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**Social context, social position and child survival:
Social Determinants of Child Health
Inequities in Nigeria**

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The cover page symbolizes the state of inequalities in Nigeria.

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*Dedicated to
The Lord God Almighty*

Abstract

Under-five mortality rate is a key indicator of the level of child health and overall well-being of a given population and is an indicator of the United Nations Millennium Development Goals 4. Of the estimated more than 10 million children that die worldwide each year, 41% of these deaths occur in sub-Saharan Africa. With over one million children dying yearly from preventable diseases in Nigeria, the country may not meet the other Millennium Development Goals by 2015. Child survival in Nigeria is threatened by poverty, nutritional deficiencies and illnesses, such as malaria, diarrhoeal diseases, acute respiratory infections, high maternal morbidity, mortality and vaccine preventable diseases. These are closely associated with measures of social position.

The overall aim of this thesis was to contribute to an understanding of the underlying mechanisms of child health inequities in under-five mortality in Nigeria in relation to social context, social stratification and social position. Specific objectives were to assess the role of mothers' religious affiliation, ethnicity, rural-urban migration and residence in disadvantaged urban neighbourhoods on under-five mortality in Nigeria.

Data from the 2003 Nigeria Demographic and Health Survey was used in these studies. This is a nationally-representative probability sample of 7864 households collected using a stratified two-stage cluster sampling procedure, from which data was collected by face-to-face interviews from 3725 women aged 15 to 49 years. These women contributed a total of 6029 live born children born to the survey. Information collected included birth histories, in-depth demographic and socio-economic information on illnesses, medical care, immunizations, and anthropometric details of children. The relationships between under-five mortality and mothers' religious affiliation was analysed in paper 1 using Cox regression. In papers II – IV, we used multilevel logistic regression analysis to assess the relationship between ethnicity, rural-urban migration and residence in disadvantaged urban neighbourhoods and under-five mortality.

Multivariate analyses showed that religious mortality differences were closely associated with the differential use of maternal and child health services among mothers of Traditional indigenous religion, which are in turn associated with poverty and low socio-economic position. Ethnic mortality differences were dependent in part on differences in individual-level socio-economic characteristics, and less directly related with inter-ethnic variation in health behaviour of the mothers. Applying three migration perspectives, mortality differences among migrant groups were associated with *disruption* of the migrant's social and economic well-being, their demographic and socio-economic *selectivity*, disparities in *adaptation* (utilization of maternal health services) due to underlying socio-economic differences between and within migrant and non-migrant populations, as well as the influence of community contexts. Residence in disadvantaged urban areas was associated with increased risks of under-five deaths. The risks increased with increasing level of disadvantage, and were explained both as a direct effect of living in a disadvantaged neighbourhood, and indirectly as a result of the socio-economic characteristics of people living in these disadvantaged neighbourhoods.

Together, the observed mortality differences among children of mothers assessed by the different measures of social position in this thesis are a reflection of the health inequities confronting children of mothers in low social positions.

Keywords: Social determinants of health, inequities, inequalities, social contexts, social stratification, social position, Nigeria.

Svensk sammanfattning

Mortaliteten för barn under fem år är ett av de viktigaste måtten på barns hälsa och välmående i en befolkning och är även en av indikatorerna för utvecklingsmålen i FN:s Millenniumdeklaration. Av de cirka 10 miljoner barn som dör varje år, sker 41 % av dödsfallen i Afrika söder om Sahara. Med över en miljon dödsfall bland barn per år i Nigeria, är det tveksamt om landet kommer att klara FN:s utvecklingsmål till 2015. Barnens överlevnad i landet hotas av fattigdom, näringsbrist och sjukdomar såsom malaria, diarrésjukdomar, akuta luftvägsinfektioner, hög mödradödlighet samt sjukdomar som går att förhindra med vaccinering. Samtliga dessa problem är nära relaterade till socioekonomisk position.

Det övergripande syftet med avhandlingen är att skapa förståelse för de underliggande mekanismerna bakom den ojämlika dödligheten hos barn under fem år i Nigeria i relation till sociala strukturer, social klass och social position. Särskilda mål har varit att värdera betydelsen av moderns religiösa tillhörighet, etnicitet, migration från landsbygd till stad, samt boende i ogynnsamma stadsmiljöer.

Studierna har använt data från 2003 års Nigeria Demographic and Health Survey. Dessa data kommer från ett representativt urval av 7863 hushåll i Nigeria där insamlande av data har skett genom ett tvåstegs klusterurval, med muntliga intervjuer av 3725 kvinnor i åldern 15-49 år. Dessa kvinnor tillförde sammanlagt 6029 levande födda barn till undersökningen. Insamlade data rör omständigheter kring barnens födelse, fördjupad demografisk och socioekonomisk information kring sjukdomar, hälsovård, vaccinering och antropometriska uppgifter om barnen. Sambandet mellan dödlighet för barn under fem år och moderns religion analyseras i delarbete I med Cox-regression. I delarbete II-IV används multilevel logistisk regressionsanalys för att fastställa sambandet mellan dödlighet hos barn under fem år och faktorer som etnicitet, förflyttning från landsbygd till stad samt boende i ogynnsamma stadsmiljöer.

Multivariabelanalyser visar att skillnaderna i dödlighet mellan barn till mammor med olika religiös tillhörighet har ett nära samband med det ojämlika utnyttjandet av mödra- och barnhälsovård bland mödrar som tillhör traditionell religion vilken även är relaterad till fattigdom och låg socioekonomisk position.

Skillnader i mortalitet mellan etniska grupper var delvis beroende av skillnader i socioekonomisk status på individnivå och mindre direkt beroende av mellan-etnisk variation i mödrarnas hälsobeteende. Vid tillämpning av tre olika migrationsperspektiv var skillnaderna i dödlighet mellan migrantgrupperna associerade till förändringar av personens sociala och ekonomiska välbefinnande, demografisk och socioekonomisk selektivitet, skillnader i anpassning (utnyttjande av mödravård) beroende på underliggande socioekonomiska skillnader mellan och inom migrantgrupperna, samt inflytande av samhälleligt kontext.

Boende i ogynnsamma stadsmiljöer var relaterat till ökad risk för dödlighet hos barn under fem år. Risker var större med ökad nivå av ofördelaktigt boende och visades både som en direkt effekt av boendet i dessa miljöer och indirekt som ett resultat av de socioekonomiska förhållanden som karakteriserar detta boende.

Sammantaget visar avhandlingen att skillnaden i dödlighet hos barn till mödrar som bedöms med olika mått på social position pekar på de ojämlikheter i hälsa som drabbar barn till mödrar i låga sociala positioner.

List of publications

This thesis is based on the following publications referred to in the text by Roman numerals:

- I. **Antai D**, Ghilagaber G, Wedrén S, Macassa G, Moradi T. Inequities in under-five mortality in Nigeria: Differentials by religious affiliation of the mother. *Journal of Religion and Health* 2009; 48(3):290-304.
- II. **Antai D**, Wedrén S, Bellocco R, Moradi T. Ethnic Disparities in child health in Nigeria: A multilevel analysis of individual and contextual factors. *Ethnicity and Inequalities in Health and Social Care* 2009; 4(2):39-48.
- III. **Antai D**, Wedrén S, Bellocco R, Moradi T. Migration and child health inequities in Nigeria: A multilevel analysis of contextual- and individual-level factors. (Submitted).
- IV. **Antai D**, Moradi T. Urban area disadvantage and under-five mortality in Nigeria: The effect of rapid urbanization. (Submitted).

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List of Abbreviations

AIDS	Acquired immune deficiency syndrome
CSDH	Commission for Social Determinants of Health
CI	Confidence interval
DHS	Demographic and Health Survey
DIC	Deviance information criterion
HIV	Human immunodeficiency virus
MCMC	Markov Chain Monte Carlo
MDG	Millennium development goal
NDHS	Nigeria Demographic and Health Survey
NPC	Nigerian Population Commission
OR	Odds ratio
ORC	Opinion Research Corporation
ORT	Oral rehydration therapy
PCV	Percentage change in variance
PQL	Penalized Quasi-Likelihood
RR	Relative risks
SE	Standard error
SEP	Socio-economic position
SSA	Sub-Saharan Africa
USAID	United States Agency for international Development
UADI	Urban area disadvantage index
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
VPC	Variance partition coefficient
WHO	World Health Organization

Definitions

Culture refers to the broad set of beliefs and practices specific to one's national, subnational, religious and/or ethnic identity that might contribute to different preferences for types of political and legal institutions, social participation, institutional development, lifestyle choices, and overall priorities. Both national policies and culture are conceptualized as antecedents to more proximal determinants of health, but are not explicitly analyzed in the study.

Ethnicity is defined as a set of characteristics (cultural, social, religious and linguistic) that form a distinctive identity shared by a community of people. It could also be described as the basis of social organization in the traditional context and thus encompasses a mosaic of observable and unobservable norms, beliefs, and rituals that govern various life events

Ethnic differences in health are systematic differences in health between different ethnic groups. Social inequities in health should, whenever possible, be described and analysed by ethnic background in countries with marked ethnic discrimination, as both the magnitude and causes of observed differences in health may differ by ethnic background within different socioeconomic groups. Conversely, descriptions and analyses of health by ethnic background should, whenever possible, be analysed by socioeconomic background, to assess the magnitude of socioeconomic differences in health within different ethnic groups.

Equity in health implies that, ideally, everyone could attain their full health potential and that no one should be disadvantaged from achieving this potential because of their social position or other socially determined factors.

Equity in health care is incorporates notions of fair arrangements that allow equal geographic, economic and cultural access to available services for all in equal need of care. Other dimensions of equity in health care include equal possibilities for adequate informal care and the same quality of professional care for all.

Social inequities in health are systematic differences in health status between socio-economic groups, as measured by income, education and occupation. All systematic social inequities in health within a country are socially produced, modifiable and unfair.

Social position is a term used to refer to both position in the socio-economic hierarchy and position in other dimensions of the social structure, such as sex, ethnicity, age, geography, political or religious affiliation etc.

Religion is a social entity or institution that is differentiated by particular beliefs and practices, requirements of membership and modes of social organization.

Migration, is a process of social change during which a person moves from one cultural setting to another in order to settle for a longer period of time or permanently.

1.0. Introduction

Childhood mortality rates declined substantially during the 1970s and early 1980s in most low- and middle-income countries (UNICEF 2004; WHO 2003; Delaunay *et al.* 2001; Ahmad *et al.* 2000), yet the levels remain excessive in many of these countries in comparison with high-income countries. The rate of decline in childhood mortality has shown evidence of slowing down in different regions of the world (Ahmad *et al.* 2000) and deteriorating in some countries (UNICEF 2004; WHO 2003; Agha 2000; Ahmad *et al.* 2000; Claeson *et al.* 2000).

These reversals in child survival gains are largely linked to infectious diseases, particularly acute respiratory infections and diarrhea (Feachem *et al.* 1991), economic decline (Ahmad *et al.* 2000; UNICEF 2004), the HIV/AIDS epidemic (Walker *et al.* 2002; UNICEF 2004; Adetunji 2000), increase in drug-resistant malaria (Snow *et al.* 2001; WHO & UNICEF 2003), low levels of vaccination coverage against childhood diseases (Rutstein 2000; Claeson *et al.* 2000) as well as armed conflict (UNICEF 2004) in several countries. Infant mortality rates in 1986 ranged from 171 per 1000 live births in Sierra Leone (the highest in sub-Saharan Africa) to 6 per 1000 live births in Sweden (UNICEF 2004). Such inter-country variations are reflective of the causal chain generated by social, economic and political conditions.

It is estimated that more than 10 million children under the age of five years die yearly around the world; seven out of ten of these deaths can be attributed to five main causes, which include malnutrition, pneumonia, diarrhoea, measles and malaria (WHO 2002a). 41 percent of these deaths occur in sub-Saharan Africa (SSA) (Black *et al.* 2003; Ahmad *et al.* 2000). About two-thirds of the child deaths in the low- and middle-income countries are as a result of diseases, such as acute respiratory infections, diarrhoea and malaria, for which practical and low-cost interventions of demonstrated effectiveness, such as immunization, oral rehydration therapy (ORT) and antibiotics exist. With universal coverage of these low-cost interventions, over half the 4.4 million deaths of children below five years of age estimated to occur in sub-Saharan Africa in 2000 could have been prevented by affordable policy interventions that are feasible for implementation in low-income countries (Jones *et al.* 2003; Tulloch 1999).

2.0. Background

2.1. Inequalities in childhood mortality between and within regions and countries

Inequalities in health persist within and between different regions of the world and continue to widen in many cases (WHO 2004a). In 1970, sub-Saharan Africa accounted for 19 percent of the world's under-five deaths; by 2006, the region's share of global under-five deaths soared to almost 50 percent. Of the global under-five deaths, the share of West and Central Africa's combined under-five deaths tripled between 1970 and 2006, from 10 percent to 30 percent, while the share for Eastern and Central Africa combined more than doubled. In contrast, the proportion for the rest of the world fell (UNICEF 2007).

Of the four sub-regions, Central Africa has made the least progress in reducing its number of under-five mortality since 1990, with its sub-regional aggregate increasing from 187 per 1,000 live births in 1990 to 193 per 1,000 live births in 2006. West Africa, in contrast, has managed to reduce its under-five mortality rate from 215 per 1,000 live births in 1990 to 183 per 1,000 live births by 2006 (UNICEF 2007). East Africa has seen steady progress, with a 28 percent reduction in the under-five mortality rate between 1990 and 2006, while Southern Africa has made a 17 percent increase in the under-five mortality rate over the same period (UNICEF 2007). In contrast, North Africa reduced its under-five mortality rate by 57 percent since 1990 from an average of about 40 per 1,000 live births, and is on track to meet Millennium Development Goal 4 (MDG 4) (UNICEF 2007).

Inequalities in health also exist within countries as evidenced by under-five mortality rate of 238 per 1,000 live births in Mali as well as 105 and 33 per 1,000 live births within a corresponding period in Kenya and Vietnam, respectively (ORC Macro 2005). Socio-economic inequalities in child health appear to be widening. Reductions in infant and under-five mortality have been fastest among the high-income countries (Pritchett & Summers 1996) and there is increasing evidence that rates of child mortality and malnutrition have fallen faster among the better off (Wagstaff & Nguyen 2001). The inequalities are also widening. Infant mortality rate was 180 per 1,000 livebirths in sub-Saharan Africa in 1990 and 9 per 1,000 livebirths in industrialised nations – a 20-fold difference. By 2000, this gap had increased to 29-fold with infant mortality rate of 175 and 6 per 1000 livebirths in sub-Saharan Africa and industrialised nations, respectively (UNICEF 2001).

Substantial inequalities in health also exist between socio-economic groups. Under-five mortality rate was 248 per 1,000 live births in the poorest wealth quintile in Mali and 148 per 1000 live births in the richest wealth quintile (Gwatkin *et al.* 2000a). In 1990, the World Summit for Children called for a worldwide reduction in child mortality to below 70 deaths per 1,000 livebirths (or one-third reduction, if this yielded a lower mortality rate) by the year 2000 (UNICEF 2001). The necessary investments in health systems and interventions needed to achieve such a reduction were not put in place in the 1990s, resulting in only five of 55 countries with an under-five mortality rate of 100 or more achieving the mortality reduction target set in 1990 (Black *et al.* 2003; UNICEF 2001).

By 2002, nations agreed to reduce under-five mortality rate by two-thirds by the 2015, from the base year 1990 as part of MDG Goal 4 for health (United Nations 2001). While substantial progress towards reducing child mortality since 1990 suggests that the target of reducing child mortality will be met in Northern Africa, Latin America, the Caribbean and South-Eastern Asia, progress has however been negligible in sub-Saharan Africa (United Nations Statistic Division 2005). Unless progress is accelerated significantly, there is little hope of achieving this goal (Haines & Cassels 2004; Nullis-Kapp 2004).

Current trends

Some countries have made great improvements and are on track to meet the MDG 4, while other countries, particularly in the African region, have stagnated or even lost ground (United Nations 2007a). Worldwide, 20 of the 25 countries with under-five mortality still at two thirds or more of the 1975 level are in sub-Saharan Africa (SSA). This slow progress has been attributed to disappointing advances in access to healthcare. The region still has vaccination coverage at significantly lower levels than in the rest of the world (United Nations 2007).

Current contraceptive prevalence in SSA remains as low as 21 percent, which is accompanied by an increase in the absolute numbers of abortions, most of which are performed under unsafe conditions (Sedgh *et al.* 2007), whereas contraceptive prevalence has increased substantially over the past 30 years in other developing regions, reaching up to 61 percent (United Nations 2004; United Nations 2008) and accompanied by decreased abortion. Childbirth care for mothers and newborns is also a source of poor progress towards the MDGs, with skilled health personnel attending close to half of all births each year in 33 countries (United Nations 2007). Sub-Saharan Africa is also the only region in the world where access to qualified health care providers at childbirth is not progressing (Koblinsky *et al.* 2006).

Poverty and health

The impact of poverty on children's health is dependent upon the lack of access to a variety of material and non-material resources, as well as environmental and psychological deprivation at the cultural, social and health levels (Bradley & Corwyn 2002). It is ultimately associated with social inequality i.e. an unequal distribution of opportunities (education, health etc.) and access to resources and services (Hornberg & Pauli 2007). Vertical social stratification, such as education, occupation and income are strongly associated with child health, as well as horizontal demographic characteristics, such as gender, age, type of household, place of residence, ethnicity, religion etc (Hornberg & Pauli 2007).

Low socio/economic position has been found to be associated with low birth weight, increased neonatal mortality and chronic diseases (Bradley & Corwyn 2002). While medical interventions can in principle prevent most early child deaths, they cannot eliminate the underlying causes of poor health, which are linked directly to those severely deprived or 30 percent of the world's children living in absolute poor conditions (UNICEF 2004). Eliminating extreme poverty is the key to improving global child survival rates, particularly over the long term.

2.2. The Nigerian context

Nigeria is a paradox; the country is rich but the people are poor. In spite of being the 6th largest producer of petroleum in the world, the 8th largest exporter and the 10th largest proven petroleum reserves in the world (UNICEF Nigeria), poverty is widespread in Nigeria and the country is paradoxically classified among the poorest countries in terms of human development index (UNDP 2009). In 2006, crude oil and gas reserves made up 99 percent of Nigeria's export revenues, 78 percent of government revenues, and 38.8 percent of the gross domestic product (GDP). Nigeria has a GDP per capita of 1,969 US\$. However, more than 70 per cent of Nigerians live on less than US\$1 per day (WHO 2006).

Disparities in poverty and health among Nigerians are marked. In 2004, poverty rates in rural areas were estimated at 64 percent, roughly 1, 5 times higher than the poverty rate of 43 percent in urban-areas. Regional disparities in poverty also exist; the poverty rate of 67 percent in the

North East region is almost twice the level of 34 percent in the South East (UNICEF 2008). The poverty gap in Nigeria is widening and a greater proportion of the nation's wealth is concentrated in the hands of the wealthiest 20 percent of the country. The wealthiest 10 percent in Nigeria is believed to own 31.4 percent of the total national income, while the poorest 10 percent own roughly 1.3 percent. About 50 percent of the total national income is owned by 20 percent of the highest income-earning group (UNDP 2001).

