theoretically relevant but empirically unimportant variables were not considered in the analysis. We present here results from the most parsimonious logistic regression model.

The estimated effects of the explanatory variables of interest, maternal education, toilet facilities and birth weight of child are presented in odds ratios. All other variables presented in Table 1 were included in the model as control variables.

3. Results

Levels of chronic malnutrition among rural Indian children by major states are given in Table 2. Almost one in every two children living in rural India was stunted. About one-half of them were in fact severely stunted.

There appears to be three distinct geographical clustering in the levels of overall stunting. The southern states of Kerala and Tamil Nadu and the small north-eastern states grouped under Manipur had the lowest prevalence of chronic malnutrition of around 30 per cent. The large central Indian states of Rajasthan, Madhya Pradesh, Uttar Pradesh and Bihar had the highest level of about 55 per cent. And the rest of Indian states had levels in the 40s. It is interesting that the states that had over 45 per cent chronic malnutrition also had a greater proportion of children suffering from severe stunting compared to other states. The states with very high levels of stunting also fared poorly in overall human development (Planning Commission, 2002).

The estimated effects of mothers' education on the likelihood of a child under three years suffering from chronic malnutrition are given in

Table 3 for various Indian states. As expected, mothers' schooling was a strong predictor of stunting. Children whose mother had completed at least middle school were about 40-45 per cent less likely to be stunted than those whose mother was illiterate. Mothers with primary schooling reduced the chances of their children being stunted by about 27 per cent compared to those who had no schooling.

Table 2 Chronic malnutrition among children in rural India, National Family Health Survey 1998-99

State/Region	Number of children	Stunting		
		Severe (Z < -3 sd)	Moderate (-3sd <Z< -2 sd)	Total (Z< -2std)
India	17,571	24.9	23.2	48.1
North				
Himachal Pradesh	586	18.6	23.7	42.3
Jammu and Kashmir	616	18.4	22.6	41.0
Punjab	542	19.1	23.3	42.4
Haryana	669	26.2	26.8	53.0
Central				
Rajasthan	1,850	31.0	23.1	54.1
Madhya Pradesh	1,632	31.0	23.7	54.7
Uttar Pradesh	1,926	33.0	24.5	57.5
Bihar	1,865	34.4	20.4	54.8
East				
Orissa	1,005	17.7	26.8	44.5
West Bengal	671	20.9	23.7	44.6
Assam, Meghalaya, Tripura	1,032	32.0	17.3	49.3
Manipur, Mizoram, Nagaland, Sikkim	1,547	12.5	19.9	32.4
West				
Gujarat	607	25.7	20.4	46.1
Maharastra	650	16.3	28.2	44.5
South				
Andhra Pradesh	673	16.0	26.1	42.1
Karnataka	707	17.7	21.6	39.3
Tamil Nadu, Kerala	993	11.2	17.2	28.2

The relationship between the level of a mother's education and the likelihood of their children being stunted is in the expected direction in all Indian states. However, the magnitude and the statistical significance varied considerably between states. Thus the estimated effects of the mother holding a high school and above qualification was statistically significant only in eight states, that for a middle school qualification in seven states and the effect of primary schooling was significant only in six states. In Rajasthan, Jammu Kashmir and Assam none of the education categories was important. In Bihar, Punjab, Haryana, West Bengal, Orissa and Karnataka, the mother's education reduced the likelihood of stunting in her children only if she had completed at least high school. It is interesting that whether

mothers' education was important or not did not follow the traditional regional groupings. Rather every region seems to have some states where mothers' education was unimportant or partially important and some other states where it was very important in the likelihood of a child suffering from stunting.

Table 3 Logistic regression estimates of mother's education on chronic malnutrition among children in rural India, National Family Health Survey 1998-99

State/Region	Estimated effects (odds ratio)			
	No schooling#	Primary complete	Middle school complete	High school and above
India	1.00	0.73**	0.61**	0.55**
North				
Himachal Pradesh	1.00	1.00	1.09	0.72
Jammu and Kashmir	1.00	0.48**	0.47**	0.48*
Punjab	1.00	0.74	0.76	0.37**
Haryana	1.00	0.90	1.28	0.47**
Central				
Rajasthan	1.00	1.09	0.75	0.75
Madhya Pradesh	1.00	0.68**	0.72	0.56
Uttar Pradesh	1.00	0.74**	0.70	0.42**
Bihar	1.00	1.07	0.88	0.55**
East				
Orissa	1.00	0.91	0.70	0.50*
West Bengal	1.00	0.52**	0.30**	0.57
Assam, Meghalaya, Tripura	1.00	0.67	1.00	0.58
Manipur, Mizoram, Nagaland, Sikkim	1.00	0.89	0.61**	0.71
West				
Gujarat	1.00	0.58**	0.33**	0.14**
Maharastra	1.00	0.95	0.49**	0.61
South				
Andhra Pradesh	1.00	0.54**	0.88	0.77
Karnataka	1.00	0.66	0.74	0.51*
Tamil Nadu, Kerala	1.00	0.79	0.55**	0.65

Note: Control variables included in model are mother's age, mother's body-mass index (bmi), a measure of mother's exposure to mass media, child's age, caste, religion, proportion with access to electricity in a district, proportion with their own flush toilet in a district, and proportion with access to their own pit/latrine toilet.
#--reference category; ** p<.05; * p<.10
* p<.10; ** p<.05; ns-not significant; # standard error adjusted for intracluster correlation at the PSU level

Table 4 provides the estimated effects of the availability of one's own toilet facilities on the likelihood of being stunted. Preliminary analysis showed that this variable was strongly correlated with access to potable water. For instance, provision of public or private water piped into a house is essential for a flush toilet. Thus the presence of a flush toilet in a house captures the effect of a number of factors including the public infrastructure in water, health and sanitation.