Nigeria is situated in West Africa and is bordered by Niger in the north, Chad in the northeast, Cameroon in the east, Benin in the west and about 850 kilometres of the Atlantic Ocean in the south. Nigeria has a total land area of 923,768 square kilometres, making it the fourteenth largest country in Africa by land mass. With a population of over 140 million people, Nigeria is the most populous country in Africa, the 10th most populous in the world, accounts for 47 percent of West Africa's population and close to one-fifth of sub-Saharan Africa's population (World Bank 2007). By 2006, life expectancy at birth was 45 years for males and 46 years for females. Total fertility rate was 5.7 per women, adult literacy rate was 66.8 percent and net primary school enrolment was 74 percent for females and 60 percent for males (WHO 2006).

Nigeria is composed of over 250 ethnic groups with the Hausa-Fulani, Yoruba and Igbo being dominant. Though all ethnic groups can be found in all regions, ethnic origin highly correlates with region of origin. Nigeria is predominantly Christian in most of the southern regions and predominantly Muslim in the core northern regions (Mberu 2005). Currently, the under-five mortality rate for the five years preceding the 2008 NDHS survey is 157 deaths per 1,000 live births, child and infant mortality rates were 88 and 75 deaths per 1,000 live births, respectively (NDHS 2008). Nigeria is one of the six countries accounting for half of worldwide under-five deaths. The country is positioned 2nd when ranked by total number of child deaths and 17th when ranked by under-five mortality rate (Black *et al.* 2003).

2.3. The concept of social determinants of health

Many of the inequalities in health within and between low-, middle- and high-income countries are as a result of inequalities in the social conditions in which people grow, live, work and age; these social conditions are referred to as the social determinants of health (SDH) (Irwin *et al.* 2006; McGinnis *et al.* 2002; Marmot & Wilkinson 1999; Shaw *et al.* 1999). Social determinants of health include both societal-level influences on health (living and working conditions and the broader social structures in which they are embedded) as well as individual-level risk factors (health behaviours) (Graham 2004a).

In March 2005, the World Health Organization (WHO) launched its own Commission on the Social Determinants of Health (CSDH) to investigate the underlying determinants of health inequalities within populations (Lee 2005; Marmot 2005). In response to these health inequalities, the WHO set up the independent Commission on Social Determinants of Health in 2005, with the aim of creating greater policy attention to the social causes of disease in every country (CSDH 2008).

Social determinants of health point to both specific features of, and to, the pathways by which social conditions affect health as well as how they can potentially be altered by informed action (Krieger 2001; Berkman & Kawachi 2000; Marmot & Wilkinson 1999). Health inequalities exist within high-income countries as well as within low- and middle-income countries. These inequalities in health occur along several axes of social stratification including socio-economic, political and cultural axes. Though studies on health inequalities show that poor health is not

restricted to people at the bottom of the socio-economic hierarchy, people that are either at the bottom of the distribution of global and national wealth, or marginalized and excluded within countries present an urgent moral and practical focus for action.

The relation between socio-economic position and health is stratified, with children of parents at the upper end of the social strata having healthier lifestyle patterns (Wardle & Steptoe 2003; Diez-Roux *et al.* 2003), lower prevalence of chronic diseases (Chen *et al.* 2006), better well-being (Halldorsson *et al.* 1999), and lower risks of dying young (Ostberg & Vågerö 1991) than children of parents in lower social strata. This is true for stratification by income (Starfield *et al.* 2002; Chen *et al.* 2006), education (Mondal *et al.* 2009; Fussell & Gauthier 2003), occupation-based measures of socio-economic position (Antai 2009a; Abu Habib *et al.* 2008), characteristics by area of residence (Khawaja *et al.* 2008; Fotso *et al.* 2007), employment status (Titaley *et al.* 2008; Koenen *et al.* 2006), and social capital (Harpham *et al.* 2006; Cassell *et al.* 2006).

This relationship creates a social gradient in health that runs from top to bottom of the socio-economic spectrum and is seen in low- (Karim *et al.* 2006; Macassa *et al.* 2003; Berhane *et al.* 2002), middle- (Murphy *et al.* 2006; Diaz 2002) and high-income countries (Marmot 2004; Victora *et al.* 2003). The social gradient in health refers to the state of worse health of those who are at a lower level of socio-economic position, whether this is measured by educational attainment, income, or occupational level, and includes even those who are already in relatively high socio-economic groups (Isaacs & Schroeder 2004; Berkman & Kawachi 2000; Daniels *et al.* 1999).

The pursuit of equity and the reduction of inequalities in health by improving the health and survival chances of the socio-economically disadvantaged within countries has become an important goal of several national governments and international organizations over the years (Irwin *et al.* 2006; Jong-wook 2005; Graham 2004a; 2004b; AbouZahr 2003; Braveman & Gruskin 2003a; Victora *et al.* 2003). Major arguments for aiming to reduce these inequalities have either been social justice (Levy & Sidel 2006; Anand *et al.* 2004; Braveman & Gruskin 2003b; Alleyne *et al.* 2000), health as a global public good (Chen *et al.* 1999), or health as a capital input into economic development, with health inequalities being the cost of economic growth (Commission on Macroeconomics and Health 2001).

2.3.1. Why reduce health inequalities?

Reasons for seeking reductions in inequalities are that:

i) It is morally indefensible not to allow human beings the opportunity to enjoy the essential freedoms and the mechanism through which other freedoms can be enjoyed (Sen 1999).

ii) Reducing health inequalities would bring health and non-health benefits to others within the population besides those having the worst health (Woodward & Kawachi 2000). Investing in improved housing may result not only in lower incidence of respiratory disease, but may also lead to less strain and violence in families, with consequent benefits to all members of society – a “spill-over” effect (Kawachi & Kennedy 1997).

iii) Inequalities are largely avoidable and disparities in health are not an inevitable consequence of effective interventions to improve population health in general and reduce inequalities (Woodward & Kawachi 2000), even though some forms of public health interventions may result in a widening of health inequalities. The distribution of effects depends on the nature of the intervention - structural and environmental interventions are likely to affect populations more evenly than educational programmes aimed at individual behaviour change (and also have greater potential to reduce health inequalities) (Woodward & Kawachi 2000).

iv) Economic inequalities are not accidental, but result from decisions made by society on issues that affect health and welfare of their populations (Galbraith 1998).

v) Cost-effective interventions are largely available, and reducing inequalities in certain cases will lead to better health outcomes than might be achieved by similar expenditures elsewhere.

vi) Inequalities can incite discontent and inter-group enmities that disrupt social order within a country and can be a cause of social instability. Differences between countries can in turn contribute significantly to global instability (Alleyne *et al.* 2000).

vii) Health is a unique resource for achieving other objectives in life, such as better education and employment. Thus, reducing health inequalities promotes the freedom of individuals and societies (Sen 1999) and aids in poverty alleviation (Alleyne *et al.* 2000).

Technical and medical solutions such as disease control and medical care are vital to the well-being of populations. However, they are not enough to meet today's major health challenges and overcome health inequities, and will need to be supplemented by empowerment of individuals, communities and nations (Commission on Social Determinants of Health 2007; Marmot 2006; UNDP 2005; Stern *et al.* 2004). Without action on social determinants, countries in greatest need will neither meet the health-related Millennium Development Goals nor achieve global targets for reducing chronic diseases such as cardiovascular diseases, cancer and diabetes (Strong *et al.* 2005). The social determinants of health approach has several advantages to global health, among which are that: *i)* It seeks to redress the imbalance between curative and preventive action as well as individualized- and population-based interventions; *ii)* It bridges the artificial distinction between technical and social interventions, and demonstrates how both are necessary aspects of action; and *iii)* It offers a better hope for sustainable and equitable outcomes by acting on structural conditions in society (Baum 2002).

2.3.2. Health disparities - inequality or inequity?

There are social hierarchies in all societies within which economic and social resources are distributed unequally in ways that infringe upon people's freedom to lead the life they value (Sen 1999). This in turn has a significant impact on health and its distribution in society. Whitehead (1992) defines *health inequalities* as "differences in health, within and between countries that are judged to be *unfair, unjust, avoidable* and *unnecessary* (i.e. they are neither inevitable nor irremediable), and which systematically burden populations rendered vulnerable by underlying social structures and political, economic and legal institutions.

Health inequalities are measurable differences in health experience and health outcomes between different population groups according to socio-economic position, geographical area, age, disability, gender or ethnic group (Leon *et al.* 2001; UNDP 2000; Whitehead 1992), and systematically put groups of people that are already socially disadvantaged (poor, female and/or members of an ethnic, racial, or religious group) at further disadvantage with regards to their health (Braveman & Gruskin 2003b).

Whitehead argued that which health differences can be considered inevitable & unavoidable and which can be said to be unnecessary & unfair would vary by place and time. She put forward seven main general determinants of health differentials, namely:

i) natural and biological variation; *ii)* health-damaging behaviour (free informed choice); *iii)* transient health advantage of one group over another when that group is first to adopt a health-

promoting behaviour (as long as other groups have the means to catch up fairly soon); *iv*) health-damaging behaviour (with severely restricted degree of choice of lifestyles); *v*) exposure to unhealthy, stressful living and working conditions; *vi*) inadequate access to essential health and other public services; and *vii*) natural selection or health-related social mobility involving the tendency for sick people to move down the social scale.

The general consensus is that health disparities associated with biological variation, free informed choice and transient health advantage when adopting a health-promoting behaviour (factors in categories 1, 2 and 3 above) are less likely to be unavoidable or fair health inequalities. Whereas those differences arising from determinants where individuals have less choice in lifestyle, working conditions or access to health care and other public services (categories 4, 5 and 6) are more likely to be considered *avoidable* and *unjust*, and thus inequities. Therefore, where inequalities in health are avoidable, and yet they are not avoided, they are regarded as being inequitable. For example, much of the differences in health among individuals are attributable to natural biological variation.

Variations in health between old and young, men and women would fall into this category. For example, higher prevalence of coronary heart disease among men 70 years of age compared to men aged 20, and the higher incidence of osteoporosis in elderly women compared with elderly men; these can clearly be attributed to the natural aging process of human beings and biological differences between men and women, respectively. These health differences are “unavoidable” and are therefore not unfair. Others however argue that health inequity involves more than mere absence of inequality, given that some health inequalities are neither preventable nor remediable (Kawachi *et al.* 2002).

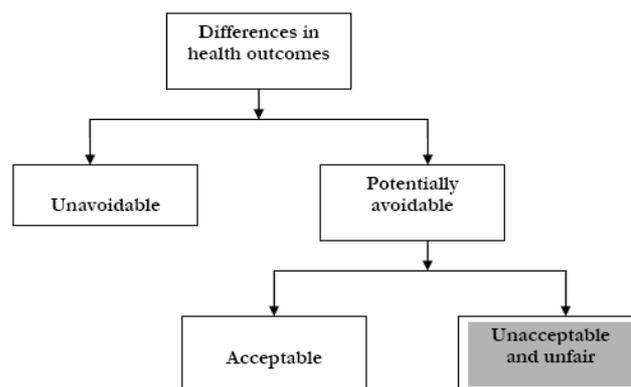
However, much of the differences between different groups in society cannot be attributed to biological variation; rather, other factors are implicated. Whether the resulting health differences are considered unfair would depend to a great extent on whether people chose the situation which caused the ill-health or whether it was mainly out of their direct control (Le Grand 1982). For instance, as a result of lack of resources, individuals in poorer social groups may have little choice but to live in unsafe and overcrowded housing, to take unsafe, dirty and low-paying jobs, or to experience frequent unemployment. The higher rates of ill-health arising from such environmental factors are clearly inequitable.

Inequities can be roughly divided into three main categories: 1) inadequate access to essential health services; 2) exposure to unfavourable social and living conditions; and 3) health-damaging behaviour that cannot be modified by individual choice alone (Alleyne *et al.* 2000). The crux of the distinction between equality and equity is that the identification of health inequities requires normative judgment hinging upon (a) one’s theories of justice; (b) one’s theories of society; and (c) one’s reasoning underlying the origin of health inequalities. Since the identification of health inequities involves normative judgment, science alone cannot determine which inequalities are also inequitable, nor what proportion of an observed inequality is unjust or unfair (Kawachi *et al.* 2002).

Figure 1 suggests that judgements about justice and fairness imply that health inequalities are at least in principle avoidable. Admittedly, judgement about avoidability is complex since they have to be understood in a broad sense. The causes of health differences are also not mutually exclusive; rather, they tend to interact. Socio-economic and environmental factors, including lifestyles, play a major part in health differences, with biological factors and the effects of sick people moving down the social scale playing only a small part (Whitehead 1992).

Equity (also referred to as social justice or fairness) is an ethical concept grounded in principles of distributive justice (Daniels *et al.* 1999). Equity means that individuals should have equal opportunities to pursue a life of their choosing and be spared from extreme deprivation in outcomes (World Bank 2005). From an equity perspective, the distribution of opportunities is more important than the distribution of outcomes. However, opportunities, which are potentials rather than actuals, are harder to observe and measure than outcomes (World Bank 2005).

Figure 1 Judging the equity of health outcomes



Adapted from Whitehead 1992

Health equity is the absence of unfair and avoidable or remediable health differences in one or more aspects of health status across socially, demographically, or geographically defined population groups, within and between countries (Braveman & Gruskin 2003b; Starfield 2001; Whitehead 1992). Health is a product of several types of previous and current exposures superimposed on genetic predispositions. Thus, achieving health equity is fundamentally a political process based on a commitment to social justice rather than to survival of the fittest (Starfield 2006).

2.3.3. Determinants of under-five mortality in low- and middle-income countries – “proximal” and “distal”

The nature of the determinants of child survival can be combined into a basic framework pioneered by Mosley & Chen (1984), which presents determinants in a hierarchical manner based on proximity in time and place to the outcome measure. These determinants operate at different hierarchical levels of causality since they occupy different positions in the causal chain of events that influence the risk of child morbidity and mortality. They can be classified into proximal and distal determinants (Huynen *et al.* 2005; Macinko *et al.* 2003; Mosley & Chen 1984).

Proximate determinants

The “proximal” (or “downstream”) determinants directly influence the risk of morbidity and mortality. They are grouped into five categories: *i*) maternal factors (e.g. mother’s age, parity and

birth spacing); *ii*) environmental contaminants (e.g. air, food/water/fingers, skin/soil/inanimate objects and insect vectors); *iii*) nutrient deficiency for mother and child; *iv*) injuries (accidental or intentional); and *v*) personal illness control (preventive and curative measures).

Most studies on determinants of childhood mortality have concentrated on these lower-level (proximate and intermediate) factors (Fotso & Kuate-Defo 2005) because they are good measures of conditions under which children are conceived, born and grown (Fotso & Kuate-Defo 2005; Macassa *et al.* 2004). Thus, it has become generally accepted that socio-economic determinants, such as maternal education, household characteristics and household income, exert an effect on under-five mortality by acting through the more proximate or direct determinants of health (Houweling 2007), which are robust determinants of both infant and early childhood mortality (Kuate-Defo 1994).

Social stratification influences inequalities in under-five mortality through proximate determinants, of which some of the most important will be discussed here:

Environment is an important proximate determinant of under-five mortality. Environmental risk factors account for about one-fifth of the total burden of disease in low-income countries (World Bank 2001a). Hygiene, the use of safe water and the immediate environment where the child lives, including indoor air pollution may act to directly or indirectly affect child health. The use of safe drinking water (Esrey 1996), the safe disposal of faeces and hand washing after defecation and before food preparation can protect children from diarrhoea and other communicable diseases (Curtis & Cairncross 2003; Curtis *et al.* 2000).

Poor living conditions, such as the quality of housing structure (building materials), inadequate ventilation in combination with prolonged exposure to indoor air pollution in family homes produced by burning coal or biomass fuels (wood, dung and fibre residues) for cooking and heating increase the risk of pneumonia in children (Bruce *et al.* 2000; Smith *et al.* 2000). So also does availability of safe water, provision of sanitary facilities (type of toilet) and hand hygiene (Curtis *et al.* 2000, Curtis & Cairncross 2003). As with nutrition and feeding, environmental factors serve as mechanisms of social stratification and are directly correlated with the socio-economic position at the individual- (Simondon *et al.* 2001), household- and neighbourhood or community-level (Mutunga 2004; Powell & Stewart 2001). These characteristics increase the exposure to disease pathogen, affect children's well-being and result in lasting consequences of social inequality throughout the life-course (Solari & Mare 2006).

Malnutrition is an important proximate determinant in low- and middle-income countries. The survival of children in low-income families may be affected by malnutrition and micronutrient deficiencies of their mothers before and during pregnancy (Duggan & Fawzi 2001; Ashworth & Antipatis 2001; Brabin *et al.* 2001; Wagstaff 2000). A malnourished child is less capable of fighting infections, and malnutrition is a contributory cause of between one third and half of all under-five deaths (Black *et al.* 2003; Caulfield & Black 2002). Exclusive breastfeeding throughout the first 6 months of life provides the required nutrients and reduces infant mortality from infectious diseases and malnutrition (Kramer *et al.* 2001). In addition, child malnutrition tends to be more common among the poor than among the better-off (Wagstaff & Watanabe 2000).

Fertility characteristics associated with the mother, such as mothers' age at birth, parity and birth spacing are important proximate determinants of under-five mortality and can improve the survival prospects of subsequent children (Wagstaff *et al.* 2004; Liljestrand 2000).

Preventive and curative health care utilization can also directly affect under-five mortality risks. Professional prenatal care and institutionalized (hospital or health centre) assistance at birth, childhood vaccinations and treatment of infectious diseases can enhance child and mother

survival (Wagstaff *et al.* 2004; Mosley & Chen 1984). Prevention strategies, such as measles immunization, regular use of insecticide-treated bednets for the prevention of malaria (Abdulla *et al.* 2001) can reduce illness and deaths among children.

Each of these preventive measures displays a socio-economic gradient, with pronounced effects among poor children (Koenig *et al.* 2001; UNICEF 2001) and countries (Gwatkin *et al.* 2000a). Poor or delayed professional care-seeking contributes up to 70% of child deaths (Terra de Souza *et al.* 2000). The decision-making involved in seeking professional healthcare is associated with socio-economic status (Gwatkin *et al.* 2000a) and is linked with treatment compliance and child health outcomes (Homedes & Ugalde 2001).

Distal determinants

The “distal” (or “upstream”) determinants are farther back in the causal chain and affect under-five mortality via proximal determinants, their inter-related mechanisms, levels, trends and distributions. These are made up of socio-economic factors, which are grouped into three broad categories: *i*) individual-level variables (parental education and occupation), cultural factors (tradition, beliefs, norms and practices regarding the origin and causation of children’s illness or death); *ii*) household-level variables (income and wealth); and *iii*) community-level variables i.e. ecological setting e.g. geography and climate, political economy and health systems (Arah *et al.* 2005; WHO 2002a; Mosley & Chen 1984). The farther one moves from the direct, proximal determinants of disease, the more complex the causal certainty and consistency. In contrast, distal determinants tend to affect different sets of proximal determinants thereby having the potential to make very large differences (Rose 1992).