Table 4 Logistic regression estimates of the effect of household toilet facilities on chronic malnutrition among children in rural India, National Family Health Survey 1998-99

State/Region	Estimated effects (odds ratio)		
	No/Shared toilet	Own flush toilet	Own pit/latrine
India	1.00	0.72**	0.79**
North			
Himachal Pradesh	1.00	0.68	1.06
Jammu and Kashmir	1.00	0.39**	0.64
Punjab	1.00	1.02	1.64*
Haryana	1.00	0.72	0.89
Central			
Rajasthan	1.00	0.78	0.98
Madhya Pradesh	1.00	0.52**	0.60
Uttar Pradesh	1.00	0.89	0.64*
Bihar	1.00	0.48**	0.98
East			
Orissa	1.00	0.44**	0.16*
West Bengal	1.00	0.47**	0.60
Assam, Meghalaya, Tripura	1.00	1.18	0.83
Manipur, Mizoram, Nagaland, Sikkim	1.00	0.70	0.98
West			
Gujarat	1.00	1.67	0.73
Maharastra	1.00	1.58	3.37**
South			
Andhra Pradesh	1.00	0.99	0.26**
Karnataka	1.00	0.49	0.87
Tamil Nadu, Kerala	1.00	0.92	1.16

Note: Control variables included in model are mother's age, mother's body-mass index (bmi), a measure of mother's exposure to mass media, child's age, caste, religion, proportion with access to electricity in a district, proportion with their own flush toilet in a district, and proportion with access to their own pit/latrine toilet.
#--reference category; ** p<.05; * p<.10
* p<.10; ** p<.05; ns-not significant; # standard error adjusted for intracluster correlation at the PSU level

The likelihood of being stunted was reduced by over 20 per cent if a household had its own flush or pit toilet. But this was not universally the case across all the states. In most states, access to one's own flush toilet did reduce the likelihood of stunting but the relationship was statistically significant in only a handful of states. Where it was important, the magnitude of the effect was large: over a 50 per cent reduction in the likelihood compared to those with no own toilet facilities. With the exception of Andhra Pradesh, Orissa and Uttar Pradesh, there was no difference in the likelihood of a child being stunted between those who had a pit toilet and those who did not. In Punjab and Maharastra, the existence of a pit toilet as opposed to no toilet or shared toilet facilities increased the risk of stunting. Compared to maternal education, the effect of toilet facilities on the likelihood of chronic malnutrition was not large or widespread.

Table 5 Logistic regression estimates of the effect of size at birth of child on chronic malnutrition among children in rural India, National Family Health Survey 1998-99

State/Region	Estimated effects (odds ratio)		
	Average/Large size	Small size	Very small size
India	1.00	1.26**	1.72**
North			
Himachal Pradesh	1.00	1.25	0.57
Jammu and Kashmir	1.00	1.11	0.63
Punjab	1.00	1.59*	1.69
Haryana	1.00	0.63**	1.90
Central			
Rajasthan	1.00	1.60**	1.97**
Madhya Pradesh	1.00	1.23	1.61**
Uttar Pradesh	1.00	1.22	2.04**
Bihar	1.00	1.36**	3.20**
East			
Orissa	1.00	1.42**	1.63
West Bengal	1.00	1.05	2.04**
Assam, Meghalaya, Tripura	1.00	1.05	1.11
Manipur, Mizoram, Nagaland, Sikkim	1.00	1.57**	3.33**
West			
Gujarat	1.00	0.94	1.28
Maharastra	1.00	2.01**	1.77
South			
Andhra Pradesh	1.00	1.51	0.46
Karnataka	1.00	1.78**	2.40**
Tamil Nadu, Kerala	1.00	1.37*	1.82

Note: Control variables included in model are mother's age, mother's body-mass index (bmi), a measure of mother's exposure to mass media, child's age, caste, religion, proportion with access to electricity in a district, proportion with their own flush toilet in a district, and proportion with access to their own pit/latrine toilet.
#--reference category; ** p<.05; * p<.10
* p<.10; ** p<.05; ns-not significant; # standard error adjusted for intracluster correlation at the PSU level

Previous studies have strongly supported the link between low birth weight and the likelihood of chronic malnutrition in infancy and childhood. Evidence presented in Table 5 adds further support to this. Data on birth weight was not collected from a considerable proportion of children in rural India. But mothers did report on how big their child was when he/she was born. Although this is a subjective measure, we believe it is a good proxy for birth weight. As shown in Table 5, children of small stature at the time of birth were more likely to be stunted in their infancy and childhood. In fact, if the child was very small at birth there was 70 per cent more chance of it being stunted in the first three years of life than those children that were reported to be of average or large size.

Again, as in the case of maternal education and toilet facilities, there were substantial differences between the Indian states in the significance of

the relationship between birth weight and stunting. In those states in which over 45 per cent of their children under three years were stunted, the very small size of a child increased the likelihood by two or more times. This includes all central Indian states, West Bengal and Haryana. The exceptions were Karnataka and Manipur where the overall level of stunting was under 40 per cent but very small size at birth increased the likelihood by over two times. In a number of states, birth weight was not a significant predictor.

The other predictor variables that had significant effect on the likelihood of stunting were the economic status of the household and birth order of the child. Children from households with lower standard of living had about 30-40 per cent more likelihood of being stunted compared to those from well-off families. Similarly, the higher the birth order the greater the chance of being stunted. Female children were about 10 per cent more likely to be stunted than male children. Again, there were large variations between the 19 states in the effects of household economic status, gender and birth order.

4. Discussion

A number of indicators can be used to examine child malnutrition. We chose to focus on one indicator of anthropometric outcomes, height for age or stunting, among rural Indian children. Stunting is a robust indicator of the long term cumulative effect of the immediate causes of malnutrition: food intake, disease, parental caring, and feeding and health care practices. Stunting as a measure of malnutrition is also less amenable to short term changes in the immediate causes (Martorell, 1999; Pelletier, 1998; Falker and Tanner, 1986; Martorell and Habicht, 1986; Martorell, 1985; Waterlow *et al.*, 1977; Habicht *et al.*, 1974; Victoria, 1992).

National level studies of child malnutrition in rural India have been very few in number for want of data. The focus of such studies was different from the one adopted in the present analysis. For instance, Mishra, Roy and Retherford (2004) used the data from NFHS-2 (and NFHS-1) to examine the effect of gender and birth order on three indicators of child malnutrition, including stunting, for the whole of India and for two broad geographic regions. Mishra, Lahiri and Luthur (1999) analysed the NFHS-1 data for India with major regions as controls. Gaiha and Kulkarni (2005)

reported from another nationwide rural survey carried out in 1994 that household poverty was a critical determinant of chronic malnutrition.