This line of thought is exemplified by the common assumptions that: *i*) diseases are attributable to several causes, located outside and within the body; *ii*) the “social” lies in the realm of the *distal*; *iii*) the “biological” belongs to the *proximal*; and *iv*) the “distal” and “proximal” are connected by *levels*, e.g. societal, institutional, household and individual, which can be conceptualized as “*near to*” or “*far from*” the causes under consideration. For instance, “distal” societal factors drive the risk of smoking, but how smoking harms health involves “proximal” biology (Whitehead & Dahlgren 2006; WHO 2005). Current discussions of causal pathways, especially in studies on the social determinants of health, focus mainly on how “upstream” societal factors shape “downstream” or proximal exposures, thereby affecting population health (Kunitz 2006; Levy & Sidel 2006; Whitehead & Dahlgren 2006; WHO 2005; Krieger 2001; Evans *et al.* 2001).

Focusing on “upstream” societal factors may provide research and policy solutions directed at the level of the target population, and the development of prevention strategies aimed at the social patterns and structures that shape people’s chances to lead healthy lives within the societies in which they live (WHO 2005; Szklo & Nieto 2000). This has been argued to be the most effective prevention strategy for the total population, in contrast to proximate exposures, which tend to be individually-oriented and in tune with clinically-oriented “high-risk” prevention strategies (WHO 2005).

Understanding the nature of these relationships is important in informing the responses needed to improve health and reduce inequalities. Further arguments against focusing on, and investing in, the health of individuals are based on the fact that: *a*) one’s life chances depend upon *contextual factors* (i.e. ambient risks that are imposed on individuals through their micro and macro environment or the behaviour of others); and *b*) *early life course* influences affect adult health. The conditions that need to be met in order to regard health inequalities as fair are, in fact, extremely stringent (Kawachi *et al.* 2002).

2.4. Social context (underlying determinants)

Child survival is determined by a complex interplay of biological, demographic and socio-economic factors (Argeseanu 2004; Lillie-Blanton & Laveist 1996). Each child is born with its personal characteristics, most of which are shaped, altered and constrained by circumstances and choices made by the mother, both before and after the child is born. The mother is simultaneously embedded within the household (parent's, husband's, or her own); thus, the health and survival of the child is determined by the resources available to the household, its choices and social position within the community (Argeseanu 2004). Likewise, the resources, networks and culture within the community influence child survival. Social context refers to “the life experiences, social relationships, organizational structures, societal influences and structural forces that determine health and well being” (Sorensen *et al.* 2003).

Social position on the other hand refers to “an individual's location or place within the society in which they live” (Diderichsen *et al.* 2001), or to both position in the socio-economic hierarchy and position in other dimensions of the social structure, such as sex, race/ethnicity, age, geography, political or religious affiliation, disability and sexual orientation (Graham 2004a; Braveman & Gruskin 2003; Whitehead *et al.* 2000). Social positions are generated by, or derived from a particular social context i.e. classifications of social position will vary in societies with different economic or industrial structures (Diderichsen *et al.* 2001).

An increasing amount of literature on social determinants of health emphasize that individual risk factors tend to cluster around or are associated with an individual's *social position*, as well as characteristics of the broader *social context* or wider social and economic policies of the society in which the individual resides (Evans *et al.* 2001). Social context and social position may also play an important role in buffering or predisposing different population groups to the “social consequences” of disease or injury, thereby implying that the pathways leading to an individual's ill health are inextricably linked to the social setting. Furthermore, in order to articulate effective interventions to redress health inequities, it is contingent to elucidate the pathways through which social context and social position are linked to health outcomes and social consequences of disease (Evans *et al.* 2001).

Social context also refers to a spectrum of societal factors that cannot be directly measured at the individual level. It encompasses the structural, cultural and functional characteristics of a particular society. The link between social context and health outcomes is emphasized for the following reasons:

- i) Aetiology:* the social environment facilitates a better understanding of disease aetiology, given that the social environment (i.e. the structure and culture of the social context) may be a contributing factor in disease and injury causation. The social environment is made up of the groups we belong to, the neighbourhoods we live in, the organization of our workplaces, and the policies that shape our lives (Yen & Syme 1999; Hallqvist *et al.* 1998);
- ii) Conceptual issues:* populations are not merely collections of individuals; rather, they are also a collective or social system in which the behaviour and health of its individual members are profoundly influenced by its collective characteristics and social norms. The causes of ill health cluster systematically in populations and the effects on an individual may depend on the exposure and outcome for other individuals. Hence, contacts between “susceptible” and “contagious” individuals are crucial for the transmission of both biological/infectious agents and social behaviour (Evans *et al.* 2001; Rose 1992);
- iii) Measurement issues:* certain health risks cannot be defined at the individual level, only at the “group” or social level (Merchant *et al.* 2003; Starfield 2002; Evans *et al.* 2001; Caughya *et al.* 2001; Stafford *et al.* 2001). Indicators of context can often be measured as aggregates of characteristics

of individuals in a population, such as average income or wealth rates (Reidpath 2005; Diez-Roux 1998). In other situations, integral measures, such as cultural norms, legislation and institutional arrangements are used to capture aspects of the social context that are not simply a function of aggregating individual characteristics (Diez-Roux 1998); and
iv) Social structure of society: the social context is made up of central social structures of society that generate and distribute power, prestige, income, wealth, and risks in different social positions. Social context exists on local, regional, national and global levels (Evans *et al.* 2001; Najman 2001; Brunner & Marmot 1999; Diderichsen 1998; Stronks *et al.* 1997; Dahlgren & Whitehead 1991).

2.5. Social position

2.5.1. Theoretical framework for the study of social determinants of child health inequities

Several theoretical models have been developed to aid the understanding of social determinants of health. The conceptual framework used in this thesis is presented in Figure 2. It applies the Diderichsen and Hallqvist model to present the origins and mechanisms by which social inequities affect child survival in low- and middle-income countries such as Nigeria (Diderichsen *et al.* 2001). Inequities in under-five mortality between populations in different social positions are the outcome in this framework, and their magnitude is determined by the four mechanisms that are responsible for bringing about child health inequities. Each mechanism and potential counter-policies at appropriate policy entry points for interventions are identified here.

2.5.2. Mechanisms

Social stratification (Mechanism 1)

Health-damaging exposures and behaviours at the individual level tend to be embedded both within an individual's social position in the society, and the wider determinants or social context of child health inequities, such as the structure, culture and function of a social system. This social context generates and distributes wealth, power and risks e.g. poverty, conflict, gender norms, labour policies, rapid urbanization, the political structure and governance. The hierarchical structuring of society in high-income countries with well-structured labour systems is generally in the form of social class or socio-economic position (SEP).

Socio-economic positions are theoretical concepts for which education, occupation and income are traditionally used as key indicators, though there are differences in meaning and operationalization (Bartley 2004; Berkman & Kawachi 2000). However, it is unclear to what extent concepts such as socio-economic position can be transferred, while retaining their meaning, to low- and middle-income countries that are less industrialized, largely rural and agrarian, and have less well-defined income-generating activities, which themselves vary significantly in terms of social, economic, cultural and political contexts.

Within these low- and middle-income countries, characteristics associated with social position, social status or prestige, differ between societies. In addition to education and occupation, these characteristics may be associated with gender, age, marital status, number and the sex of the children, caste, skin colour, ethnicity, religious affiliation, neighbourhood of residence, migration status, household income- and material possessions, and land- or livestock ownership, (Braveman 2006; Koupil 2005; Graham 2004a; Braveman & Gruskin 2003a; Van Poppel *et al.* 2003; Mays *et al.* 2002; Evans *et al.* 2001; Statistics South Africa 2001; Krieger 2000). These also qualify as

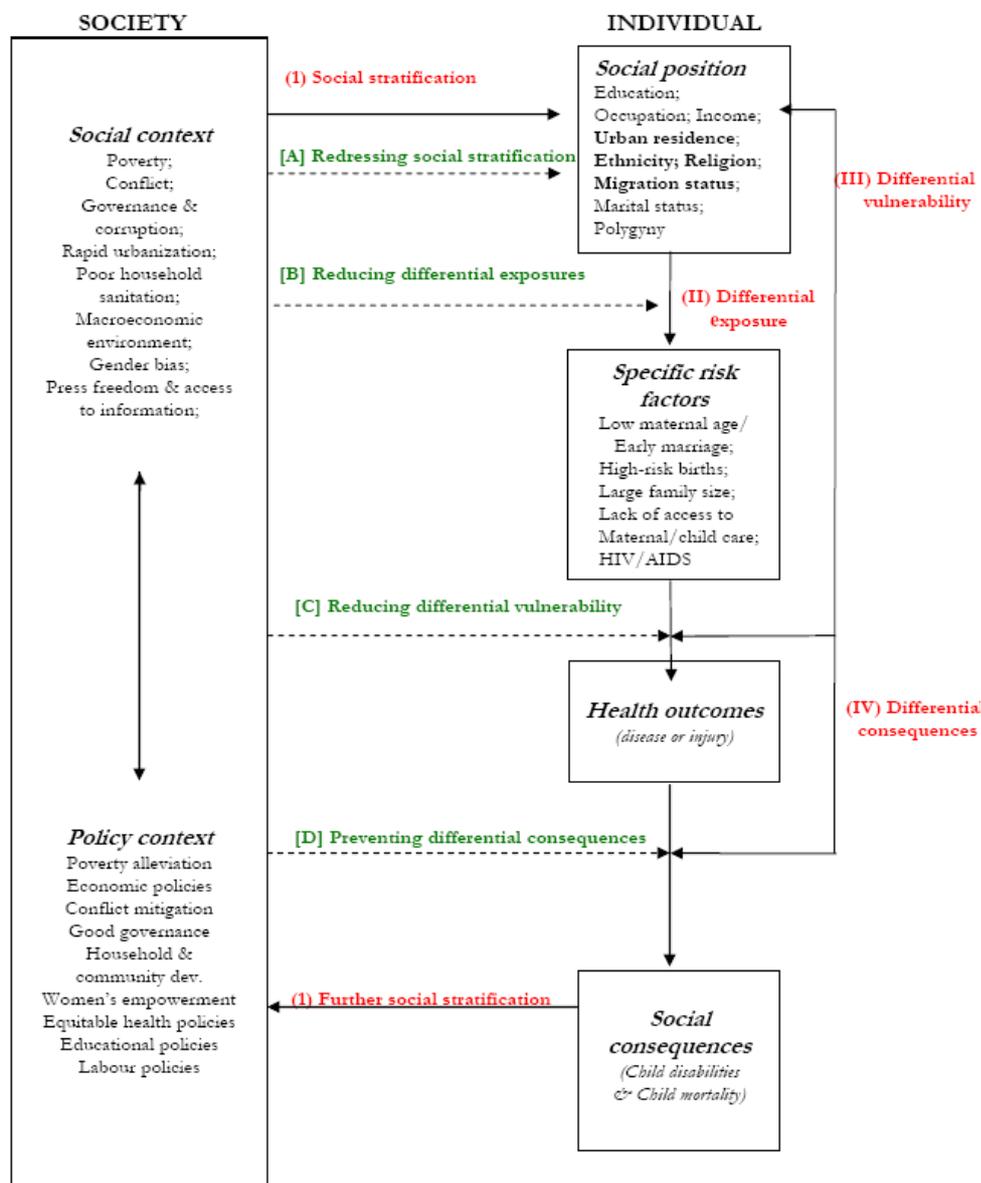


Figure 2. Conceptual framework for studying the health impact of social context and social position.

Key: Mechanisms Policy entry points

Source: Adapted from Diderichsen *et al.* 2001.

fundamental causes of people's (unequal) access to health resources and represent dimensions of both social and health inequality.

Mechanisms 1 (Social stratification) emphasizes how social contexts create social stratification and assign individuals to different social positions, which then determine their opportunities to produce differences in health outcomes (Evans *et al.* 2001). In other words, the distribution of health and disease in a society is not random, but is associated with the social position of the individual, which in turn defines the life and working conditions of people and social groups. By the widening of inequalities between members of society through the differential allocation of available resources and social benefits based on different measures of social position, social stratification as a characteristic of social context, assumes a central role in determining social inequities in child health (Grusky 1992). In Figure 2 above, social stratification - the process of assigning individuals to social positions is shown as (I). The social contexts are "those central engines of society that generate and distribute power, wealth and risk", such as poverty, conflict, rapid urbanization, the educational system, labour policies, gender norms and political institutions.

Differential exposure (Mechanism 2)

Social stratification may in turn generate differential exposure (mechanism II) to health-damaging conditions i.e. individuals from lower social positions are exposed to different health risks compared to individuals from higher social positions. These exposures may vary between social groups in terms of type, amount, or duration (differential exposures). For example, low social position in sub-Saharan African countries like Nigeria tends to be associated with living in impoverished environments, which in turn exposes children to adverse environmental conditions, water-borne diseases, overcrowding and other infectious diseases like malaria, Tuberculosis and infectious hepatitis (Gordon *et al.* 2004; Whitehead 1992). This mechanism is the central focus of this thesis.

Differential vulnerability (Mechanism 3)

As a result of social stratification, individuals in different social positions may be exposed to varying risk factors, which in turn result in differential vulnerability (mechanism III) to the effect of specific diseases and injuries. For instance, higher frequency of diseases and injuries among individuals with lower socio-economic status (Hogan & Marandola 2005; Blakely *et al.* 2003; Wilkinson 1997).

Differential consequences of ill health (Mechanism 4)

Social stratification may also result in differential consequences (mechanism IV) of ill health (in this case, child disability and child mortality). For instance, in many low- and middle-income countries, the absence of social support networks, such as a welfare system, healthcare coverage, unemployment or disability insurance, result in the burden of the costs of healthcare or work absence due to sickness or disability being borne directly by individuals and their families.

The ability to cope in such circumstances would depend on the individual's socio-economic circumstances, which in turn is dependent on the individual's social position – the lower the social position, the more likely the absence of coping strategies or buffers (such as other family members), or inability to afford private insurance, resulting in child disability/child mortality. The social and economical consequences of illness may feed back into the etiological pathways and contribute to the further development of disease in the individual. On an aggregate level, this effect might even feed into the context of society as well, thereby influencing aggregate social and economic development (further stratification I) (Diderichsen *et al.* 2001; Sen 1999).

2.5.3. Policy entry points

As presented above (section 2.5.1), the Diderichsen model (Diderichsen *et al.* 2001) identifies four policy entry points or levels of action for interventions and policies, namely: redressing social stratification; reducing differential exposures to health-damaging factors; reducing differential vulnerability; and preventing differential consequences of ill health that can deepen social inequities.

Redressing social stratification (Policy entry point A)

A strategic starting point for policy interventions is recognizing the significance of the social context and its characteristic feature of social stratification. Thus, redressing social stratification is the most critical area in terms of diminishing disparities in health. Two general types of policy approaches are proposed; the first approach is the promotion of policies that alter or diminish social stratification itself by reducing inequalities in power, prestige, income and wealth linked to different socio-economic positions e.g., labour market, education and family welfare policies. The second approach is a systematic impact assessment of socio-economic policies to mitigate their effects on social stratification. The policy implications resulting from the studies in this thesis fall into this category.

Reducing differential exposures (Policy entry point B)

This entails reducing the specific exposure to health-damaging factors suffered by people in disadvantaged positions. In general, most health policies do not differentiate exposure or risk reduction strategies according to social position. There is increasing experience, however, with health policies aimed at combating inequities in health that target the specific exposures of people in disadvantaged positions, including aspects such as unhealthy housing, dangerous working conditions and nutritional deficiencies that have an impact on exposure to child health risks.

Reducing differential vulnerability (Policy entry point C)

This involves reducing the vulnerability of disadvantaged people in low social positions to the health-damaging conditions they encounter. An alternative way of modifying the effect of exposures is through the concept of differential vulnerability. Intervention in a single exposure may have no effect on the underlying vulnerability of the disadvantaged population; rather reduced vulnerability may only be achieved when interacting exposures are diminished or relative social conditions significantly improved. An example would be the benefits of literacy and female education as one of the most effective means of mediating women's differential vulnerability.

Preventing differential consequences (Policy entry point D)

These policies intervene through the health system to reduce the differential or unequal consequences of ill-health and prevent further socio-economic deterioration among disadvantaged people who become ill. Examples would include additional care and support to disadvantaged patients; additional resources for rehabilitation programmes to reduce the effects of illness on people's earning potential; and equitable health care financing.

2.6 Indicators of social position

The focus of this thesis is restricted to the dimensions of social position commonly used in low- and middle-income countries and that are brought about by social stratification, such as religious affiliation, ethnicity, migration and urban of residence.

2.6.1. Religion

Religious stratification is the institutionalized use of religious affiliation as a criterion for access to social, economic and political resources. Religious inequality occurs in societies where there are two or more religious groups, when affiliation to one religious tradition provides social, economic and political benefits that are not readily available to members of other faith groups (Pyle & Davidson 2003). When the benefits of affiliating to one religious tradition become embedded in the social fabric of society (i.e. laws and/or customs of a society), religious inequality will persist over time, resulting in religious stratification and its use as a criterion for accumulating more class, status and power than members of other faiths (Pyle & Davidson 2003; Rothman 2002). If religious affiliation is not a legally sanctioned norm, it might be incorporated into aspects of culture, such as values, beliefs, other social institutions and ideologies (Rothman 2002).

Theoretical perspectives on religion and child survival

The relationship between religion and health has often been interpreted within a framework of hypotheses, which elucidates its pathways and mechanisms of influence (Goldscheider 1971). Two of these, the “characteristics hypothesis” and the “particularized theology hypothesis” are applied in this thesis:

i) The “characteristics hypothesis” states that religious affiliation *per se* has little or no independent influence on child survival; rather it is the difference in the socio-economic and demographic composition of religious groups that largely accounts for observed differences in child survival (Antai *et al.* 2009; Antai 2009a; Antai & Antai 2008; Gyimah 2007; Goldscheider 1971). This indicates that religious affiliation is confounded with and mediated by socio-economic factors.

ii) The “particularized theology hypothesis” on the other hand asserts that differences in child survival within religious groups are a result of specific doctrines of a religion i.e. the presence or absence of specific religious tenets directly pertaining to child health, the influence of beliefs and values of religious groups that affect child health and survival (Antai 2009a; Antai *et al.* 2009; Vargas Valle *et al.* 2009; Antai & Antai 2008; Ogunjuyigbe 2004; Adetunji 1991; Goldscheider 1971).

Religion also influences health through the provision of a platform for social interaction and diffusion of health-related ideas (Hummer *et al.* 2004; Rostas 1999). The prescription or proscription of certain lifestyles as well as the regulation of health-related behaviours of its adherents may lead to the adoption of health-damaging or health-promoting behaviours, thereby impacting child health and survival.

2.6.2. Ethnicity

Ethnicity is a social construct (Krieger 2001), and may be a salient marker of social position depending on the society. Ethnicity may be associated with socio-economic disadvantage in terms of employment, income, and place of residence (Chor *et al.* 2004; Fry 2000). Ethnicity is a multi-faceted quality that refers to the group to which people belong, and/or are perceived to belong, as a result of certain shared characteristics, including geographical and ancestral origins, but particularly cultural traditions and languages (Bhopal 2004).

Theoretical perspectives on ethnicity and child survival

Several possible explanations for ethnic differences in child survival in low- and middle-income countries have been put forward (Brockerhoff & Hewitt 1998), among which are that:

i) ethnic variations in infant mortality reflect differences in socio-economic and demographic characteristics (Gyimah 2006; Jatrana 2003; Nazroo 2003; Barros *et al.* 2001; Chandola 2001; Brockerhoff & Hewitt 2000; 1998; Kuate Defo 1996). This implies that ethnicity is confounded by socio-economic position;

ii) the relative effects of cultural and traditional factors associated with ethnicity *per se* are independent of socio-economic and demographic factors. This ascribes importance to norms, beliefs and ideals as being key to understanding variations in child health outcomes regardless of socio-economic status (Suwal 2001; Tabutin & Akoto 1992).

Adherence to, and the performance of culture-specific practices and beliefs may enhance or hinder child survival. These include perceptions of disease aetiology, treatment patterns and childcare practices (Ogunjuyigbe 2004); and

iii) there is an association between ethnic group dominance in national political economy and childhood mortality levels that occurs through the preferential channelling of economic benefits at the household and community levels. This political dominance enables certain ethnic groups to secure and maintain greater political power and advantage over other ethnic groups; the exceptions being Nigeria and pre-war Rwanda, where economically disadvantaged groups have historically monopolized government leadership since independence (Mustapha 2006; Brouckerhoff & Hewitt 1998).

2.6.3. Migration

Migration, at its most basic form, is a change in the “usual” place of residence (Bilsborrow 1998). There is no consensus on the definition of migration, since we are dealing with a physical-social transaction, rather than just an equivocal biologic event. However, a definition of migration should include at least two dimensions – spatial (referring to a change in place of residence from a place of origin to a destination, defined variably by the crossing of a spatial boundary e.g. provincial boundary in internal migration or national border in international migration); and temporal (referring to time at the “usual” residence). A migrant was defined in this thesis as a person who moved between any combination of rural and urban areas in the 10 years prior to the survey. The positioning of potential migrants within society influences their propensity to migrate, with more educated individuals being more likely to migrate than less educated individuals (Feliciano 2005; Findlay & Rogerson 1993).

Theoretical perspectives on migration and child survival

Three perspectives of migration are applied in explaining the relationship between migration and under-five mortality.

Firstly, *migrant disruption*: this suggests that the process of migration disrupts familial and social networks, the provision of information on childcare and treatment during the childrens’ illness, as well as social and cultural practices (Garenne 2006; Ssengonzi 2002) by changing economic resources (Kanaiaupuni & Donato 1999). Not uncommonly, rural women tend to breastfeed their children for longer periods with resulting longer birth intervals than urban women (Vitzthum 2001). Shorter birth intervals are frequently associated with increased fertility, higher number of children that compete for meagre household resources and reduced child survival (Alam 1995).

Factors associated with migration, such as physical- and disease-environments, housing quality and food availability can also influence the outcome of migration (Garenne 2006). The disruption perspective therefore argues that despite availability of better health services in urban areas, children of rural-urban migrants may have lower survival chances than children of non-migrants due to disruptive consequences of the migration itself.

Secondly, *migrant selectivity* suggests that rural-urban migration tends to be selective for those with specific demographic and socio-economic characteristics that are favourable to child survival (e.g. education, occupation and wealth). Rural-urban migrants tend to be younger, educated, economically better-off (Sastri 1996) and healthier (Lu 2008; Garenne 2006) than non-migrants.

An observed increase in the survival chances of children of rural-urban migrants is thought to be mainly associated with the migrant characteristics that also increase their propensity to migrate (Ssengonzi 2002; Stephenson & Ong 2003; Amankwaa *et al.* 2003), rather than to increased availability of health services in urban areas (Ssengonzi *et al.* 2002; Amankwaa *et al.* 2003; Uyanga 1983).

Thirdly, *migrant adaptation* posits that differential health outcomes among the children of rural-urban migrants and non-migrants are associated with the difficulty of migrants to adjust to, and effectively use health services and facilities in the new urban environment (Tam 1994). Thus, migrant adaptation refers to the extent to which a migrant adapts into the host society. Social institutions, such as health services, family members already living in the host area and community groups play an important role in enabling the adaptation of migrants into the host population (Stephenson & Ong 2003). The utilization of health services is considered as being of greatest importance to child survival (Tam 1994), either directly (by promoting preventative behaviour through enhanced knowledge, attitudes and skills via for example, attendance of antenatal clinics or medical intervention in the event of child illness) or indirectly by acting on these and incorporating preventative measures into daily life (because utilization of health services is an indicator of all round competence in child care, such as the understanding and recognition of symptoms of ill health).

Failure of migrants to adapt to their new urban environment may lead to their continued use of traditional medical services and the under-utilization of modern health services (Uyanga 1983). In addition, migrants tend to be concentrated in low income and informal employment, which often prevents migrants from fully adapting into urban society (Stephenson & Ong 2003). Migrant under-utilization of modern health services, the continued use of traditional rural medical services coupled with unemployment, low income and informal employment are believed to result in mortality differences between children of rural-urban migrants and urban non-migrants.

2.6.4. *Urban residence*

Environmental risk factors account for about one-fifth of the total burden of disease in low-income countries (World Bank 2001a). About 3% of these deaths (1.7 million) are attributable to environmental risk factors, with child deaths accounting for about 90% of the total. WHO (2002a) reports that among the 10 identified leading mortality risks in developing countries, unsafe water, sanitation and hygiene are ranked second, while indoor smoke from solid fuels are ranked fourth. Disadvantaged urban environments can affect health in several ways working in synergy.

The effect of a particular place on health depends primarily upon the characteristics of that place. Since poor and disadvantaged urban environments are characterized by overcrowding, shortage of safe water, lack adequate waste and sanitary services, living in socio-economically disadvantaged areas results in increased risks of infectious diseases and mortality (Van de Poel *et al.* 2007; Mintz *et al.* 2001; World Bank 2001b), even after adjusting for individual demographic and socio-economic characteristics (Marinacci *et al.* 2004; Pickett & Pearl 2001). With the world's urban population growing at a fast pace, there is need for greater emphasis to be placed on the association between measures of socio-economic position of urban areas and the health of populations living in those areas (Galea & Vlahov 2005), given that socio-economic characteristics of areas are important determinants of child survival (Kawachi & Berkman 2003; Macintyre *et al.* 2002).

Neighbourhoods matter for several reasons:

1, Where communicable diseases are concerned, it has long been recognized that spatial proximity or density of diverse urban populations can generate negative *health externalities*. Such externalities predispose residents to environmental contamination and communicable diseases, such as: respiratory and other infectious diseases (Hembree *et al.* 2005; Northridge and Sclar 2003; Krieger & Higgins 2002; Passchier-Vermeer & Passchier 2000); sexually transmitted infections (Montgomery *et al.* 2003); effect of unsanitary behavioural practices (Frei *et al.* 2003) water contamination and rapidly spreading epidemics (Alexander & Ehrlich 2000). These could cause health risks of disadvantaged urban populations that rival or exceed those of rural populations, despite the generally improved access of urban residents to emergency transport and modern health services presumably enjoyed by urban residents (African Population and Health Research Center 2002).

2, Less-often recognized, but potentially of equal importance, are the *social externalities* associated with urban living. Women and households are connected to others in their neighbourhood through social networks and connections that shape the flow of resources, determine access to opportunities, influence the flow of information that benefit child health, thereby strongly impacting health outcomes (Berkman & Kawachi 2000). Communities with higher levels of social networks are often thought to be cohesive and thriving communities (Theall *et al.* 2009). The more diverse the social networks people have, the better their potential for generating social capital (Field 2003; Grootaert 2001).

3) Spatial segregation of different socio-economic and ethnic groups is an important determinant of health in cities. This affects health through concentrated poverty, the quality of neighbourhood environment and the individual socio-economic attainment of minorities (Williams 1997). People living in segregated communities may have disproportionate exposure, susceptibility and response to economic and social deprivation, hazardous conditions and toxic substances (Williams & Collins 2002). They also frequently lack adequate access to healthcare services and tend to have disproportionately low rates of health insurance. These are important predictors of inequalities in access to medical care (Mayberry *et al.* 2000; Acevedo-Garcia 2000).

Theoretical perspectives on urban residence and child Survival

Urbanization is “the process of becoming urban, which reflects aggregate population growth in cities through either natural population increase or migration” (Galea & Vlahov 2005). As urban- or city-living becomes the ideal for many people in low- and middle-income countries, the resulting rapid urbanization, in combination with widespread and prolonged poverty, poor governance, and the failure of national and urban housing policies resulting in an overstretching of capacity of most urban economies to provide the growing demand for social amenities of urban areas (Fotso *et al.* 2007; UN-Habitat 2003).

This results in an increasing proportion of urban dwellers residing in disadvantaged areas (frequently referred to as slums), characterized by overcrowded or deteriorating housing, poor or no social amenities (e.g. safe water, electricity, poor environmental and sanitary conditions), poor or no access to basic social and health services, as well as poor livelihood and economic opportunities (Fotso *et al.* 2007; Van de Poel *et al.* 2007; Mintz *et al.* 2001; Woldemicael 2000). This in turn increases the susceptibility of residents to a variety of health problems and increases childhood mortality risks (Fotso *et al.* 2007; Hembree *et al.* 2005; Galea & Vlahov 2005; Northridge & Sclar 2003; Zulu *et al.* 2002; Krieger & Higgins 2002; Gracey 2002; Alexander & Ehrlich 2000).

Furthermore, although the spatial concentration of poverty is essential to the definition of disadvantaged neighbourhoods, current efforts at systematizing the definition of disadvantaged neighbourhoods use indicators such as access to safe drinking water, adequate sanitation, electricity, overcrowding and security of housing tenure, and focus on households rather than directly taking into account the concentrations of poverty or affluence in the neighbourhoods that surround these households. Neighbourhood effects are a primary example of the forces operating outside households that can exert influence on household-level behaviour and health outcomes (Montgomery & Hewett 2004). Thus, there is ample reason on both substantive and methodological grounds to explore neighbourhood effects of the urban areas of low-and middle-income countries.

3.0 Aims

The overall aim of this thesis was to contribute to an understanding of the underlying mechanisms of child health inequities in under-five mortality in Nigeria in relation to social context, social stratification and social position.

3.1. Specific objectives

- I. To assess the role of mothers' religious affiliation on under-five mortality in Nigeria.
- II. To examine the role of ethnicity on under-five mortality in Nigeria.
- III. To examine the effect of rural-urban migration on under-five mortality in Nigeria
- IV. To assess the trend of under-five mortality in urban areas of Nigeria in relation to urban population growth and examine the role of urban area socio-economic disadvantage on under-five mortality.

4.0. Materials and methods

4.1. Data

The analyses in all four studies (paper I – IV) of this thesis were based on data from the 2003 Nigeria Demographic and Health Survey (2003 NDHS) (NPC 2004). Retrospective birth history data from the urban populations in the 1990, 1999 and 2003 Nigeria Demographic and Health Surveys were used to directly calculate the probability of child deaths below five years of age and examine the under-five mortality trend for the period 1987-2003 in paper IV. The DHS is a large survey program set up in the mid-1980s and carried out in over 70 low- and middle-income countries, with the aim of monitoring and evaluating key population, health and nutrition indicators in these countries.

There is scarcely any country with under-five mortality rates over 25 per 1000 live births having a complete vital registration system (Morris *et al.* 2003; Ndong *et al.* 1994; Lumbiganon *et al.* 1990); the exceptions being South Africa, which has the most complete system in continental Africa, and the island states of Mauritius and the Seychelles with vital registration coverage of 95 percent or more (Lopez *et al.* 2001). In addition, births in poorer households and by less educated mothers are less likely to be registered (UNICEF 2005), making the DHS surveys probably the best and most cost-effective data source available for comparative studies on socio-economic inequalities in under-five mortality in low- and middle income countries (Houweling 2007; Mung'ala & Snow 1994).

DHS surveys are funded by the United States Agency for International Development (USAID) with the participating countries bearing the main responsibility for the implementation of these surveys. The 2003 NDHS was until very recently the latest in a series of nationally-representative population and health surveys. It was conducted in Nigeria by the National Population Commission (NPC) in collaboration with the Ministry of Health Nigeria and technical support was provided by the ORC Macro. The surveys include retrospective birth history data and death information on all children ever born to the respondents. Date of birth is reported in months and years, and age of birth, survivorship status and current age or, if the child had died, age at death are generally reported in months for deaths at two years of age or younger, and in years for deaths above two years. Since the information on births and deaths is reported retrospectively by the mothers rather than registries, it is subject to reporting error. Response rate among eligible women was 95% (NPC 2004).

Reliability of reported birth histories could be assessed using *i*) a complete vital registration system (the gold standard), which is generally unavailable in low- and middle-income countries (WHO 2003). Other data sources that could be used include censuses, health surveys and facility-based information systems. Censuses do not appropriately provide in-depth information on socio-economic characteristics of households, while health surveys and facility-based information systems are prone to an inherent selection bias in facility attendance. A few studies comparing birth history data in a DHS survey with a complete longitudinal follow-up study on births and deaths indicated that the under-five mortality levels and trends estimated in the DHS survey were accurately estimated (Garenne *et al.* 1994; WHO 2003); and *ii*) an assessment of frequencies of missing data and observed mortality patterns. The average percent of incomplete birth dates in DHS is generally low, but varies between countries (Macro International 1994).

Recall bias may have occurred in the survey that may have affected the estimates in the studies presented in this thesis. For instance, older women and women with several children may under-report events that occurred a while back in time. Similarly, children that died shortly after birth

may not have been recalled, resulting in possible heaping of age of death at 12 months (Macro International 1994). These are among the reasons why under-five mortality is generally more reliable than neonatal and infant mortality, and the argument behind limiting estimation of under-five mortality to the five-year period prior to the survey (Mahy 2003). However, DHS data quality assessments show that errors are however minimal in most cases (Gaspar *et al.* 1998; Sullivan *et al.* 1991; Curtis 1994). Since reliable cause-specific information is not readily available in the DHS, mortality estimates are based on all-cause mortality.

4.2. Sampling design

The 2003 NDHS utilized a two-staged cluster sampling procedure based on the list of enumeration areas (EAs) developed from the 1991 Population Census sampling frame. Nigeria is administratively divided into 36 states and the Federal Capital Territory (FCT) of Abuja. Each state consists of local government area (LGA) units and each LGA is subdivided into localities. Each locality is further divided into enumeration areas. At the time of the data collection, there were a total of 212,080 enumeration areas. In the first sampling stage, 365 clusters (primary sampling units) were selected with a probability proportional to the size, the size being the number of households in the cluster. An equal number of households were chosen in each cluster within a sampling domain, so that the sample design is self-weighting. Cluster sampling, as opposed to taking a random, completely dispersed sample of all households in the country, is logistically necessary to perform the surveys within a reasonable time period at an acceptable cost. However, certain clusters are sometimes oversampled, in order to allow a sufficiently large sample to yield reliable subnational estimates.

In the second sampling stage, a complete listing of households was carried out in each selected cluster. Households were then systematically selected from the chosen clusters for participation in the survey, resulting in a nationally-representative probability sample of 7864 households. From these households, data were collected by face-to-face interviews from 3725 women aged 15 to 49 years. Women who were either permanent residents of the households or visitors present in the household on the night before the survey were eligible to participate in the 2003 NDHS. These women contributed a total of 6029 live born children to the survey. Information about the aggregate childbearing experiences of the selected mothers was collected (i.e. the number of sons and daughters who live with the mother, the number who live elsewhere, and the number who have died). More detailed information on the sampling design is described elsewhere (NPC 2004).

4.3. Questionnaire

The DHS uses standardized core questionnaires, which generally allow for comparisons across countries and between time-periods. The Women's Questionnaire for women aged 15–49 years gathered information covering women's demographic characteristics, their fertility and reproductive history, which included their full birth history, antenatal care history for the most recent birth within the five-year period preceding the survey, delivery and postnatal care for all births, as well as the survival of their live-born infants. From the data collected, a retrospective file consisting information on all children ever born to the women in the sample was generated. Each live birth and subsequent child health outcome was related to information on each parent and household. The child records constituted the basic analytic sample.

4.4. Indicators

4.4.1. Outcome variable (under-five mortality)

The outcome variable in all the four studies of this thesis was under-five mortality (${}_5q_0$), defined as the probability of a live-born child dying between birth and the fifth birthday (0 - 59 months).

Rationale for focusing on under-five mortality

Under-five mortality rate is a key indicator of the level of child health and overall well-being of a given population (McGuire 2006; Franz & Fitzroy 2006). Together with infant mortality rate and life expectancy, it is a measure of changes in population health and development (Schell 2007). As such, it is an indicator of the millennium development goals 4, which seeks to reduce the under-five mortality rate by two-thirds by the year 2015 from the baseline in 1990 (UN Millennium Project 2005; Sachs & McArthur 2005). Under-five mortality is closely linked to living conditions especially at the household and community levels and is an indicator that is sensitive to various aspects of socio-economic development in a population, such as living standards, female education, status of women and the impact of preventive and curative health care (Vargas Valle *et al.* 2009; UNICEF 2007; UNFPA 2003). Due to general lack of data on vital statistics in low- and middle-income countries, vulnerable populations are often identified using mortality rates. Under-five mortality rate captures more than 90 percent of the global mortality among children below 18 years of age (UNICEF 2008).

Nutrition and medical interventions tend to be more important in this age group. As such, under-five mortality better mirrors the effect of gender discrimination than infant mortality, given that under-five mortality rates tend to be higher for boys than for girls in countries without significant parental gender preferences (UNICEF 2008). Under-five mortality also shows large variation across socio-economic groups, geographical areas and between rural and urban areas. Data on under-five mortality are relatively reliable compared with other measures of population health (UNFPA 2003). Finally, under-five mortality is also used as the health outcome for reasons of statistical power and data reliability.

Under-five mortality is expressed as a rate per 1,000 live births. In this thesis, under-five mortality rate is estimated for the five years preceding the survey. This means that all children aged between 0 and 59 months during this pre-defined time-frame were included in the estimation. Exposure time and cases were observed during this time-frame (five years prior to the survey). All living children 59 months or younger during this five-year time-frame were considered as exposures i.e. contributed person-time. All deaths among children 59 months or younger during this time-frame were regarded as cases. Children born during the time-frame (at birth) or before the time-frame (at any age until 59 months) could enter this time-frame. Children that stayed alive after age 59 months within this time-frame were censored after age 59 months. This period-based measure of estimating under-five mortality rates provides a better estimate of the level of under-five mortality in the period under study compared to cohort-based measures. It gives a better estimate of mortality levels in that period, and the estimates are somewhat more robust, given that more children and deaths can be included i.e. information on all living children aged 59 months or younger during the time-frame, as opposed to only the children *born* in the time-frame (Houweling 2007).

4.4.2. Exposure variables

Paper I (Religious affiliation)

The main exposure variable was religious affiliation of the mother, based on the question “what is your religion? This was categorized as: Christian, Muslim, and Traditional indigenous religion/ Others.