We drew data from the 1998-99 NFHS-2 survey to focus on stunting in rural India and on the importance of three critical factors: maternal education, birth weight and household hygiene. We included a number of control variables in the multivariate model to obtain the net effect of maternal education, toilet facilities and birth weight. Also considered were district level controls and mother's body mass index that were not available in other studies on India. Mother's body-mass index is a good proxy for unobserved genetic and family background factors (Strauss, 1990; Handa, 1999), and district level variables can capture the effect of unobserved community level influences on child malnutrition.

The results presented above showed that the rate of stunting in India is one of the highest in the developing world—may even be considered 'appallingly' or 'distressingly' high. However, there is considerable variation in the rate of stunting across the states in India. While only about one in four children under the age of three years was stunted in the southern states of Tamil Nadu and Kerala, in the central/north Indian states of Uttar Pradesh, Madhya Pradesh, Rajasthan and Bihar about one in two children was stunted. Moreover, there were huge variations between the states in the influence of mothers' education, household hygiene and birth weight for chronic malnutrition.

While mothers' education substantially reduced the likelihood of being stunted for India as a whole, the magnitude of the effect and its significance varied considerably across India. In some states there was no effect and in others it varied from being marginal to being pronounced. Similarly, in some states mothers having had primary schooling made a substantial difference to the nutritional status of children, but not in other states. In some regions, maternal education mattered only if it was at least middle school. Similar patterns of variation between Indian states is found in the existence and magnitude on the likelihood of being stunted of the effect of access to a flush or pit toilet and birth weight of the child.

There is a large body of literature beginning with the groundbreaking work of Caldwell (1979) on the links between maternal education and child health (Caldwell, 1986; Wolfe and Behrman, 1987; Cleland and Van Ginneken, 1988; Raghupathy, 1996; Basu, 1997; Cleland and Harris, 1998;

Rosenzweig and Schultz, 1982; Kishor, 1993; Doan and Bisharat, 1990). Maternal education is believed to influence child health, including nutritional status, through at least two broad routes. First, maternal education can enhance access to knowledge that might influence the immediate determinants of nutritional status—food intake, feeding and child care and health care practices. For instance, educated mothers might adopt better domestic hygienic practices, provide balanced and appropriate food, and give timely and adequate health care (Strauss, 1990; Thomas, Strauss and Henriques, 1991; Handa, 1999; Behrman, 1995). Second, education improves the autonomy or power of women within family and society. Thus educated mothers are empowered to demand and allocate resources and to seek, negotiate and bargain with health care providers to obtain the best services possible for their children.

For want of data on birth weight, the reported size of body stature of children was used as a proxy indicator. The findings of this study showed strong association between small stature and stunting for rural Indian children; and this association varied across the states. It is generally accepted that low birth weight is a good summary indicator of long-term maternal nutrition, ill health, hard work, repeated pregnancies and poor antenatal and post-natal care (UNICEF and WHO, 2004; Kramer, 1987; Hoa et el., 1996; Gopalan, 1992; Sachdev, 1997). Physical environmental factors also determine the infant's birth weight and future health (Barker, 1992; Sachdev, 1997; Jefferis, Power and Hertzman, 2002). Strategies aimed at reducing the number of low birth weight babies in India could make substantial contributions towards achieving the Millennium Development Goal of further reductions in child mortality (Wilcox, 2001; United Nations, 2005).

The purpose of this paper was primarily descriptive. The analysis presented above has clearly shown that there are substantial variations between the Indian states not only in the level of chronic child malnutrition but also in the effects of three major determinants: maternal education, toilet facilities and child birth weight. These findings broadly correlate with the regional disparities in overall development in India (Panning Commission, 2002). States that have high levels of chronic malnutrition tend to rank at the bottom of human development index. In states where education does not have a significant effect on stunting, the factors likely to be important are the quality of infrastructure and access to food. This could arise from variations in the social meaning of education (Cleland and Harris, 1998). In

communities where only a small minority of mothers was educated, the lack of it might not signify anything more than identifying with the vast majority. On the other hand, in places where the majority of women attain some schooling, the lack of it might entail deprivation in health, economic and social wellbeing.

The findings of this paper have an important policy implication: specific strategies and programmes aimed at child nutrition in India need to be state or community specific. There seems no one pan-Indian solution for the very high levels of chronic malnutrition among rural children. Any progress made in reducing child malnutrition will contribute towards the Millennium goal of halving the prevalence of malnutrition in the next 10 years.

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Part V

SYNTHESIS AND POLICY IMPLICATIONS

14

Mortality, Poverty and Hunger Nexus: A Synthesis and Policy Implications[1]

Ian POOL, Kannan NAVANEETHAM,

Arunachalam DHARMALINGAM, Graziella CASELLI

1. The Unhealthy "Triptych": Mortality, Poverty, Hunger

The central aim of development is to improve the well-being of populations. Growth in per capita income and increases in productivity and production are among the means by which this may be achieved, but so too are a wide range of other factors in other sectors: education, social welfare, culture and health. The Millennium Development Goals (MDGs) of the international community, and the United Nations family of agencies identifies what the minimum requirements are if the wellbeing of the world's populations are to improve, or at least if inequities are to be reduced.

If the path to development is slow, or blocked, or inequitable in the way its rewards and its failures are distributed, then this will be manifested by increases in, or the growth of differential levels for three factors, what we have called here a "triptych" that paints a picture of societal exclusion: Mortality, Poverty and Hunger. Much of the focus in the MDGs is towards these factors directly, or working indirectly through others. However, the

[1] An earlier version of this chapter was originally published as a Policy Paper that synthesized key issues emerging from the discussion at the seminar held at the Centre for Development Studies, Thiruvananthapuram in February 2005. See Ian Pool (2007) Mortality as a Determinant and a Consequence of Poverty and Hunger: Policy Implications, CICRED Policy Paper no. 4, Paris, CICRED.

overarching issue is development and underdevelopment, and the avoidance of the development of underdevelopment.