Explanatory factors

Demographic characteristics:

Exposures assessed included: (i) *Sex of the child*, classified as male or female; (ii) *Birth order and interval between births*, created by merging “birth order” and “preceding birth interval” into one variable. These variables were merged for the following reason. ‘Preceding birth interval’ is the interval before the birth of the child in question and the effect of the preceding birth interval is considered in relation to the younger of the two children. Since first births are not preceded by another birth, they are often left out of the analysis of preceding birth interval and survival of the preceding child. In order to enable the inclusion of first births in the preceding birth analysis, first births were merged with births having a preceding birth interval of 24 months or longer, as has been described in previous studies (Jatrana 2003; Mturi & Curtis 1995). The resulting variable was grouped into seven categories as: first births, birth order 2-4 with short birth interval (<24 months), birth order 2-4 with medium birth interval (24-47 months), birth order 2-4 with long birth interval (48+ months), birth order 5+ with short birth interval (<24 months), birth order 5+ with medium birth interval (24-47 months), and birth order 5+ with long birth interval (48 months); and (iii) *Maternal age*, grouped as: 15–18, 19–23, 24–28, 29–33 and 34 years or older.

Socio-economic characteristics:

These were assessed using the following variables: i) *Mothers’ education*, categorized as: no education, primary and secondary or higher; ii) *Fathers’ education*, categorized as: no education, primary and secondary or higher; iii) *Mothers’ occupation*, classified as: Professional/technical/Managerial; Clerical/sales/services/skilled manual; Agricultural self-employed/agricultural employee/household & domestic/unskilled manual occupations; and Not working; iv) *Fathers’ occupation*, was classified as: Professional/technical/Managerial; Clerical/sales/services/skilled manual; Agricultural self-employed/agricultural employee/household & domestic/unskilled manual occupations; and Not working; and v) *Wealth index*, which is used in the absence of reliable data on incomes and expenditures in the demographic and health survey.

This is a composite index and a good measure of relative economic position in developing countries (Filmer & Pritchett 2001; Bollen *et al.* 2002). It assigns weights or factor scores generated by principal component analysis using information on household socio-economic indicators, which include those relating to household ownership of durable assets, and household environmental conditions collected from censuses and surveys. These were then used to compute the wealth index applying principal components analysis. Principal components analysis allows each asset owned to be given a score and the factor loading scores summed up for each household (Filmer & Pritchett 2001; Gwatkin *et al.* 2000b). Individuals were ranked according to the total score of the household in which they resided in. The socio-economic index generated was subsequently stratified into quintiles to represent different levels of wealth, categorized as: poorest, poorer, middle, richer and richest.

Maternal and child health services

These were assessed as: *i) Place of delivery*, classified as home and hospital facility (private as well as public); *ii) Mother received tetanus toxoid injection during pregnancy*, categorized as “yes” and “no” and *iii) Prenatal care by doctor*, with responses classified as “yes” and “no”.

Paper II (Ethnicity)

The main exposure variable was ethnicity, identified by the question “what is your ethnic group?” in the DHS questionnaire. This was categorized as: *i) Hausa/Fulani/Kanuri*, which were grouped on the basis that these ethnic groups either speak a common language or dialect, share a common sense of identity, cohesion and history; or have a single or similar set of customs and behavioural rules as in marriage, clothing, diet, taboos; *ii) Igbo*; *iii) Yoruba*; and *iv) Others* (a merger of other minor ethnic groups).

Individual-level explanatory factors

Four additional child- and mother-level variables of interest were examined:

i) Birth order and interval between births, created by merging “birth order” and “preceding birth interval” classified as: first births, birth order 2-4 with short birth interval (<24 months), birth order 2-4 with medium birth interval (24-47 months), birth order 2-4 with long birth interval (48+ months), birth order 5+ with short birth interval (<24 months), birth order 5+ with medium birth interval (24-47 months), and birth order 5+ with long birth interval (48 months); *ii) Mother's age* was grouped in years as: 15-18, 19-23, 24-28, 29-33, and 34 years & older; *iii) Mothers' education*, categorized as: no education, primary, and secondary or higher education; and *iv) Mother's age at birth of first child*, categorized as: 18 years or less and 19 years or older; this categorization was intended to assess the effect of early marriage on child survival.

Paper III (Rural-urban migration)

Migrant status was the main exposure variable and was categorized as: *i) Urban non-migrant*; *ii) Rural non-migrant*; and *iii) Rural-urban migrant*.

A migrant was defined as a person who moved between any combination of rural and urban areas in the 10 years prior to the survey. The DHS data does not collect migration histories; rather, it collects basic information relating to number of years spent in the respondents current place of residence (categorized as single years, always, and visitor) and type of both the previous and current place of residence (rural and urban).

These were used to establish migration status. We created a variable that categorized the migration streams into rural-to-urban migrants, rural non-migrants, and urban non-migrants. Urban-to-rural migrants were excluded from the analysis for lack of sufficient statistical power. In this study, migration status was defined by a person changing his/her place of residence across an administrative boundary; this may omit those involved in circular migration within an area. Visitors were excluded from the analysis. A woman who reported previous residence as rural and current residence as urban was classified as a rural-urban migrant. The non-migrant groups consisted of rural- or urban non-migrant depending upon their reported duration at the place of residence as “always”.

Individual-level explanatory factors

Child- and mother-level variables of interest were grouped into three categories:

Demographic characteristics:

These were assessed as: *i) Birth order and interval between births*, created by merging “birth order” and “preceding birth interval” classified as: first births, birth order 2-4 with short birth interval (<24 months), birth order 2-4 with medium birth interval (24-47 months), birth order 2-4 with long birth interval (48+ months), birth order 5+ with short birth interval (<24 months), birth order 5+ with medium birth interval (24-47 months) and birth order 5+ with long birth interval (48 months); *ii) Sex of the child*, categorized as: male and female; *iii) Mother’s age*, grouped as: 15-18, 19-23, 24-28, 29-33, and 34 years & older; *iv) Mother’s age at birth of first child*, categorized as: 18 years or less and 19 years or older; and *v) Marital status*, categorized as: single, married and formerly married.

Socio-economic characteristics:

These included: *i) Mothers’ education*, categorized as: no education, primary, and secondary or higher education; *ii) Mothers’ occupation*, grouped as: professional/technical/managerial; clerical/sales/services/skilled manual; agricultural self-employed/agricultural employee/household & domestic/unskilled manual occupations; and not working; and *iii) Wealth index*, divided into quintiles: poorest, poorer, middle, richer and richest.

Health care utilization:

These were assessed as: *i) Mother received tetanus toxoid injections in pregnancy*, responses were categorized as: yes and no; *ii) place of delivery of child*, categorized as: home, and hospital facility; and *iii) prenatal care by doctor*, categorized as: “yes” and “no”.

Paper IV (Urban area disadvantage)

Urban area disadvantage was the main exposure variable and was measured using the urban area disadvantage index (UADI) score. The UADI score reflects the overall level of urban area disadvantage calculated using eight indicators of neighbourhood-level socio-economic disadvantage that included the percentage of children: *i) living in a household without piped water; ii) living in a household without flush toilet; iii) living in a household without electricity; iv) living in a household without non-polluting cooking fuel; v) whose mothers were unemployed; vi) whose mothers were uneducated; vii) living in crowded households and viii) living in households within the lowest two wealth quintiles (poorest 40%).*

Individual-level explanatory factors

These potential confounders were grouped into child- and mother-level demographic and socio-economic characteristics.

Child-level characteristics:

These included: *i) sex of the child*, categorized as: male and female; and *ii) birth order and interval between births*, created by merging “birth order” and “preceding birth interval” classified as: first births, birth order 2-4 with short birth interval (<24 months), birth order 2-4 with medium birth interval (24-47 months), birth order 2-4 with long birth interval (48+ months), birth order 5+ with short birth interval (<24 months), birth order 5+ with medium birth interval (24-47 months), and birth order 5+ with long birth interval (48 months).

Mother-level characteristics

i) Mother's age, grouped as: 15-18, 19-23, 24-28, 29-33, 34 years and older; *ii) marital status*, categorized as: single, married and divorced; *iii) mothers' education*, categorized as: no education, primary and secondary or higher education; *iv) mother's occupation*, grouped as: professional/technical/managerial; clerical/sales/services/skilled manual occupations; and not working; and *v) wealth index*, categorized into quintiles as: poorest, poorer, middle, richer and richest.

4.5. Contextual units (relevant geographic units)

4.5.1. Theoretical considerations

The contextual constructs used in papers II – IV within this thesis are all defined at the “neighbourhood” or community level (used interchangeably). Neighbourhoods or the geographic area whose characteristics may be relevant to the specific health outcome being studied, are considered to be the natural social unit within which populations interact with each other and with institutions. It is an ecological subsection of a larger community, a collection of both people and institutions occupying a geographically-defined area that is conditioned by a set of ecological, cultural and political forces (Sampson 1999). Though the concepts of “neighbourhood” and “community” are not precise, both are geographically-anchored (Gephart 1997). There are several possible definitions of neighbourhoods depending on the criteria used. The size and definition of the neighbourhoods may vary according to the phenomenon of interest (Gephart 1997).

Administratively-defined neighbourhoods may be relevant when the hypothesized processes involve policies (Diez Roux 2001), and are often used as proxies for “neighbourhoods” or “communities” in several studies (Diez Roux 2001). These consist of smaller census tracts and census-defined block groups (Krieger *et al.* 2002; Pearl *et al.* 2001; Rauh *et al.* 2001; Reijneveld *et al.* 2000), which are assumed to be homogeneous with respect to population characteristics, socio-economic position and living conditions (US Census Bureau 2007). Census tracts/blocks are assumed to be homogeneous with respect to population characteristics, socioeconomic status and living conditions (US Census Bureau 2007). However, the choice of appropriate statistical unit is usually determined by data availability.

4.5.2. Neighbourhood scale

Neighbourhoods were operationalized at the level of primary sampling units (PSUs) or clusters in papers II – IV. Primary sampling units are small and consist of one or more enumeration areas (EAs), which are the smallest geographic units for which census data are available in Nigeria (NPC 2004; Martin 2004). The sampling frame for identifying primary sampling units in the DHS is usually the most recent census; in this case the sampling frame was the list of enumeration areas developed from the 1991 Population Census. Each cluster or primary sampling unit was made up of a minimum of 50 households. In urban areas, this was made up of census enumeration areas/blocks were used to identify primary sampling units in urban areas, while villages were used to identify a primary sampling unit in rural areas. In the case of an enumeration area/block or village having less than 50 households, a contiguous enumeration area/block or village was added to ensure a minimum of 50 households per primary sampling unit (NPC 2004). If an enumeration area/block or village constituted of over 500 households, it was still considered as making up one primary sampling unit; however, it would be segmented, with a sub-sample of segments being selected for household listing and interviewing.

The choice of primary sampling unit as the neighbourhood scale was done for two reasons: first, primary sampling unit is considered the most consistent measure of “community” across all of the surveys, and thus the most appropriate identifier of community for neighbourhood comparisons in this thesis (Griffiths *et al.* 2004). Studies using DHS show that the sample size per cluster or primary sampling unit meet the optimum size with a tolerable precision loss (Kravdal 2006). The bias introduced by using cluster averages based on about 25 women as a proxy for the primary sampling unit population averages is minimal - only about 4% (Aliga & Ren 2006).

4.5.3. Definition and categorization of contextual exposures

Contextual or community-level risk factors used in this thesis include:

- i) Region of residence*, categorized according to the six geo-political zones in Nigeria, as North Central, North East, North West, South East, South South and South West (papers II and III);
- ii) Community mother’s education*, defined as the percentage of mothers with secondary or higher education in the PSU and categorized as: Low and High (cut-off at median value in all primary sampling units combined, 13%) (papers II and III);
- iii) Community child immunization*, defined as the percentage of children that received the eight vaccines in the Expanded Program on Immunization (EPI) schedule recommended by the World Health Organization (WHO), which include: Bacillus Calmette-Guerin (BCG) at birth, three doses of diphtheria, pertussis and tetanus (DPT) vaccine at 6, 10 and 14 weeks of age, three doses of oral polio vaccine (OPV) at birth, and at 6, 10 and 14 weeks of age, and one dose of measles vaccine at 9 months of age. This variable was categorized as: low, middle, and high (papers II and III);
- iv) Community hospital delivery*, defined as the percentage of mothers who delivered their child in the hospital, and categorized as: low, middle, and high (cut-off at the median value) (paper III);

The low, middle, high community-level categories in the contextual variables described above were defined using the cut-off at median value in all PSUs combined. “Middle” category referring to the proportion at the median value, “low” category referred to the proportion below the median value, and “high” category referred to the proportion above the median value. Community hospital delivery was included because hospital delivery is one of the most important preventive measures against maternal and child health outcomes, and an important determinant of under-five mortality. Community mother’s education was assessed because higher levels of maternal education are associated with better child survival.

vi) Urban area disadvantage index (UADI) reflects the overall level of urban area disadvantage and was assessed using urban area disadvantage index scores generated via principal component analysis of eight indicators of socio-economic disadvantage at the neighbourhood level. These includes the percentage of children: *i)* living in a household without piped water; *ii)* living in a household without flush toilet; *iii)* living in a household without electricity; *iv)* living in a household without non-polluting cooking fuel; *v)* whose mothers were unemployed; *vi)* whose mothers were uneducated; *vii)* living in crowded households; and *viii)* living in households within the lowest two wealth quintiles (poorest 40%).

A total of 165 urban PSUs were included in the analysis from the total number of 365 for both urban and rural areas. The UADI is suitable: *i)* when the main focus of analysis lies in the effects of characteristics of place of residence on health (Whitely *et al.* 1999; MacIntyre *et al.* 2002); *ii)* because it allows for the control of possible socio-economic confounding when examining the effects of the local environment on health (MacIntyre *et al.* 2002); and *iii)* when data describing an individual’s socio-economic circumstances have not been, or cannot be collected directly

(Danesh *et al.* 1999). The clusters were ranked on the basis of the continuous UADI scores and categorised into quintiles divided at the 20th, 50th and 80th percentiles, such that the 20% least disadvantaged urban areas were designated as Class I and the 20% most disadvantaged urban areas were assigned into Class V. The ranks indicate how a neighbourhood compares to all the other neighbourhoods and are easily interpretable (paper IV).

4.6. Potential confounders

A variable qualified as a potential confounder if it differed significantly between the independent variable *and* was related significantly to the dependent variable. On this basis the following possible confounders were considered: birth order and birth interval, mother's age and mother's age at the birth of first child, and socio-economic characteristics (mother's education, mother's occupation, household wealth and region of residence) depending on the associations being investigated. These parameters were selected on the basis of prior knowledge of potential influence on child health outcome variables, considered in the context of the epidemiologic setting in Nigeria.

4.7. Ethical considerations

This thesis is based on analysis of secondary data, for which permission for usage was obtained from Opinion Research Corporation Macro International, Incorporated (ORC Macro Inc.). The survey was approved by the National Ethics Committee in the Federal Ministry of Health, Nigeria and the Ethics Committee of the Opinion Research Corporation Macro International, Incorporated (ORC Macro Inc.), Calverton, USA. All participant identifiers were excluded from the obtained dataset.

5.0. Statistical Analyses

5.1. Trend in urban under-five mortality rates between 1986 and 2003

The probability of child deaths below five years of age in urban areas was directly estimated from the 1990, 1999 and 2003 Nigeria DHS birth history data (paper IV). Urban population pattern for the period between 1983 and 2003 was derived from the United Nations Department of Economics and Social Affairs of the Secretariat (UN DESA 2004).

5.2. Effect measures

A key feature of this thesis is the association between characteristics associated with social position, social status or prestige (ethnicity, religious affiliation, migration status and neighbourhood of residence), and under-five mortality. The specific measures used varied with the specific research question.

5.3. Cox proportional hazards regression

In paper I, the association between mother's religious affiliation and under-five mortality was analyzed using Cox regression. It simultaneously explores the effects of several variables on survival (Cox 1972). Cox regression does not assume a particular distribution for the survival times; rather it assumes that the effects of the different variables on survival are constant over time and are additive in a particular scale.

$$h(t) = h_0(t) \exp(\beta_1 z_1 + \dots + \beta_k z_k) \quad (1)$$

Where $h_0(t)$ is the baseline or underlying hazard function of time and corresponds to the probability of dying (or reaching an event) when all the explanatory variables are zero; z_j are covariates; and β_j the coefficients for the k covariates that give the proportional change that can be expected in the hazard, related to changes in the explanatory variables. In the Cox regression model, children are considered as independent observations, although there is the possibility of clustering of deaths within the same household or community. Results were presented as relative risks (RRs) with 95% confidence intervals (CIs).

5.4. Multilevel logistic regression analysis

In papers II - IV, multilevel logistic regression analysis was used to account for the hierarchical nature of the DHS data, and the fact that children of the same mother are more alike than children selected at random from the population. A three-level multilevel logistic regression model was used in each study, with children (level 1) nested within mothers (level 2), who were in turn nested within communities (level 3) (Raudenbush & Bryk 2002; Diez Roux 2000; Snijders & Bosker 1999). The three-level multilevel model is written as follows:

Where

$$\log \text{it} (\pi_{ijk}) = \log \left(\frac{\pi_{ijk}}{1 - \pi_{ijk}} \right) = \beta_0 + X_{ijk} + u_{0jk} + v_{0k} \quad (11)$$

where π_{ijk} is the probability of dying for the i th child of the j th mother in the k th community, ϵ_{ijk} is a child-level error term distributed as Bernoulli constant, \mathbf{X}_{ijk} is a vector of covariates corresponding to the i th child of the j th mother in the k th community including mother's ethnicity, and educational background, β_0 is a vector of unknown parameters, \mathbf{u}_{ijk} is the random effect at the mother level, and \mathbf{v}_{0k} is the random effect at the community level. The intercept or average probability of dying is assumed to vary randomly across mothers and communities. The models fitted into the analyses were dependent on the objectives of the study.

Multilevel analysis provides a powerful means of simultaneously including both neighbourhood- and individual-level predictors in regression models with individuals as the units of analysis (Diez Roux 2001). It allows: *i*) the examination of neighbourhood or area effects after individual-level confounders have been controlled for; *ii*) the examination of neighbourhood-level characteristics as modifiers of the area effect, and vice versa; the simultaneous examination of within- and between-neighbourhood variability in outcomes (Snijders & Bosker 1999; Singer & Willett 2003) and of the extent to which between-neighbourhood variability is "explained" by individual- and neighbourhood-level factors.

Moreover, in multilevel analysis, groups and contexts are not treated as unrelated but are conceived as coming from a larger population of groups about which inferences can be made. By bringing together group- and individual-level variables and examining variability both within and between groups, multilevel analysis avoids the inferential fallacies that may occur when a relevant level is ignored (Diez Roux & Aiello 2005).

5.4.1. Measures of association (fixed effects)

The fixed effects (measures of association) between the risk of under-five deaths and individual- and community-level characteristics were expressed as odds ratios (ORs) and 95% confidence intervals (95% CIs).

5.4.2. Measures of variation (random effects)

The random effects (measures of variation) were expressed as: variance partition coefficient and percentage change in variance (Papers II - IV).

The variance partition coefficient (VPC) measures the clustering of death of individual children with a specific covariate pattern i.e. it measures the extent to which siblings resemble each other more than they resemble children from other families in relation to the risk of under-five deaths. The VPC is calculated as the percentage of the total variance ($V_F + V_I$) in the risk of under-five deaths that is attributed to the family level (V_I). Thus, it is a measure of clustering within neighbourhoods. It can therefore be used to operationalize the concept of contextual phenomena (Merlo *et al.* 2007). The equation for the variance partition coefficient is:

$$VPC = \frac{V_F}{V_F + V_I} \times 100 \quad (111)$$

A large VPC value (close to 1) indicates maximally segregated clusters, and a low VPC value (close to zero) suggests homogeneous risks of under-five deaths among clusters.

Proportional change in variance (PCV): Neighbourhood differences in the risk of under-five deaths may be attributable to contextual influences or to differences in the individual composition of neighbourhoods in terms of child and maternal characteristics, as well as other

individual characteristics not considered in our study model. By adjusting for individual- and community-level characteristics, we take into account some part of the compositional differences and explain some of the neighbourhood variance detected in the empty model (model 0) using the proportional change in variance. The equation for the proportional change in variance is:

$$\text{PCV} = \frac{(V_A - V_B)}{V_A} \times 100 \quad (1V)$$

Where V_A = variance of the initial model, and V_B = variance of the succeeding model.

The precision of the estimates was appraised by their standard error (SE). Parameters were tested using Wald statistics i.e. the ratio of an estimated variance to its standard error (Larsen & Merlo 2005) and exact p -values.

5.4.3. Model fit statistics

Bayesian Deviance Information Criterion (DIC) was used to assess the goodness-of-fit of consecutive models. The DIC decreases as significant effects (both random and fixed) are added to the model. Thus, a lower DIC value indicates a better fit of the model (Browne 2003; Spiegelhalter 2002). The multilevel analyses were performed using MLwiN software package 2.0.2 (Center for Multilevel Modelling 2000), with Binomial, Penalized Quasi-Likelihood (PQL) procedures (Rashbash *et al.* 2008).

6.0. Results

6.1. Paper I: Inequities in under-five mortality in Nigeria: Differentials by religious affiliation of the Mother.

Objective: To assess the role of mother's religious affiliation in under-five mortality and health-related decisions in Nigeria.

In this study, we assessed the relationship between religion and health within a framework consisting of two hypotheses: the “characteristics hypothesis” and the “particularized theology hypothesis”. The characteristics hypothesis posits that religious affiliation *per se* has little or no independent influence, but rather it is the difference in the demographic, social and economic composition of religious groups that largely accounts for observed differences in under-five mortality. The particularized hypothesis asserts that differences in under-five mortality within religious groups are largely due to specific doctrines of a particular religion i.e. the presence or absence of specific religious tenets directly pertaining to child health, the influence of beliefs and values of the religious groups that influence child health and survival.

Findings showed that under-five mortality was significantly associated with mother's religious affiliation, with children of mothers affiliated to Traditional indigenous religion having higher risks of dying compared to children of Christian mothers after controlling for parental socio-economic characteristics. Following sequential introduction of measures of health care utilization (first, place of delivery, then prenatal care b/mother receive tetanus toxoid injection during pregnancy, the association between under-five mortality and mother's religious affiliation became non-significant, indicating that this association was explained by differential use of healthcare services, specifically attendance to prenatal care by doctor among the mothers. In relation to the hypotheses, residual under-five mortality differences in Nigeria after controlling for demographic and socio-economic factors indicate mortality differences between religious groups that are largely due to the specific doctrines, beliefs and values associated with Tradition indigenous religion. This is consistent with the particularized theology hypothesis.

6.2. Paper II: Ethnic Disparities in Child Health in Nigeria: A Multilevel Analysis of Individual and Contextual factors.

Objectives: To estimate the risk of under-five deaths among the ethnic groups in Nigeria; to assess whether under-five mortality varies across communities; to elaborate the relationship between ethnicity and under-five mortality by sequentially controlling for other risk factors; and to determine whether community-level factors account for ethnic variation in under-five mortality.

Findings indicated that under-five mortality was significantly associated with ethnicity, as the risks of under-five deaths were significantly lower for children of Yoruba mothers compared to children of Hausa/Fulani/Kanuri mothers. Much of the association between ethnicity and under-five mortality were explained by differences in individual-level socio-economic (mother's education and mother's age) and demographic (birth order and birth interval) characteristics. None of the contextual-level variables analyzed were significantly associated with under-five mortality in this study. There was significant community-level variance in the final model, which may be due to the presence of unmeasured or immeasurable community-level factors for which more research is necessary.

In addition, there were disparities in under-five mortality rates among the ethnic groups, with children of Yoruba mothers having the lowest mortality rates (82 per 1,000 live births) and children of Hausa/Fulani/Kanuri having the highest rates (165 per 1,000 live births). Under-five mortality rate among the children of mothers belonging to the Igbo and Other minority ethnic groups were 118 per 1,000 and 160 per 1,000 live births, respectively.

6.3. Paper III: Migration and Child Health Inequities in Nigeria: A Multilevel Analysis of Contextual- and Individual-level Factors.

Objectives: To estimate and compare the under-five mortality rates for the different migrant groups; to assess the role of rural-urban migration on under-five mortality; to assess the possible mechanisms through which migration may influence under-five mortality; and to assess the individual-and community-level relationships between migration status and the risk of under-five deaths.

The calculated under-five mortality rate for children of rural-urban migrant mothers (12 per 1,000 live births) was lower than that for children of urban non-migrant mothers (16 per 1,000 live births), but higher than that for children of rural non-migrant mothers (8 per 1,000 live births). We applied three perspectives of migration to explain the differential health outcomes between migrants and non-migrants, in that migration status was fitted with a different category of exposure variables against the risk of under-five deaths in each of the five models – a modelling strategy intended to enable a comparison of the influence of each of the different exposure variables on the association between migration and the risk of under-five deaths.

The first perspective, *migrant disruption* suggests that the process of migration disrupts the natural progression of demographic events in the lives of the migrants. This implies that the process of migration itself and the associated with the disruption of family and community attachments and possibly income-generation ability are likely to be detrimental to child survival outcomes. The second, *migrant selectivity* suggests that rural-urban migration is selective for individuals with specific demographic and socio-economic characteristics that are favourable to child survival and also increase their propensity to migrate. The third, *migrant adaptation* refers to the extent to which rural-urban migrants effectively use healthcare facilities and how they adapt into the new urban environment.

Findings showed that the risks of under-five deaths were significantly lower for children of rural non-migrant and urban non-migrant mothers compared with children of rural-urban migrant mothers with migration status as the lone variable in model 1. This association is indicative of *migrant disruption* resulting from the migration process itself. The risks were attenuated but remained significantly lower for children of rural non-migrants and were removed for children of urban non-migrants compared to children of rural-urban migrants after adjusting for demographic- (birth order/birth interval, sex of the child, mother's age, mother's age at birth of first child and marital status) and socio-economic (mother's education, mother's occupation and wealth index) characteristics in models 2 and 3, respectively.

In addition, the risks of under-five deaths were significantly lower for children of single and divorced mothers compared to children of married mothers. In contrast, the risks of under-five deaths were significantly higher for children of mothers with primary education and lower wealth status compared to children of mothers with secondary or higher education and those in the richest wealth quintile, respectively. This indicates that demographic and socio-economic

characteristics, which determine *migrant selectivity*, played a significant role in the risks of under-five deaths among migrant groups.

The risks were further attenuated while remaining significant for children of rural non-migrants compared to children of rural-urban migrants after adjusting for measures of healthcare utilization (mother received tetanus toxoid injections in pregnancy, place of delivery and prenatal care by doctor) in model 4. The risks of dying were significantly higher for children of mothers who had not received tetanus injection during pregnancy compared with children of mothers who did. This shows that difficulty in adapting into the new urban environment predispose the children of rural-urban migrants to higher mortality. It also indicates that *migrant adaptation* plays a significant role in the survival of children of rural-urban migrants. The risks were further attenuated but remained significantly lower for children of rural non-migrants compared to children of rural-urban migrants after adjusting for community-level factors (mother's region of residence, community child immunization and community mother's education) in model 5.

In addition, the risks of under-five deaths were significantly lower for children of mothers who lived in communities with high level of hospital delivery compared with children of mothers living in communities with median level of hospital delivery. Statistically non-significant community-level variation from Model 5 suggests that the sampled communities are homogeneous in terms of under-five mortality, but does not necessarily imply an absence of contextual effects.

6.4. Paper IV: Urban area disadvantage and Under-five Mortality in Nigeria: The effect of rapid urbanization.

Objectives: To assess the trend of urban under-five mortality in relation to urban population growth in Nigeria; and to assess whether area level socio-economic disadvantage has an impact on under-five mortality risks after individual demographic and socio-economic characteristics are taken into account.

Urban under-five mortality increased as urban population steadily increased between 1983 and 2003. We assessed the social construct of urban area disadvantage to reflect the urban neighbourhood context of disadvantage, using the urban area disadvantage index. Findings showed that the risks of under-five deaths increased as the level of urban area disadvantage increased after adjusting for individual child- and mother-level demographic and socio-economic characteristics.

In addition, low socio-economic position (primary education or less, unemployment and being in the poorest wealth quintile) was associated with increased risks of under-five deaths. Significant community-level variance in the final model, having taken into account relevant differences in the characteristics of individual residents between disadvantaged neighbourhoods, implies the clustering of children with similar risk factors within disadvantaged communities and indicates a contextual effect.

7.0. Discussion

The social contexts in which people live create social stratification and assign individuals or groups into different social positions within society. These social positions are powerful determinants of the distribution of risk factors, differences in susceptibility to these risk factors and the likelihood of possessing particular health enhancing resources (lynch & Kaplan 2000). Though socio-economic position is traditionally defined by individual-level measures, such as education, income and occupation, classifications of social position tend to vary in societies with different economic or industrial structures (Diderichsen *et al.* 2001).

This thesis focused mainly on the measures of social position that are more relevant to the social contexts in Nigeria and other low- and middle-income countries. Thus, socio-economic indicators such as education and occupation acted as confounders. Two research strategies were used for these purposes, viz Cox regression analysis and multilevel logistic regression analysis. Below, a critical assessment of the key findings in this thesis is presented.

7.1. Individual-level effects

7.1.1. Inequities in Under-five mortality in Nigeria: Differentials by religious affiliation of the Mother

This study showed that the risks of under-five deaths were associated with mother's affiliation to Traditional indigenous religion compared to Christianity. This association was largely due to the mothers' differential use of prenatal care provided by a doctor, indicating that mortality differences between religious groups in Nigeria were largely due to the specific doctrines, beliefs and values associated with Tradition religion. This is consistent with the particularized theology hypothesis. As a previous study commented, "religion is a potent cultural resource which may act as the vehicle of change, challenge or conservation. Its capacity to mobilize people and material resource remains strong; however, it is likely to be mobilized in ways that may be in tension with established practices and policies..." (Beckford 2003).

Despite public health promotion by modern science, there is a tendency to resist this new knowledge and medical intervention in favour of the more locally established influence of cultural beliefs and practices of Traditional indigenous religion that rely mainly on local "deities". Moreover, their perceptions of disease aetiology and treatment patterns have mythological undertones, thus relegating modern medical care to the background (Feyisetan & Adeokun 1992). This tends to be a more fatalistic approach to illness and plays a role in child survival outcomes in the country (Koch 2008; Ogunjuyigbe 2004; Oladepo & Sridhar 1987) and may be an expression of social class that reflects the lower socio-economic position associated with many adherents of Traditional indigenous religion especially in rural communities (Pyle & Koch 2001).

In line with this hypothesis, our study observed that in addition to a higher proportion of Traditionalist mothers having delivered at home and not receiving prenatal care by a doctor, a higher proportion of Traditionalist mothers and fathers were resident in rural areas, uneducated, working in the agriculture/household & domestic sector and of poor wealth status. In addition, the higher risks of under-five deaths associated with children of mothers with primary education and children of fathers with no education or primary education lend support to findings from recent research (Antai 2009a; Antai 2009b; Antai & Antai 2008; Ferraro & Kelley-Moore 2000), which point to persistent socio-economic inequalities among mothers in different religious groups.

In Nigeria, traditional medicine plays a significant role in meeting the health needs of the country as it is highly patronized by a large proportion of the population (Osunderu 2009). This may be as a result of a combination of factors, among which are the inequitable distribution of healthcare facilities (Agara *et al.* 2008; Ajala 2005), shortage of professional health care health facilities and personnel, as well as unavailability and high costs of modern medicines (Koch 2008). These facilitate the increased patronage of traditional medicine practitioners in the country. In line with this assumption, our study identified the differential use of maternal and child health services, specifically attendance to prenatal care among the mothers, as being crucial to increasing the risks of under-five deaths among children of Traditionalist mothers. This is an expected finding, given the coexistence of maternal and child health services (MCHS) with traditional indigenous health care services in rural communities in Nigeria, with women being less likely to attend prenatal care and to deliver in modern medical settings (Falkingham 2003; Gleit & Goldman 2000). Thus, the use of MCHS in rural areas is commonly determined by the traditional and cultural beliefs of rural residents, their perceptions regarding the efficacy of traditional birth attendants in comparison to their professional health care counterparts, and their religious beliefs, as seen in recent studies in Nigeria (Babalola & Fatusi 2009; Osubor *et al.* 2006; Fatusi & Ijadunola 2003; Addai 2000) and elsewhere (Mekonnen & Mekonnen 2003; Stewart *et al.* 1997).

These factors act together with the wide accessibility and affordability of traditional medicine to increase the popularity and socio-cultural appeal of traditional medicine and traditional healers to the majority of Nigerian population (Agara *et al.* 2008; Osifo *et al.* 2007; Osowole *et al.* 2005; WHO 2002b). This is more commonly observed in rural communities where the majority of the Nigerian population resides and where traditional healers enjoy a kind of monopoly. However, urban dwellers in high socio-economic positions have also been reported to adhere to traditional religious practices (Agara *et al.* 2008; Ogunjuyigbe 2007; Ajala 2005; Verhoef *et al.* 2005; Wootton & Sparber 2001) where switching from modern medicine to traditional medicine is a common phenomenon (Ezeome & Anarado 2007). These conditions tend to negatively impact child health and survival.

In addition, poverty and low socio-economic position are important underlying factors influencing increased use of Traditional indigenous medicine in our study, which agrees with recent studies (Koch 2008; Onah *et al.* 2006; Celik & Hotchkiss 2000). In Nigeria, Traditional birth attendants (TBAs) are reported to offer more convenient user-fee payments spread over a period of time to their predominantly rural and poor clients (Babalola & Fatusi 2009; Onah *et al.* 2006), which may also help in explaining the lower likelihood of prenatal care by doctor found in our study. Education serves as a proxy for information, cognitive skills and values. It influences health-seeking behaviour through several pathways, which include higher level of health awareness and modern perceptions of disease aetiology and treatment patterns among women with higher education, increased ability of educated women to afford the cost of modern medical health care as well as their increased autonomy to make health related decisions including prenatal care by doctor (Celik & Hotchkiss 2000). Traditionalist mothers were most likely to be uneducated and poorer than Christian mothers; hence it is not surprising that children of these mothers had poorer health outcomes.

Higher education is associated with improved child health and welfare, it could therefore be argued that though religious groups may try to influence the health-seeking behaviour of their members, mothers with primary or higher education may be more inclined than uneducated mothers to seek and adopt health-promoting strategies of modern medicine for the treatment of their children's ailments. Our study therefore infers that the differential use of maternal and child health services, specifically attendance to prenatal care among the mothers was crucial to the increasing the risks of under-five deaths among children of Traditionalist mothers.

7.1.2. *Ethnic Disparities in Child Health in Nigeria: A Multilevel Analysis of Individual and Contextual factors*

Health and health behaviour are influenced by more distal health determinants such as education, income, occupation and other dimensions of socio-economic position (Galobardes *et al.* 2006; Krieger *et al.* 1997). As such, ethnic health disparities are confounded by disparities in socio-economic position (Dressler *et al.* 2005), necessitating the need to recognize the contingency of the relations between ethnicity, socio-economic position and particular health outcomes (Smith 2000) by controlling ethnic inequalities in health socio-economic factors (Vokó *et al.* 2009). If significant ethnic differences in under-five mortality remain even after socio-economic characteristics are controlled for, as in this case and that of a follow-up study (Antai 2010), then it can be concluded that socio-economic position partially mediates the association between ethnicity and under-five mortality, and additional factors related to ethnicity can then be hypothesised as partial determinants.

The present study found a significant association between mother's ethnicity and under-five mortality, with lower risks of under-five deaths amongst children of Yoruba mothers compared to children of mothers from the Hausa/Fulani/Kanuri ethnic group. Much of this association was mediated in part by differences in individual-level socio-economic characteristics, especially mother's education and mother's age, creating allowance for ethnicity as an explanatory variable for elements of health behaviour after adjustment for socio-economic factors (i.e. ethnicity is statistically significantly associated with elements of health behaviour after adjustment for the socio-economic factors. Socio-economic factors have also been attributed to ethnic differences in childhood mortality in other studies (Vokó *et al.* 2009; Matijasevich *et al.* 2008; Dommaraju *et al.* 2008; Mustafa 2006; Schulpen *et al.* 2006; Hessol & Fuentes-Afflick 2005; Macassa *et al.* 2004; Jatrana 2003; Brockerhoff & Hewett 2000).

However, the utility and interpretation of ethnicity as a health determinant has long been debated in the scientific literature. Several models have been put forward to explain the relationship between ethnicity and health (Kaplan & Bennett 2003; Dressler *et al.* 2005) often with "ethnicity" and "race" being used interchangeably (Ford & Adam Kelly 2005). This is a trend fostered by the increasing use of the compound word race/ethnicity, which is unfortunate but purposefully reflects the conceptual and practical problems of separating the two concepts.

Race, as it is used in health-related research, consists of personal and group identity facets in addition to biological indicators. In contrast, ethnicity is recognized more as a social, rather than a biological construct (Krieger 1997) that refers to the sharing of a common culture, including shared origin, shared psychological characteristics and attitudes, shared language, religion and cultural traditions (Jones 2001; Freeman 1998; Krieger 1997). As a result, ethnicity refers to cultural identification that is fluid and may change over time (Ford & Adam Kelly 2005). Ethnicity could also be conceptualized as a construct separate from a person's race, although the two sometimes co-occur (Ford & Adam Kelly 2005).

Ethnicity in sub-Saharan Africa carries a slightly varied connotation. First, people of sub-Saharan African ethnicity are almost exclusively of the black race (as people of Pacific Island ethnicity are almost exclusively of Asian ethnicity). Thus, "ethnicity" is a complex term that is not always understood by study participants, often requiring further clarification in a relevant local context. Ake (1993) conceptualizes ethnicity also as a concrete distinctive phenomenon, in that ethnic groups, especially in sub-Saharan Africa, are real if they are made up of actual people united in consciousness of their own ethnic identity, however spurious that consciousness may be.

The concreteness of ethnic groups in sub-Saharan Africa is invariably affirmed by ethnic markings imposed on them by society and which underscore the social existence of ethnicity even when they are arbitrary or shifting (Ake 1993). Ake further describes the ethnic group as “a descent-based group, a segmentary hierarchy with boundaries defined by standards of exclusion and inclusion that are both objective and subjective” - a position that more appropriately provides the backdrop for understanding ethnic differences in sub-Saharan Africa.

This study also found that the association between ethnicity and under-five mortality was also attributed in part to birth order/birth interval. This is in agreement with another set of theories which propose health behaviour variations among ethnic groups as an explanation for health disparities (Dressler *et al.* 2005; Williams & Jackson 2000). We found that among the Hausa/Fulani/Kanuri mothers, children of 2nd-4th birth order after 24 – 47 months birth interval, and 5+ birth order after 24-47 months interval were the most common, and that among the Hausa/Fulani/Kanuri mothers, younger mothers (24 – 28 years) who were 18 years or less at the birth of their first child and mothers with no education were the most common.