In this chapter we explore the following themes:

- The interconnectedness between mortality, poverty and hunger;

- The need to recognise the cardinal roles of demographic phenomena as determinants and consequences of mortality, which is itself a demographic factor but one that also has other demographic attributes (e.g. age- and gender-specificity of risk);

- The need to recognise the diversity of situations in which mortality, poverty and hunger occur.

2. Major Conclusions about Mortality, Poverty and Hunger

2.1. That there is inter-connectedness between the components of the triptych

Poverty and mortality are inseparable–one cannot consider poverty without addressing issues of health. Equally well, it is impossible to understand health without taking into account levels of nutrition and its attendant factors: malnutrition and extreme hunger; over-nutrition, obesity and diabetes; and the broader political-economic, environmental and agronomic questions of food and water security. This was a very important conclusion to emerge from most of the papers. As we will show later, this has implications for the formulation and implementation of the MDGs. Poverty and hunger on the one hand have been thematically separated from health on the other hand. These are two aspects of health specifically identified in the MDGs (child and maternal health). The connectedness comes from the fact that hunger and malnutrition are key determinants of a high prevalence of ill-health, but equally well it can be argued that nutrition and poverty are inseparable (whether due to under-nutrition and low caloric intake, or over-nutrition and obesity, particularly because of reliance on a poorly balanced diet).

A corollary to this emerging from the seminar was that survivorship, measured by the avoidance of premature death, is an essential entitlement of development, and that, conversely, poverty increases the risks of failing to survive, thereby depriving a person of that entitlement. A further corol-

lary to this is that surviving well is also a basic entitlement, a principle enshrined in the 1978 Alma Ata Declaration of the WHO General Assembly (Health for all). Surviving well is an essential element of quality of life, and poor health is a factor of deprivation. These comments then reinforce the point that mortality and poor health are really aspects of exposure to poverty.

2.2. That a better understanding of the demographic dimensions of poverty and hunger is essential for a more effective implementation of the MDG.

Demographic factors, not just mortality but also a wide range of other ones, play a central role as determinants and consequences of poverty and hunger. Mortality is, by definition, a demographic variable, but beyond this and beyond infant and maternal death, there are other demographic aspects that must be taken into account in the MDGs. This holds true even for the population factor of mortality – e.g., the recognition of the significance of age-specific differences in rates – if the MDGs are to be addressed more effectively. The indigenization of a demographic perspective into MDG-planning will, at the very least, minimise the risk of loose interpretations of the MDG principles and thus increase the effectiveness of MDG action programmes. Population is not about counting people; it is about ensuring that people count in policy and planning. This returns the argument to the basic point made at the very beginning–that development, and thus the MDGs, are strategies by which human wellbeing is improved.

Age: Let us start with age-specific rates of mortality and their impacts. The most poignant example is the death of the child-rearing generation, which as a consequence increases the rates of orphanhood and decreases productivity. These in turn threaten food security in parts of Africa because of the way HIV/AIDS has cut a swathe through the population at active ages. One could cite many other examples of why the formulation and implementation of the MDGs must be systematically underpinned by an appreciation of demographic factors.

Geographical distribution and redistribution of the population: Think of the burgeoning metropolises of the third world. Or consider the pressures of poverty that push Chinese from underdeveloped regions to join the country's huge "floating population", which is itself highly age-specific in structure; or analogous movements that are illegally played out every single night,

mainly by the same age-group, say at the Straits of Gibraltar or along the US-Mexican border. Alternatively, think of the queues of young Pakistani men or of young South-east Asian women waiting for flights to the Gulf States, sometimes to an uncertain future. In their regions of origin these young, frequently undocumented migrants leave behind a labour force depleted by the absence of its most active members, often in areas that are environmentally threatened.

Family life: It is younger families that are most likely to have to shoulder the costs of child-rearing yet which may be the poorest for a number of reasons (e.g. the need to share their family income, shelter, food etc among their children, typically more numerous in poor regions, as well as the parents). Then there are the problems of a sole-parent, whether widowed or separated, a person typically in the prime childrearing ages who has to balance income generation, necessary to sustain their family, with all the caring and nurturing demands of family life. In addition, there is the fact that, even among the better-off in cash societies, career promotion and thus income may increase after the heaviest pressures of child-rearing have declined.

Age structural transitions: The global declines in fertility, sometimes reinforced by migration inflows/outflows, have produced momentum effects, typically "population waves" (and troughs) as cohorts (composed of people born around the same date) of differing sizes pass across different life-cycle stages. This decline alternatively places severe pressures on services and goods required at those ages when the waves peak, then forces cutbacks in services and goods as troughs emerge. This produces a complex situation for planners and policy-makers. Where changes in cohort sizes are highly perturbed because of past demographic events and trends (e.g. famines; fluctuations in fertility rates; migration flows), as in China or Russia, the need for more refined planning models that endogenize demographic variables becomes even more urgent. Conversely, these waves can aid MDG implementation because of a so-called "demographic bonus" when overall rates of demographic and economic dependency are low, due to declines in child dependency before aged dependency rates set in. Typically the bonus-period will be short and often falls within the time horizon of the MDGs (2005-15). Thus far from being a certainty, this period will offer a window of opportunity in which the bonus will be delivered only if the

opportunity is exploited (Goal 8 relating to mobilization of civil society is particularly apposite here).[2]

Ageing per se: Unless supported by family networks and/or a comprehensive welfare state the elderly may become increasingly impoverished, even when they are asset-"rich" (e.g. they may own a family dwelling yet face major problems due to maintenance and property taxes). The geographical propinquity of kin and affines, today increasingly minimised because of the migration effects noted above, is yet another population (spatial) dimension to this problem;

Gender: The MDGs highlight the need for gender equality–in Dr Nafis Sadik's seminal phrase "development without women is not development". But central to the realisation of this goal is the fact that, even in the absence of sex-prejudicial practices (e.g. sex-specific abortion; maternal deprivation), gender-specific, and typically also age-specific, demographic changes of all sorts (e.g. migration flows, mortality) have affected the gender balance and thus often placed extreme burdens on women and girls (far less frequently on men and boys).

Crosscutting and a function of all aspects of these factors noted above, and essential to societal wellbeing, are demographic factors, above all age-structure. A general principle emerges here. Demographic behaviours that are normative for the context in which they occur (e.g. migration from poor regions), and even in the absence of prejudicial practices may have disparate and inexorable impacts on various segments of populations, and thus require policy and planning responses that are refined to meet this situation.

2.3. That there is great diversity in the profiles and morphologies of populations disproportionately exposed to the ravages of the triptych

Poverty and its triptych companions act selectively. There is thus a great diversity in the situations in which the MDGs are to be implemented. This diversity is also multi-dimensional: regional, demographic (as by age- and gender), ethnic, populations in some minority or excluded groups. This multi-dimensionality must always be recognised if the international com-

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[2] See also *Policy Implications of Age-Structural Changes*, prepared by S.R. Adioetomo, *et al.*, Paris, CICRED Policy papers series, 2005; *Age-structural transitions: challenges for development* , Pool I., Wong L. R. and Vilquin E., (eds.), Paris, CICRED, 2006.

munity and governments are to be assured that some poor groups, or some poor areas, or some poor age-gender-groups, or some poor ethnic or minority or excluded groups are not overlooked in programmes that produce overall, averaged out, improvements in wellbeing.

There is yet another dimension to this. Because of the multi-faceted nature of poverty and other problems to which programmes have been directed in the past, reduction of poverty and other differences in wellbeing have frequently adopted fragmented, and/or uni-dimensional approaches.

A methodological rather than substantive point can be added at this juncture. The empirical analyses presented in the chapters in this book add to the implementation of the MDGs in another way. They provide some benchmarks for later evaluations of the progress of MDG implementation. These benchmarks are not just in terms of overall targets, although they may suggest ways in which these might be refined so as to be more realistic in some contexts[3], but are also in terms of the diversity of the problems faced in implementing the MDGs. A corollary to this is that the MDGs are essentially scale-neutral, yet, as will be shown below, the factors of the triptych operate at diverse scales.

3. Towards Analysis of the Triptych

Clearly then we are dealing here with a very critical issue that is at the heart of the United Nations' Millennium Development Goals. The findings presented in this volume identify ways in which the MDGs could be modified so as to increase their effectiveness. In short, the issues here are central to development, a major point to be discussed later.

In analysing the linkages between mortality, poverty and hunger, one is looking at a bi-directional question – m→ p and p→ m. However, the directionality was far more complex than this, for example, p→ m→ p, or m→p→m.

Research and policy interventions most commonly study the impact of poverty on mortality differentials, yet the converse is a very important

[3] E.g. what is a realistic goal for the reduction of infant mortality in the Gambia, as against what is feasible in countries which already have very low levels.

question. An example would be the effects of HIV/AIDS on poverty through factors such as orphanhood.

In this volume, in fact, only one chapter very specifically dealt with the relationship m→ p although it was implicit in a number of others. This m→ p study was at the micro-level, but not at the meso/macro. Nevertheless, it showed the social and economic impacts of death and the rites that immediately follow this.

In the past, most research touching on the field has been "univariate". Researchers have looked at mortality/health *or* at poverty, but not the interlinkages between them. We have tended to look at the prevalence and incidence of morbidity and mortality, and to attempt to explain trends, but the impacts of mortality should be examined. To take another case, we have established prevalence rates for HIV/AIDS, but far less about its socio-demographic impacts in terms of causing poverty.

Another major problem is that in making bi- or multivariate analyses, necessary for the research agenda that we are addressing – that is looking at mortality, poverty and hunger – one is dealing with three factors each going through its own transition. Nevertheless, this will rarely be in perfect tempo with the transitions in the other parts of the triptych, and thus a key factor to analyse and include in any explicanda is where each factor is, on its own transition path. Thus any population will find itself at one stage in a mortality or epidemiologic transition, at a different stage in a poverty transition, and yet another in its nutritional transition. The Pacific Island populations are often relatively advanced along the path of an epidemiologic transition, by some standards at an early stage in a poverty transition. However, in terms of a nutritional transition, especially the consumption of imported consumer items, they are advanced in a detrimental direction. Parenthetically, a poverty transition is part of general development, but is also something rather different – poverty, accompanied by poor nutrition yet high caloric intakes can occur in countries that, in classical economic development terms are highly developed.

4. Frameworks and Methodologies Relative to the Triptych

The question then arises: how can we capture these linkages and the different factors? A complication, just noted, is that the different stages of

the poverty, hunger (or nutritional) and mortality transitions may even require different measurements. The most self-defining of the trio is mortality which is the same everywhere–a death is a self-defining event–but once it is looked at in detail (by cause; by health factors that underpin it) then immediately difficulties are encountered.

To add to this there is a lack of frameworks. Although fragments exist, there is no overarching schema on the area under review. That said, the contributions to this volume produced a number of frameworks. For example, at the micro-level, Chapter 10 mapped the relationships between HIV/AIDS morbidity/mortality and poverty; and there was the life-span framework used in another paper (Chapter 2).

Moreover, a wide range of analytical strategies at different levels of aggregation are needed to investigate the issue. These strategies run from micro-level/qualitative to macro-level international cross comparisons. This reflects the complexity and diversity of the issue being analysed.

A further fundamental difficulty is how to measure poverty. Should the focus be on income and its proxies, or on what might be described as distributional factors? Whichever set of indicators is taken there is a need to measure population share. This is because we are measuring, above all, the impacts on people: a baseline question is how many are affected. Most potential variables are difficult to handle statistically. Even for an interval level measure factor like income, that superficially seems easy to calibrate, the researcher encounters major difficulties, both at the data collection (reporting is very difficult) and at the analytical stage. For example, mean income affects levels of poverty, but the appropriate benchmark is a constantly changing one. Among other factors are overcrowding, whether in households, or in neighbourhoods, including (for example) atolls in the Pacific.

It is also difficult to measure health, both its bio-medical and social manifestations. Among the dimensions to be analysed, mortality (all causes combined) is easier to analyse; mortality by cause is more difficult; and health/morbidity even more so. There are different approaches to achieve the last. At a population-wide level, various techniques allow for self-reporting of good health/poor health (e.g. the SF36), occurrence currently of morbid conditions, and daily living and thus functionality, which is possibly the most efficient to collect and analyse. There might also be

clinical data, but these represent only the "tip of the iceberg" of the prevalence of poor health conditions.