These findings reflect the influence of culture associated more with the Hausa/Fulani/Kanuri ethnic group in Nigeria. For example, an analysis of the social context of childbirth among the Hausa/Fulani/Kanuri ethnic group of Northern Nigeria showed a strong influence of cultural beliefs and practices on childbirth and associated fertility-related behaviours. The culture of early marriage, young age at birth of first child, high order births with short birth interval, low literacy and low educational attainment typical of women of this ethnic group significantly contributes to high childhood and maternal mortality and morbidity (Babalola & Fatusi 2009). Thus, ethnicity may have an indirect effect on health outcomes by influencing health behaviours, such as birth order and birth interval, health beliefs, the way in which symptoms are expressed, physical functioning, use of health care delivery systems and medical treatment processes as previously (Williams & Jackson 2000).

7.1.3 Migration and child health inequities in Nigeria: A multilevel analysis of contextual- and individual-level factors.

Applying three migration perspectives to explain under-five mortality differences between rural-urban and non-migrants, this study found that, firstly, the risks of under-five deaths for children of rural-urban migrant mothers were higher than the risks for children of rural- and urban non-migrant mothers. This is indicative of *migrant disruption*. This is not surprising, given that family migration tends to negatively affect women’s economic well-being and employment family migration which is usually stimulated by the man’s professional career (Boyle *et al.* 2006).

Rural-urban migration often disrupts women’s employment or whatever economic activity they were involved in, leaving them frequently unemployed, occupying lower positions or earning less than they had prior to the move (Boyle *et al.* 2001, Cooke 2003, Clark & Davies Withers 2002). Migration also leads to changing social networks, particularly the social networks where kin relations play a major role (Boyle *et al.* 2006; Ssengonzi *et al.* 2002). This disruption also entails the loss of a source of psychological and social support necessary for childcare and treatment during the children’s ill-health, strain in psychological and social functions (Sluzki 1998), particularly for families with children, who additionally have to organise child care and other child-centred activities (Muszynska & Kulu 2007).

Secondly, after the adjustment for demographic and socio-economic characteristics, the risks of under-five deaths for children of rural-urban migrant mothers were higher than the risks for

children of rural non-migrants mothers. The risks of under-five deaths were significantly lower for children of single and divorced mothers, but significantly higher for children of mothers with primary education and lower wealth status, indicating that demographic and socio-economic characteristics, which determine *migrant selectivity*, were important determinants of differences in the risks of under-five deaths between children of rural-urban migrants and rural- and urban non-migrants. This is indicative of *migrant selectivity*.

Rural-urban migration is typically carried out by individuals that are self-selected for their demographic and socio-economic characteristics (Taylor & Martin 2001) that often comprises of younger, poorer and more socio-economically vulnerable mothers aspiring to improve their well-being, as the present study has shown. They often make up a socio-economically disadvantaged group. As such, rural-urban migrants constitute a more vulnerable population, with their children predisposed to increased risks of under-five deaths in comparison to children of rural non-migrants, who as this study showed, were better-off and more adjusted to their rural social and economic environment. As a result, children of rural non-migrants had better child survival outcomes.

The finding of decreased risks under-five deaths for children of single and divorced mothers may be attributed to the disproportionately smaller proportion of children of single and divorced mothers, or may be associated with single or divorced mothers having greater autonomy over decision-making e.g. timing and destination of migration. In addition, women as the primary caregivers for children are often the first to recognize and seek treatment for their children's ill health, with resulting better health outcomes for their children (UNICEF 2006). Thus, the combination of the effects of the migration process itself and the self-selected vulnerability of rural-urban migrant mothers may account for the increased risks of under-five deaths among their children compared to children of rural non-migrant mothers.

Thirdly, the risks of under-five deaths for children of rural-urban migrants were higher than that for children of rural non-migrants mother after controlling for health care utilization. In addition, the risks of dying were higher for children whose mothers were disadvantaged in terms of receiving tetanus toxoid injection during pregnancy. Disparities in child health outcomes tend to be wide between rural and urban areas of developing countries. These disparities may be largely due to differences in socio-economic position between and within these populations, with urban advantage often attributed to the better access to healthcare services, preventive and curative, rather than the place for residence (Konseiga 2006).

However, this certainly does not imply that an urban child can expect to enjoy better health than his/her rural counterpart. The rapid and uncontrolled growth of urban cities in Nigeria and other low- and middle-income countries has compelled the poor to live in informal settlements characterized by poor access to water supply and sanitation, poor and crowded housing - conditions that are known to indirectly affect their health. As a result, the protective effect of the urban setting over the rural setting, which accounts for the usual rural-urban mortality differences, may be distorted by the poor availability and accessibility to healthcare services in the social context of rapid urbanization (Songsore 2000). This is reflected in the present study by the higher risks of under-five deaths among children of mothers that did not receive tetanus toxoid injection during pregnancy and signifies the significant role *migrant adaptation* plays in the survival of children of rural-urban migrants, and is line with findings from other studies (Kiros & White 2004; Nyarko *et al.* 2001). In this context, the differences in healthcare utilization may be attributed to migrant mothers' poor social networks, poor integration into the urban communities, lower social positions and unemployment (Kristiansen & Mygind 2007).

Though this study did not assess the effect of duration of residence of the rural-urban migrant mothers, it is believed that the longer the duration of residence in the receiving urban area, the more migrants integrate and show evidence of adaptation with resulting improved child health outcomes (Ahmed *et al.* 2009). Though others suggest that integration and acceptance into the host urban society are more important than the length of stay (Kiros & White 2004).

Finally, the risks of under-five deaths were higher for children of rural non-migrants compared to children of rural-urban migrants after adjustment for community-level factors. This provides a clue about the influence of community contexts in shaping under-five mortality differences among migrant groups, given that contextual features such as healthcare services, quality of the housing and environment are reported to influence health (Macintyre *et al.* 2002). The vulnerability associated with moving to an unfamiliar environment makes access to prevention and healthcare services a major component of healthcare adaptation response in host societies (Lenz *et al.* 2006; Kandula *et al.* 2004; Politzer *et al.* 2001). This is reflected in the present study by the lower risk of dying among children of mothers resident in communities with high level of hospital delivery, which is consistent with the literature (Torres-Cantero *et al.* 2007; Ku & Matani 2001).

7.1.4 Urban area disadvantage and Under-five Mortality in Nigeria: The effect of rapid urbanization.

This study showed that under-five mortality rate increased with increasing urban population growth in Nigeria between the periods 1979-1983 and 1999-2003, which is indicative of urbanization. Results of the multilevel logistic regression analysis showed that the risks of under-five deaths increased with increasing levels of urban area disadvantage. This indicates that living in socio-economically disadvantaged urban neighbourhoods represents an independent risk for under-five deaths, as shown in recent studies (Guidotti & Gitterman 2007; Pongou *et al.* 2006), and may be explained as a direct effect of living in deprived urban neighbourhoods (Dibben *et al.* 2006; Krieger & Higgins 2002; Gracey 2002; Zulu *et al.* 2002; Pickett & Pearl 2001) characterized by overcrowded or deteriorating housing, inadequate social amenities, poor environmental and sanitary conditions, and poor economic opportunities – contextual effect i.e. these neighbourhoods have collective properties exerting an influence on the resident's health outcomes independently of individual factors (Sampson *et al.* 2002).

It could also be explained as an indirect effect of the socio-economic characteristics of people living in these disadvantaged areas – compositional effect i.e. the characteristic of the individuals comprising the neighbourhoods are attributable to differences in health outcomes (Diez Roux 2002). This is exemplified by the increased risks of under-five deaths among children of mothers in low socio-economic positions (primary education or less, unemployment and being in the poorest wealth quintile) in this study, and other studies (Giashuddin *et al.* 2009; Schulz *et al.* 2008; Songsore 2000).

Ultimately, it is the multiplicity of socio-economic factors at both the individual and community levels that shape the survival chances of children in urban environments.

The increased risks of under-five deaths found among first births and children of high birth order after short birth interval residing in disadvantaged urban areas may also be linked with the social position of mothers, given the higher proportion of younger, uneducated and poorer mothers residing in highly disadvantaged areas. The limited access of these mothers to MCHS and fertility information may in turn have influenced birth spacing and age of the mother at the time of the second birth (Makepeace & Pal 2006; Rahman *et al.* 1996), given that ignorance and difficult conditions of life in these areas are likely to result in low healthcare use and lack of knowledge about health risks (Hussain *et al.* 1999).

In Nigeria and other low-and middle-income countries, inequalities in overall poverty levels between rural and urban areas (UN-Habitat 2003; Drakakis-Smith 2000) act as the main driver for rural–urban migration (Waddington & Sabates-Wheeler 2004). Poverty and rural-to-urban migration are two important factors negatively associated with health outcomes among urban populations (Jegasothy 1999; Brockerhoff 1995). The resulting pace of urbanization outstrips economic growth, making it difficult for national and urban authorities to provide adequate housing and health care, quality social amenities and sufficient employment and educational opportunities for the growing urban population (Fotso *et al.* 2008; Edelman & Mitra 2006; Teshome Nega 2002; Brockerhoff 2000).

The resulting widespread growths of unplanned resettlements are hubs of social and economic deprivation and environmental pollution. People residing in such disadvantaged areas are often systematically excluded from opportunities that may enable them live better lives and achieve better health (Mercado *et al.* 2007; Zulu *et al.* 2002). These are inequities brought about by residence in deprived urban areas, indicating that inequities in living conditions associated with social position increase the risks of under-five deaths for children of residents within these neighbourhoods.

7.2. Contextual-level effects

One motive for including contextual-level measures in the under-five mortality model is that a mother's socio-economic position and health-seeking behaviour at the individual level are likely to be influenced by various structural and institutional characteristics of the community, such as the availability of healthcare services. These factors may in turn depend partly on general socio-economic resources among people in the community and probably the broader area as well as a wide range of political and other factors at different levels.

The development of multilevel modelling techniques has facilitated the identification of community-level effects on health. Factors such as cultural beliefs, access to health care, community services and infrastructure, social support and the socio-economic development of particular communities may create an environment that lowers or amplifies the risks of poor health among children of that community compared to the risks among children matched on individual characteristics but from a different community (Pickett & Pearl 2001; Duncan *et al.*, 1998; Osmond & Manda 1998). Thus, the characteristics of the community in which an individual lives have the potential to mediate the individual- and household-level influences on health outcomes.

The observed statistical non-significance of the community variation in under-five mortality within this thesis suggests that the sampled communities were homogeneous in terms of under-five mortality. This however does not necessarily imply an absence of contextual effects. Reasons for the seemingly absent or weaker community effects may be attributed to several factors including: *i*) the possibility of “mis-specifying” a statistical model by omitting a “relevant” variable at the contextual (community) level; *ii*) much of the clustering at the contextual level may have been explained by the individual-level variables already included in the model, such as the region of residence, urban location, religion, and socio-economic status, which describe a number of elements of the living environments of communities; *iii*) the community correlation of child health outcomes may be less important than the family correlation in explaining under-five mortality; this interpretation is consistent with other studies (Osmond & Manda 1998).

Nevertheless, the statistically significant community effect observed and the overall significance of the community effect in the final model of some studies herein, suggest that community contextual effects are important in explaining the under-five mortality differences found. In addition, the significant community effects remaining after controlling for individual and community-level factors in the models indicate that the models did not completely explain community-level variation in under-five mortality by the measures of social position assessed. This may have resulted from factors not included in the models; such as traditional views on childbearing are more difficult to assess or factors that we were unable to control for because the data do not exist, such as cultural influences on healthcare utilization, which are difficult to quantify and vary across communities.

7.3. Strengths and limitations

This thesis has several strengths. First, examination of neighbourhood effects provides a unique opportunity to highlight the need for models and analytic strategies that incorporate systems defined at multiple levels, without ignoring the interdependencies and mutual influences between people, between places, and between people and the places in which they live (Diez-Roux 2001). This is a major strength of this study. Second, neighbourhood-level socio-economic characteristics are much more highly correlated than individual-level socio-economic factors; thus, the risk of mis-specifying the neighbourhood-level effect is minimal (Pickett & Pearl 2001). Third, the development of composite indices enable easy handling of several highly correlated neighbourhood-level variables improves statistical efficiency and simplifies the presentation of results. Using several single neighbourhood-level measures separately to reflect a single underlying concept, such as urban socio-economic position introduces the risk of collinearity and cumbersome results, a point emphasized by previous studies (Pickett & Pearl 2001).

Fourth, the DHS surveys are nationally-representative and enable the generalization of the results across the country (Fotso 2006). Fifth, variables in the DHS surveys are defined similarly across countries and results are therefore comparable across countries (de Walque 2008). Sixth, the advantages of using administrative boundaries are the possibility of comparing any set of data on the same geographical frame, or of presenting complex data in a simple way. Seventh, further inclusion of individual-level characteristics to the model may have resulted in reduced strength of the association with area disadvantage. Eighth, multilevel analyses with random effects have been used in this thesis, which is the proper statistical method to use when investigating contextual effects on individual health outcomes (Subramanian 2004; Bingenheimer & Raudenbush 2004).

This thesis also has certain limitations. First, the administratively defined boundaries used as a proxy for neighbourhoods in this study may non-differentially misclassify individuals into an inappropriate administrative boundary, which can generate information biases and reduce the validity of analyses. Second, other individual and community factors not addressed in the present study are also likely to be important determinants of under-five mortality. Third, demographic and health surveys do not ordinarily collect data on household income or expenditure, which are the indicators commonly used to measure wealth. The assets-based wealth index used here is only a proxy indicator for household economic status, which may not always produce results similar to those obtained from direct measurements of income and expenditure where such data are available or can be collected reliably (Filmer & Pritchett 2001).

Fourth, the studies that include ethnicity as a variable are based on the analysis of the risks of under-five deaths among three major ethnic groups and an aggregation of a large number of minority ethnic groups ('others'). This aggregation of minority ethnic groups possibly masks

social and cultural differences that may explain some sub-ethnic group differences, which could increase or decrease the risks of under-five deaths. We therefore urge the exercise of caution in generalising the findings to all minority ethnic groups. Fifth, recall errors arising from an under-reporting of births and deaths of children who were not alive at the time of the survey may have occurred in the survey and may have affected the mortality estimates in this thesis. It is known that older women or women with several children tend to under-report events in the more distant past. Children who died shortly after birth may have been omitted, and a few mothers may have been reluctant to talk about their dead children either because the culture in which they live may discourage discussing the dead or for feelings associated with death. However, DHS data quality analyses have found that errors are minimal in most cases (Fotso *et al.* 2007).

Two types of sampling errors may affect survey outcomes viz: *i*) the statistical error due to the limited sample size, and *ii*) the design effect, which represents the factor by which the cluster-based sampling compounds this error. A design effect of 1.2 means that the total error is 1.2 times higher than it would have been if a simple random sample, without clustering, had been chosen. The design effect depends on the number of households per cluster and on the extent to which the outcome of interest (e.g. child mortality) varies within and between clusters. Thus, for a given survey design, the design effect differs between outcomes and between countries (Korenromp *et al.* 2004).

8.0. Implications for practice

The extent to which governments will succeed in attaining health goals rests on a number of factors among which are: having “sufficient understanding” of the causes of health inequalities and inequities specific to each social context; a well-grounded “knowledge of the policies and interventions that can effectively address those causes, as well as the “political will” to invest in those policies. Thus, there is a need to recognize the role of the wider social, economic and political contexts of health inequities that shape health-related behaviours and responses to health interventions when designing downstream interventions.

There is also a need to make a distinction between the societal factors that influence health (social contexts) and the social processes that determine health inequalities (social position) when planning intervention strategies. Mechanisms that contribute to the stratification of health outcomes are in fact the same mechanisms that generate and distribute power and wealth - a point that has been previously echoed (Graham 2004a; 2004b; Diderichsen *et al.* 2001; Scrambler 2001).

Strategies for tackling the health divide

This thesis mainly focused on social position arising from social stratification, which in turn depends on the social context. Hence, policy strategies should be aimed mainly at redressing social stratification. As such, the policy implications in this thesis reflect a combination of policy approaches:

1, *Primary approach*: promotes altering or diminishing the effects of social stratification itself by reducing inequalities linked to different elements of socio-economic position.

Since religious, ethnic, migrant group and disadvantaged urban area differences in under-five mortality were strongly linked with socio-economic position of the mothers and the underlying differences in utilization of maternal and child health services, these underscore the importance of taking the local social context into account when formulating health interventions.

Strategies aimed at addressing health inequalities and inequities are best targeted primarily at the whole population within the local community level (Asthana & Halliday 2006), with special preference given to women and girls since women are the primary caregivers of children. The wellbeing of women contributes to the health and wellbeing of their children (UNICEF 2006).

These strategies may include:

- i) Identifying and reducing social, economic and other barriers to women and girls among disadvantaged groups gaining access to education at all levels.
- ii) Introducing comprehensive support programmes in less privileged communities to improve the level of literacy and education among women and girls.
- iii) Enhancing the access and utilization of maternal and child healthcare services, especially in disadvantaged and hard-to-reach communities. This may involve free mother and child healthcare services to ensure that the whole target populations benefit from services offered.
- iv) Intensifying information and promotion programmes to address cultural norms regarding birth spacing practices associated with different cultural practices. These need to identify and incorporate components specific to different social contexts and cultures (ethnic and religious) that are either protective of, or damaging to child survival so as to enable effective and culturally-appropriate interventions.
- v) Targeting rural-urban migrant groups and re-settlements within urban areas in order to increase information and education among women, and increasing their accessibility to healthcare services.
- vi) Systematically discouraging excessive rural-urban migration by providing and maintaining educational and economic opportunities, and social amenities (e.g. electricity, pipe borne water and better roads) in rural areas.
- vii) Improving social amenities in urban areas. This may call for stringent policies in the case of rapidly expanding or disadvantaged neighbourhoods.

2. *Secondary approach*: includes socio-economic policies to mitigate their effects on social stratification and seeks to reduce the differences in health and wellbeing between high-, middle- and low-income groups by equalizing health opportunities across the socio-economic gradient.

This may involve:

- i) Macro-economic policies at the national level intended to alleviate social inequalities, poverty, extreme economic hardship and marginalization of individuals in low social positions within religious, ethnic and migrant groups as well as people in disadvantaged urban neighbourhoods. Success may depend on effective partnerships between governmental and non-governmental organisations, and between district health and political authorities, with emphasis being placed on health promotion at community level.

The focus of community-oriented strategies is on a certain geographical region, city, or neighbourhood. Advantages of this approach include ownership i.e. the people living in a community become stakeholders with a natural interest in promoting the possibilities for a healthier life in their community or neighbourhood. It may also stimulate dialogue about certain public health issues specific to those neighbourhoods.

The risks inherent in the community-oriented approach, from a health-equity perspective, include: *i)* relying exclusively on a community-oriented approach for health promotion instead of wider policies; *ii)* limited impact of community-oriented programmes when the interests of more affluent groups are different from those more disadvantaged groups. Thus, community-oriented programmes need to benefit all socio-economic groups in a manner that inequities in health are reduced as efforts are made to improve the differences in health outcomes within the community as a whole.