Finally, there is also a lack of data. Multivariate analysis is limited by the fact that in many countries data on one factor will be available, but not those on another.

5. Levels of Aggregation

This area is one in which analyses must be conducted at different levels of aggregation. For each of these levels–cross-comparative, macro, meso and micro–there are methodological problems. While multi-level analysis may seem to be the answer, this depends on data availability and also introduces its own problems. Moreover, special care must be taken to avoid breaches of the laws of aggregation, to avoid the so-called "ecological fallacy".

"Spatial" or "geographical capital" are important for analyses of the triptych. Its analogue at a lower level of aggregation, so-called "social capital" is also important. This could be for, say, neighbourhoods or the social groups involved in various institutions (say the parents and pupils in a given school zone). Spatial and social capitals both have implications for policy and planning.

Cross-national analyses are perhaps the most difficult to carry out yet they increase the power of the research. Not the least of the difficulties is the problem of availability of directly comparable data. Beyond this, there is the problem that bivariate measurement is affected by the stage of transition achieved by each of the different factors: poverty, mortality and nutrition. It is a bit like using ratios instead of rates: for ratios the analyst is never sure whether they are recording numerator or denominator effects, or both.

There is also a need to be aware of what one might call "meta" factors–for example, the path towards, as against the level of, development. Polities such as Cuba or Kerala have development trajectories very different from states with higher per capita GDP, but the latter typically have much less success in terms of distributional policies and thus are more inequitable. The traditional development studies question of the conflict between policies to accelerate growth in income and wealth, and those that focus on distribution and equality of access according to need is fundamental to this

whole problem, and for all levels of aggregation. One might also include the general environment and natural resources as "meta" factors, as is clear in the papers on West Africa and the Pacific (Chapter 4).

Macro-level analyses are arguably the easiest to effect, because, typically, regional data are available from censuses, and for vital estimates. However, there are problems of "averaging out" intra-regional differences, and thus variance is reduced. Furthermore, multivariate statistical analysis becomes problematic, especially where the number of units (say states/provinces) is limited.

Meso-level analyses are the most difficult in a sense, not because of conceptual issues but because of problems of measurement. This is exacerbated when analysts have to turn to Demographic and Health Surveys (DHS) or similar sources to examine clusters. The question of intra-cluster variance, both statistical and substantive, becomes as critical as inter-cluster.

If data are available in a form that is robust in terms of both sampling and non-sampling properties, then micro-level analyses are easiest, especially if the analysis is at a national level (i.e. the unit of analysis is the individual or household). The problem here is that, typically, the cluster size in samples is far too small for assessing the effects as intervening variables of community contextual factors. This may be a factor even when census mesh-blocks are the unit of analysis.

The results presented in the chapters in this volume seemed to show that household level data have produced the clearest results. However, one is left with a concern that meso-level factors that are difficult to measure may play an important role in household differentials, but are not really taken into account. In sum, study design becomes a factor of paramount importance in this area.

6. Results

The studies point to relationships between the three factors of mortality, poverty and (to a lesser degree) hunger. Few studies directly measured this latter factor. Nevertheless, the relationships are complex.

Perhaps the relationships are so complex in reality that studies can not–should not–attempt to disaggregate mortality, poverty and hunger. Perhaps

they are a symbiotically interwoven "trio", and that is why we have called them the *exclusion triptych* or cycle.

This cycle is an extension of the conventional malnutrition-infection cycle, adding in poverty. This was reinforced in the chapter 2 where it showed how nutrition operated both directly and indirectly: maternal deprivation and malnutrition affected the health status of mothers and has an immediate impact on the size and other health indicators of neonates, and this effect can be traced across the entire life cycle. Chapter 4 showed the effects on nutrition of agricultural production and food security, and increasingly, water security which are increasingly problematic, for reasons that include natural environmental factors. In some regions, over- and under-nutrition can co-exist, as in the Pacific. This said, it must be recognized that poverty may play a major role in societies where the morbidity patterns are dominated by non-communicable disease rather than communicable–some small-island countries of the Pacific are examples. These countries have often have a "double-burden", of communicable diseases such as diarrhoeal, respiratory and other acute infectious diseases, and the non-communicable diseases that cause premature adult mortality. Finally, new factors of infection are operating, as chapter 4 showed in the case of HIV/AIDS. The fact that its force is most marked at the young working, productive ages means that there is a loss of the most productive sector of the workforce both for the formal and subsistence sectors. There are also other cost impacts.

The relevance of the effects of this triptych is most marked for children. This finding is a reinforcement of the well-established axiom of development studies specialists: that the most sensitive index of development in all its manifestations is the health of children. Thus we may modify this to state what we could call the *Trivandrum Axiom*: that the most sensitive index of development is the "exclusion triptych" of "mortality – poverty – hunger".

This merely underlines another key point coming out of this volume. Generally speaking, *distributional* "economic" and "social" factors seem more related to the triptych than does income per se. Distributional factors relate not just to more equitable distributions of incomes, wealth, goods and service. More important seem to be factors such as access to health and

related services, and more general infrastructural issues, as can be illustrated by intra-state differentials in the triptych in Kerala.

Moreover, distributional factors may be strongly affected by intervening factors, particularly cultural differences. Nutrition is a critical factor, whether as a result of factors such as agricultural production or cultural practices.

Distributional problems may be exacerbated by the "withdrawal of the state" and dependence on the market. This typically comes about as a result of the application of current development paradigms. Beyond this, radical social change producing factors such as rapid urbanization and intense migration flows have sometimes directly exacerbated these effects.

Last but not least, there is a high degree of selectivity in terms of the force of the exclusion triptych. Indigenous and other minorities outside the mainstream of society seem most likely to be negatively affected. There is even selectivity at a higher level of aggregation – at the regional or country level.

7. Policy Issues

The chapters in this volume have all raised policy questions. Although the contributions to this volume extend the knowledge base on the triptych, there are still many gaps and these affect theory, conceptualisation and measurement, and thus limit the generation of empirical information. This means that the evidence-base on the eradication of poverty and hunger, and on the reduction of mortality is still incomplete, although advanced significantly by this volume.

A critical policy issue for the eradication of poverty and hunger, and the reduction of mortality is the development path–whether distributional or focused on national income generation and the market. Swings between these paradigms have further destabilised the policy environment. There is also the conundrum of whether or not the two approaches are mutually exclusive or can be satisfactorily married.

A major policy issue is the point just noted in the last section of this chapter: the selectivity of the effects of the triptych. Everywhere there are problems with "excluded" groups, such as the more rural and minority populations that fall outside the mainstream. Their disadvantage will often

be heightened by the fact that frequently they lack access to the political process, are unable to make their voices heard, and lack access to social and physical capital, to services and the infrastructure.

Policy formulation and implementation relating to the exclusion triptych is essential to the realisation of the Millennium Development Goals (MDG) of the United Nations family. In fact, for most of the UN's goals, by addressing the triptych the international community and civil society have a means of informing the action plans of the MDGs and providing a focus for them.

Finally, this volume validates and also very much reinforces the significance of the MDGs and the need to mobilize the international community to address the problems it hopes to reduce. Equally, the results and analyses presented in this volume have shown that the MDGs are directed at what is a very diverse problem. As noted above, there may be a need to modify or enhance aspects of some of the MDGs if their full effect is to be achieved.

The MDGs represent a consensus across the international community. To that extent, they provide a focused way of summarising and synthesizing the policy factors that emerge from this volume. To conclude, then, this chapter turns to the MDGs.

8. Millennium Development Goals

The chapters in this volume provided a number of analyses that identified places where the MDGs might need refining or strengthening. For its subject matter, the triptych, the MDGs were of varying degrees of interest, as represented by the following hierarchical prioritisation:

GOAL 1
GOALS 4, 5 & 6
GOALS 2, 3 & 7

Goal 1: Eradicate extreme poverty and hunger

The volume identified the fact MDG1 focuses on poverty and hunger, but does not recognise health as part of an inseparable triptych. This is something the international community might need to explore further if poverty and hunger, and their two prime consequences, are to be addressed

A number of the chapters presented here raised other issues. Chapter 4 on West Africa argues that, in fact, poverty and hunger are almost inseparable twins. It is also possible that even when production is adequate for many poor groups food may be priced out of the market, and thus hunger could be widespread even among relative "plenty". The quality of nutrition is also a factor to be taken into account; poor nutrition could occur even where there is a "cornucopia" of food.

Turning to refinement of analyses so as to increase the effectiveness and efficiency of programme delivery, in the scientific analysis each part of the triptych has strategies that can be carried across to the other(s). Studies on poverty and hunger have focused on groups that are disadvantaged, whereas the mortality literature has emphasised the demographic dimensions. This extends beyond cross-sectional analyses to cohort and other longitudinal studies that identify how negative impacts (e.g. exposure to risk of a given disease; nutritional deprivation) at one life-cycle stage can be carried forward to later stages.

Goals 4, 5, 6: Reduce child mortality, improve maternal health, and combat HIV/AIDS, malaria and other diseases

All the chapters consider child mortality as a factor central to the triptych, and even as a sensitive indicator of overall development. For some regions such as West Africa, the average annual rates of decline that would be necessary to attain the MDG make this goal almost unattainable without massive interventions, probably with international support (see MDG 8 below).

Maternal health and general wellbeing are critical also. It has both direct effects on the triptych, and, through neonatal infant loss because of maternal deprivation, it also has indirect impacts.

The reduction of the incidence and prevalence of HIV/AIDS, malaria, tuberculosis and other major infectious diseases would have an immediate effect on mortality. However, as some of these affect active ages, their reduction would have an impact on both production and productivity, thereby assisting in maintaining food and water security, services and industrial output.

Goals 2, 3 and 7: Achieve universal primary education, Promote gender equality and empower women, ensure environmental sustainability

The first two of these are very important elements of development in their own right, but in the present context, they are rather more indirect determinants of change. Equally, they are correlated to all of mortality, poverty and hunger, both directly through socio-economic mechanisms, and indirectly through level of knowledge as a determinant of understanding of mechanisms allowing the reduction of the effects of the triptych.

Education is very much linked to poverty, hunger and mortality–for the reasons noted in the last paragraph, the better-educated are less likely to be disadvantaged. Some papers have shown that a critical threshold is reached only when adults have received education at the secondary or tertiary level.

Gender equality and the empowerment of women are essential if the effects of the triptych are to be reduced. The mechanisms are both directly through mechanisms such as education and economic wellbeing, and indirectly through intermediate factors such as maternal health.

Again, environmental sustainability is an important goal in its own right, but the links to the triptych are less important and immediate, and are often indirect. Two linkages do however stand out: first, the immediate environment surrounding the dwelling of the household/family; second, there are the resources available to the family/household, including access to land, and the capacity of the land to produce adequate amounts of food.

Goal 8: Develop a global partnership

This is a cross-cutting goal, an enabling one, a strategy, rather than an objective, but one that is essential to the achievement of the other seven MDGs. Without global partnerships then it is difficult to see how less developed regions and countries can eradicate poverty and hunger and reduce mortality.

9. Concluding Remarks

Absolute and relative deprivation continues to afflict a large section of the population in the developing world. This deprivation is most obviously manifested by the levels, growth and differentials in poverty, malnutrition

and mortality. The arguments and findings presented in this volume confirm that poverty, nutrition and mortality are not just inter-related and complex but that they are inseparable. The failure to survive, or not surviving well, is strongly influenced by exposure to poverty and the resultant lack of access to social, economic and cultural resources.

The success of the strategies and programmes aimed at eradicating poverty and hunger is highly dependent on the demographic contexts of a particular country. The demographic factors, including the age structural transitions, are simultaneously causes and consequences of the triptych, poverty, hunger and mortality. As the impact of the triptych is selective, policy and planning responses must be refined to meet demographic patterns and parameters.

The contributions in this volume suggested a number of pathways that could be followed and frameworks for understanding the interconnections between mortality and poverty. The chapters in this volume also highlight the importance of culture, economic relationships, market-oriented production, history and geography for arriving at a better understanding of poverty, nutrition and mortality.

We believe that the analysis, findings and arguments of this volume extend the knowledge base on poverty, hunger, nutrition and mortality. They also reinforce the significance of the Millennium Development Goals and the need to mobilise the international community to address the problems of poverty, hunger and mortality.

CICRED – UNFPA - CDS

International Conference on

Mortality as Both a Determinant and a Consequence of Poverty and Hunger

Thiruvananthapuram, India: February 23-25, 2005

Programme

	23 February 2005
9.00 AM–10.00 AM	Registration
10.00 AM-11.00 AM	**Inaugural Session** Chair: Dr. K.C. ZACHARIAH, Hon. Fellow, CDS.
10.00 AM-10.10 AM	Welcome address Dr. K. N. NAIR, Director, CDS.
10.10 AM-10.25 AM	About CICRED and Conference theme Dr. Christophe Z. GUILMOTO, Director, CICRED
10.25 AM-10.45 AM	Inaugural address Dr. K. MOHANDAS, Director, Sree Chitra Tirunal Institute of Medical Science and Technology, Thiruvananthapuram
10.45 AM-10.55 AM	Address by the Chairman
10.55 AM-11.00 AM	Vote of Thanks Dr. K. NAVANEETHAM, Conference Coordinator, CDS.
11.00 AM-11.30 AM	Coffee/Tea break
11.30 AM-1.00 PM	**Session I: Poverty and Hunger: Causes and Consequences of Mortality-Latin America** Chair: Dr. Christophe Z. GUILMOTO
Elsa PEREZ	Causes of death of the less than 5-year-old population of the South Pacific Region of Mexico, 1990-2002
Rogelio J. LOPEZ COUSIN	Profile of the Changes in the Levels of Mortality in the Republic of Panama, for Country and Indigenous District and Some Considerations Related to Poverty and Health, Period: 1990-2000
Discussants	Dr. Omas Bulan SAMOSIR and Dr. Mala RAMANATHAN
Rapporteurs	*Asish Thomas George and Shyjan.D*
1.00 PM – 2.00 PM	Lunch-Break

2.00 PM–3.30 PM	**Session II: Poverty and Hunger: Causes and Consequences of Mortality-Africa** Chair: Dr. Kesaia SENILOLI
Rania ROUSHDY	Urban Poverty and Child Mortality: A Case Study of Households and Neighbourhoods in Cairo, Egypt
Benoit LIBALI	Impact des funérailles sur le cycle de la pauvreté et de la faim à Brazzaville en République du Congo
Discussants	Dr. Bintiwatie SOEDHWA and Dr. S. IRUDAYA RAJAN
Rapporteurs	*Varinder Jain and Rathikanta Kumbhar*
7.00 PM–10.00 PM	Dinner hosted by CDS and CICRED (Hotel Muscat)
	24 February 2005
9.30 AM–11.00 AM	**Session III: Poverty and Hunger: Causes and Consequences of Mortality-Asia** Chair: Dr. Chandan MUKHERJEE
Josefina V. CABIGON	Poverty: the Cause and Consequence of Philippine Mortality
Omas Bulan SAMOSIR	Comparative Study on the Effects of Socio-economic Factors, Industrialisation, and Urbanisation on Mortality in Indonesia and Japan
Discussants	Rogelio J. LOPEZ COUSIN and Dr. U.S. MISHRA
Rapporteurs	*Rudra Narayan Mishra and Venkata Narayana.M*
11.00 AM-11.30 AM	Coffee/Tea break
11.30 AM–1.00 PM	**Session IV: Poverty and Hunger: Causes and Consequences of Mortality-Asia (ctd)** Chair: Rania ROUSHDY
D. NARAYANA	Perception, Poverty and Health: A Contribution
P.K. BHARGAVA	Poverty Linked HIV/AIDS as Determinants of Mortality: Evidence from a Community Based Study in Karnataka, India
D. JAYARAJ	A Preliminary Analysis of the Relationship between Generalised Deprivation and Infant Mortality in India
Discussants	Josefina V. CABIGON and Dr. M. KABIR
Rapporteurs	*Alice Sebastian and Syam Prasad*
1.00 PM – 2.30 PM	Lunch

2.30 PM-3.30 PM	**Session V: Poverty and Hunger: Causes and Consequences of Mortality-Asia /Latin America**. Chair: Dr. P. R. Gopinathan NAIR
Xiaoying ZHENG	Regional Differences of Population Life Expectancy in China
Bintiwatie SOEDHWA	Longitudinal Analysis of Possible Links between Poverty and Mortality in Suriname
Discussants	Dr. Rania ROUSHDY & Dr. K.S. JAMES
Rapporteurs	*Nadhanael and Remya Prabha*
6.00 PM-9.30 PM	CICRED Meeting, Hotel Samudra, Kovalam
	25 February 2005
9.30 AM–11.00 AM	**Special Session: Mortality, Poverty and Hunger: Towards the Development of a Knowledge Base** Chair: Dr. Ian POOL
K. NAVANEETHAM and J SUNNY	Theoretical linkages between Mortality, Poverty and Hunger: The case of South Asia
Alieu SARR	Mortality, a determinant and a consequence of poverty and hunger in West Africa
Kesaia SENILOLI	"They Are Digging Their Graves with Their Teeth": Mortality, Poverty and Nutrition in the Pacific
Discussants	Dr. Vineetha MENON and Dr. D. JAYARAJ
Rapporteurs	*Subrata Mukherjee and Subramanian T.K*
11.00 AM-11.30 AM	Coffee/Tea break
11.30 AM-12.30 PM	**Synthesis and Closing Session** Chair: Dr. K.N. NAIR
Rapporteurs' Report	Mr. Subrata MUKHERJEE
Synthesis and Policy Issues	Dr. Ian POOL
General Discussion	Participants
Closing remarks	Dr. Christophe Z. GUILMOTO
12.30 PM-2.00 PM	Lunch
2.00 PM – 3.30 PM	Meeting of the policy paper committee
6.00 PM – 7.30 PM	Meeting of the editorial committee