9.0. Proposal for future studies

An outline of possible future studies is presented here. Firstly, significant variation in the outcome still existing at the community level after controlling for individual- and community-level factors in the models indicates that the models do not fully explain the community-level variation in the risks of under-five deaths. This residual variation may be due to factors not included in the models, or factors that cannot be measured in a quantitative survey. Thus, more research is needed to understand the factors influencing health behaviour at the community level, such as cultural influences on health service utilization, which are difficult to measure and may vary across communities.

Secondly, inter-relation between the ethnic-, religious-, and migrant groups, socio-economic position and childhood mortality is worth investigating. Thirdly, since rural-urban migrants tend to resettle in certain neighbourhoods within urban areas, there is a need to assess the effect of neighbourhood ethnic segregation on childhood mortality. Finally, further research is needed to understand the effect of duration of residence, integration and acceptance of rural-urban migrants in the host urban society on childhood mortality.

10.0. Conclusions

This thesis employed a conceptual framework to contribute to an understanding of the underlying mechanisms of child health inequities in under-five mortality in Nigeria in relation to social context, social stratification and social position. It made explicit links between theory, practice and policy implications aimed at tackling these social inequities as they relate to social determinants of child health inequities in Nigeria. It did so by exploring pathways and processes that give rise to inequities in under-five mortality for each element of social position examined.

This thesis has shown that there were significant disparities in survival chances of children below five years of age among religious, ethnic, migrant groups and disadvantaged urban residents.

1) Religious mortality differences were closely associated with the differential use of maternal and child health services among mothers of Traditional indigenous religion, which were in turn associated with poverty and low socio-economic position.

II) Ethnic mortality differences were dependent in part on differences in individual-level socio-economic characteristics, and in part to inter-ethnic variation in birth spacing behaviour of the mothers.

III) Applying three migration perspectives, mortality differences among migrant groups were associated with *disruption* of the migrant's social and economic well-being as well as the effect of the migration process itself; the *selectivity* of the rural-urban migrants by their demographic and socio-economic characteristics; and disparities in *adaptation* (utilization of maternal health services) of the rural-urban migrants, which in turn was due to the underlying socio-economic differences between migrant and non-migrant populations, in addition to the influence of community contexts.

IV) Residence in disadvantaged urban areas was associated with increased risks of under-five deaths. The risks increased with increasing level of area disadvantage, and were explained by both the direct effect of living in a deprived neighbourhoods (contextual effect) and the indirect effect of the socio-economic characteristics of the individuals living in these neighbourhoods (compositional effect).

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12.0. References

- Abdulla S, Armstrong Schellenberg J, Nathan R, Mukasa O, Marchant T, Smith T, Tanner M, Lengeler C. Impact on malaria morbidity of a programme supplying insecticide treated nets in children aged under 2 years in Tanzania: community cross sectional study. *British Medical Journal* 2001; 322: 270-273
- AbouZahr C. Global burden of maternal death and disability. *British Medical Bulletin* 2003; 67:1-11.
- Abu Habib N, Lie RT, Oneko O, Shao J, Bergsjø P, Daltveit AK. Sociodemographic characteristics and perinatal mortality among singletons in North East Tanzania: a registry-based study. *Journal Epidemiology Community Health* 2008; 62:960-965.
- Acevedo-Garcia D. Residential segregation and the epidemiology of infectious disease. *Social Science & Medicine* 2000; 51:1143-1161.
- Addai I. Determinants of use of maternal-child health services in rural Ghana. *Journal of Biosocial Science* 2000; 32:1-15.
- Adetunji J. Trends in under-5 mortality rates and the HIV/AIDS epidemic. *Bulletin of the World Health Organization* 2000; 78:1200-1206.
- Adetunji JA. Response of parents to five killer diseases among children in a Yoruba community Nigeria. *Social Science & Medicine* 1991; 32:1379-1387.
- Adler NE, Ostrove JM. Socioeconomic status and health: What we know and what we don't. *Annals of the New York Academy of Sciences* 1999; 896:3-15.
- African Population and Health Research Center. *Population and Health Dynamics in Nairobi's Informal Settlements: Report of the Nairobi Cross-Sectional Slums Survey (NCSS) 2000*. African Population and Health Research Center, Nairobi; 2000.
- Agara AJ, Makanjuola AB, Morakinyo O. Management of perceived mental health problems by spiritual healers: A Nigerian study. *African Journal of Psychiatry* 2008; 11:113-118.
- Agha S. The determinants of infant mortality in Pakistan. *Social Science & Medicine* 2000; 51:199-208.
- Ahmad OB, Lopez AD, Ionue O. The decline in child mortality: a reappraisal. *Bulletin of the World Health Organization* 2000; 78:1175-1191.
- Ahmed AT, Quinn VP, Caan B, Sternfeld B, Haque R, Van Den Eeden SK. Generational status and duration of residence predict diabetes prevalence among Latinos: the California men's health study. *BMC Public Health* 2009; 9:32.
- Ajala OA, Sanni L, Adeyinka SA. Accessibility to health care facilities: A panacea of sustainable rural development in Osun State Southern Nigeria. *Journal of Human Ecology* 2005; 18:121-128.
- Ake C. What is the problem of ethnicity in Africa? *Transformation* 1993; 22.

- Alam N. Birth spacing and infant and early childhood mortality in a high fertility area of Bangladesh: age-dependent and interactive effects. *Journal of Biosocial Science* 1995; 27:393-404.
- Alexander SE, Ehrlich PR. Population and the environment. In: Ernst WG (Ed.) *Earth Systems: Processes and Issues*. UK: Cambridge University Press; 2000.
- Aliga A, Ren R. Cluster optimal sample size for Demographic and Health Surveys. International conference on teaching statistics, ICOTS-7, Salvador Bahia, Brazil; 2006.
- Alleyne GA, Casas JA, Castillo-Salgado C. Equality, equity: why bother? *Bulletin of the World Health Organization* 2000; 78:76-77.
- Amankwaa AA, Bavon A, Nkansah PT. Rural-urban migration and its effects on infant and child mortality in Ghana. *African Population Studies* 2003; 18:1-26.
- Anand S, Peter F, Sen A. (Eds.). *Public health, ethics, and equity*. Oxford: Oxford University Press; 2004.
- Antai D. Faith and child survival: The role of religion in childhood immunization in Nigeria. *Journal of biosocial Science* 2009a; 41:57-76.
- Antai D. Inequitable childhood immunization uptake in Nigeria: A multilevel analysis of individual and contextual determinants. *BMC Infectious Diseases* 2009b, 9:181
- Antai D. Ethnic Inequalities in Under-five Mortality in Nigeria: Does socio-economic position matter? *Journal of Epidemiology and Community Health* 2010 (forthcoming).
- Antai D, Antai J. Individual- and contextual-level determinants of social inequities in under-five mortality in Nigeria: differentials by religious affiliation of the mother. *World Health Population* 2008; 10:38-52.
- Antai D, Ghilagaber G, Wedre'n S, Macassa G, Moradi T. Inequities in Under-Five Mortality in Nigeria: Differentials by Religious Affiliation of the Mother. *Journal of Religion and Health* 2009; 48:290-304.
- Arah OA, Westert GP, Delnoij DM, Klazinga NS. Health system outcomes and determinants amenable to public health in industrialized countries: a pooled, cross-sectional time series analysis. *BMC Public Health* 2005; 5:81.
- Argeseanu S. Risks, amenities, and child mortality in rural South Africa. *African Population Studies* 2004; 19:13-33.
- Ashworth CJ, Antipatis C. Micronutrient programming of development throughout gestation. *Reproduction*. 2001; 122:527-535.
- Asthana S, Halliday J. Health inequalities policies and interventions: what role can local agencies play? Plymouth Area Redesign Board (PARB): Genesis in Health – New Frontier Conference, Plymouth; 2006.
- Babalola S, Fatusi A. Determinants of use of maternal health services in Nigeria – looking beyond individual and household factors. *BMC Pregnancy and Childbirth* 2009; 9:43.

- Barros FC, Cesar GV, Bernardo LH. Ethnicity and infant mortality in Southern Brazil: A birth cohort. *International Journal of Epidemiology* 2001; 30:1001-1008.
- Bartley M. Health inequality: An introduction to theories, concepts and methods. Cambridge: Polity Press; 2004.
- Baum F. *The new public health*, 2nd ed. Melbourne, Oxford University Press; 2002.
- Beckford JA. *Social theory and religion*. Cambridge: Cambridge University Press; 2003.
- Berhane Y, Hogberg U, Byass P, Wall S. Gender literacy, and survival among Ethiopian adults, 1987-96. *Bulletin of the World Health Organization* 2002; 80:714-20.
- Berkman LF, Kawachi I (Eds.). *Social Epidemiology*. New York, NY: Oxford University Press; 2000.
- Bhopal R. Glossary of terms relating to ethnicity and race: for reflection and debate. *Journal of Epidemiology and Community Health* 2004; 58:441-445.
- Bilsborrow RE. The state of the art and overview chapters. In: R Bilsborrow (Ed.) Migration, urbanization and development: New directions and issues. New York: UNFPA and Kluwer Academic Publishers; 1998.
- Bingenheimer JB, Raudenbush SW. Statistical and substantive inferences in public health: Issues in the application of multilevel models. *Annual Review of Public Health* 2004; 25:53-77.
- Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? *Lancet* 2003; 361: 2226-2234.
- Blakely T, Atkinson J, Kiro C, Blaiklock A, D'Souza A. Child mortality, socioeconomic position, and one-parent families: independent associations and variation by age and cause of death. *International Journal of Epidemiology* 2003; 32:410-418.
- Bollen KA, Glanville JL, Stecklov G. Economic status proxies in studies of fertility in developing countries: does the measure matter? *Population Studies* 2002; 56:81-96.
- Boyle PJ, Kulu H, Cooke T, Gayle V, Mulder CH. *The effect of moving on union dissolution*. MPIDR Working Paper, WP-2006-002. Rostock: Max Planck Institute for Demographic Research; 2006. <http://www.demogr.mpg.de/papers/working/wp-2006-002.pdf>.
- Brabin BJ, Premji Z, Verhoeff F. An analysis of anemia and child mortality. *Journal of Nutrition* 2001; 131: 636S-645S.
- Bradley RH, Corwyn RF. Socioeconomic status and child development. *Annual Review of Psychology* 2002; 53:371-399.
- Braveman P. Health disparities and health equity: Concepts and Measurement. *Annual Review of Public Health* 2006; 27:167-94
- Braveman P, Gruskin S. (2003a). Poverty, equity, human rights and health. *Bulletin of the World Health Organization* 2003a; 81:539-545.

- Braveman P, Gruskkin S. Defining equity in health. *Journal of Epidemiology and Community Health* 2003b; 57:254-258.
- Brockhoff M. Child survival in big cities: the disadvantages of migrants. *Social Science & Medicine* 1995; 40:1371-1383.
- Brockhoff MP. *An urbanizing world. Population Bulletin* 2000; 55:1-44.
- Brockhoff M, Hewett P. Ethnicity and child mortality in sub-Saharan Africa. Policy Research Division Working Paper No 107, New York: Population Council; 1998.
- Brockhoff M, Hewett P. Inequality of child mortality among ethnic groups in sub-Saharan Africa. *Bulletin of the World Health Organization* 2000; 78:30-41.
- Browne W. *MCMC estimation in MLwiN. Version 2.0*. London: University of London, Centre of Multilevel Modelling, Institute of Education; 2003.
- Bruce N, Perez-Padilla R, Albalak R. Indoor air pollution in developing countries: a major environmental and public health challenge. *Bulletin of the World Health Organization* 2000; 78:1078-1092.
- Brunner E, Marmot M. Social Organization, Stress, and Health. In *Social Determinants of Health*, M. Marmot, RG Wilkinson (Eds.) Oxford: Oxford University Press; 1999.
- Cassell JA, Leach M, Fairhead JR, Small M, Mercer CH. The social shaping of childhood vaccination practice in rural and urban Gambia. *Health Policy Plan* 2006; 21:373-391.
- Caughya MO, O'Campo PJ, Patterson J. A brief observational measure for urban neighborhoods. *Health & Place* 2001; 7:225-236
- Caulfield L, Black R. *Malnutrition and the Global Burden of Disease: Underweight and Cause-Specific Mortality*. Geneva, Switzerland: World Health Organization; 2002.
- Celik Y, Hotchkiss DR. The socioeconomic determinants of maternal health care utilization in Turkey. *Social Science & Medicine* 2000; 50:1797-1806.
- Center for Multilevel Modelling. *MLwiN software package*. Centre for Multilevel Modelling; 2000.
- Chandola T. Ethnic and class differences in health in relation to British South Asians: using the new National Statistics Socio-Economic Classification. *Social Science & Medicine* 2001; 52:1285-1296.
- Chen LC, Evans TG, Cash RA. Health as a global public good. In: I Kaul, I Grunberg, MA Stern (Eds.) *Global public health: international cooperation in the 21st century*. New York: Oxford University Press; 1999.
- Chen E, Hanson MD, Paterson LQ, Griffin MJ, Walker HA, Miller GE. Socioeconomic status and inflammatory processes in childhood asthma: the role of psychological stress. *Journal of Allergy and Clinical Immunology* 2006; 117:1014-20.

Chor D, Faerstein E, Kaplan GA, Lynch JW, Lopes CS. Association of weight change with ethnicity and life course socioeconomic position among Brazilian civil servants. *International Journal of Epidemiology* 2004; 33:100-106.

Claeson M, Bos ER, Mawji T, Pathmanathan I. Reducing child mortality in India in the new millennium. *Bulletin of the World Health Organization* 2000; 78:1192-1199.

Clark WAV, Davies Withers S. Disentangling the interaction of migration, mobility, and labor-force participation. *Environment and Planning A* 2002; 34:923-945.

Commission on Macroeconomics and Health. Macroeconomics and health: Investing in health for economic development: Report of the Commission on Macroeconomics and Health. Geneva: WHO; 2001

Commission on Social Determinants of Health (CSDH). *Achieving Health Equity: from root causes to fair outcomes. Commission on Social Determinants of Health Interim Statement.* Commission on Social Determinants of Health; 2007.

Commission on Macroeconomics and Health (CSDH). Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. Geneva: World Health Organization; 2008.

Cooke TJ. Family migration and the relative earnings of husbands and wives. *Annals of the Association of American Geographers* 2003; 93:338-349.

Cox DR. Regression Models and Life Tables (with Discussion). *Journal of the Royal Statistical Society, Series B* 1972; 34:187-220.

Curtis SL. Assessment of the quality of data used for estimation of infant and child mortality in DHS-II surveys. Occasional papers No. 3, Calverton, MD: Macro International; 1994.

Curtis V, Cairncross S, Yonli R. Domestic hygiene and diarrhoea – pinpointing the problem. *Tropical Medicine and International Health* 2000; 5:22-32.

Curtis V, Cairncross S. Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. *Lancet Infectious Disease* 2003; 3:275-281.

Dahlgren G, Whitehead M. *Policies and Strategies to Promote Equity in Health.* Stockholm: Institute for Future Studies; 1991.

Danesh J, Gault S, Semmence J, Appleby P, Peto R. Postcodes as useful markers of social class: population based study in 26,000 British households'. *British Medical Journal* 1999; 318:843-844.

Daniels N, Kennedy BP, Kawachi I. Why justice is good for our health: the social determinants of health inequalities. *Daedalus* 1999; 128:215-251.

Delaunay V, Etard JF, Preziosi MP, Marra A, Simondon F. Decline of infant and child mortality rates in rural Senegal over a 37-year period (1963-1999). *International Journal of Epidemiology* 2001; 30:1286-1293.

de Walque D. Who gets AIDS and how? Education and sexual behaviors in Burkina Faso, Cameroon, Ghana, Kenya and Tanzania. Policy Research Working Paper 3844, Washington, D.C., World Bank; 2006.

Diaz MD. Socio-economic health inequalities in Brazil: gender and age effects. *Health Economics* 2002; 11:141-54.

Dibben C, Maria S, Macfarlane A. Area deprivation, individual factors and low birth weight in England: is there evidence of an "area effect"? *Journal of Epidemiology and Community Health* 2006; 60:1053-1059.

Diderichsen F. Understanding Health Equity in Populations - Some Theoretical and Methodological Considerations. In: B Arve-Par'es (Ed.) *Promoting Research on Inequality in Health*. Stockholm: Swedish Council for Social Research; 1998.

Diderichsen F, Evans T, Whitehead M. The Social Basis of Disparities in Health. In: T Evans, M Whitehead, F Diderichsen, A Bhuiya, M Wirth (Eds.) *Challenging Inequities in Health: From ethics to action*. Oxford: Oxford University Press; 2001.

Diez Roux AV. Bringing context back into epidemiology: variables and fallacies in multilevel analysis. *American Journal of Public Health* 1998; 88:216-288.

Diez Roux AV. Multilevel analysis in public health research. *Annual Review of Public Health* 2000; 21:171-192.

Diez Roux AV. Investigating neighborhood and area effects on Health. *American Journal of Public Health* 2001; 91:1783-1789.

Diez Roux AV. A glossary for multilevel analysis. *Journal of Epidemiology Community Health* 2002; 56:588-594

Diez Roux AV, Aiello AE. Multilevel analysis of infectious diseases. *The Journal of Infectious Diseases* 2005; 191:S25-S33.

Diez Roux AV, Merkin SS, Hannan P, Jacobs DR, Kiefe CI. Area characteristics, individual-level socioeconomic indicators, and smoking in young adults; the coronary artery disease risk development in young adults. *American Journal of Epidemiology* 2003; 157:315-326.

Dommaraju P, Agadjanian V, Yabiku S. The pervasive and persistent influence of Caste on child mortality in India. *Population Research and Policy Review* 2008; 27:477-495.

Drakakis-Smith D. *Third World Cities*. London: Routledge; 2000.

Dressler WW, Oths Ks, Gravlee CC. Race and ethnicity in public health research: models to explain health disparities. *Annual Review of Anthropology* 2005; 34:231-252.

Duggan C, Fawzi W. Micronutrients and child health: studies in international nutrition and HIV infection. *Nutrition Reviews* 2001; 59:358-369.

Duncan C, Jones K, Moon G. Context, composition and heterogeneity: Using multilevel models in health research *Social Science & Medicine* 1998; 46:97-117.

- Edelman B, Mitra A. Slum dwellers access to basic amenities: the role of political contact, its determinants and adverse effects. *Review of Urban and Regional Development Studies* 2006; 18:25-40.
- Esrey SA. Water, waste, and well-being: a multicountry study. *American Journal of Epidemiology* 1996; 143:608-623.
- Evans T, Whitehead M, Diderichsen F, Bhuiya A, Wirth M (Eds.) *Challenging Inequities in Health: From Ethics to Action*. Oxford, England: Oxford University Press; 2001.
- Ezeome ER, Antitrade AN. Use of complementary and alternative medicine by cancer patients at the University of Nigeria Teaching Hospital, Enugu, Nigeria. *BMC Complementary and Alternative Medicine* 2007; 7:28.
- Falkingham J. Inequality and changes in women's use of maternal health care services in Tajikistan. *Studies in Family Planning* 2003; 34:32-43.
- Fatusi AO, Ijadunola KT. National study on essential obstetric care facilities in Nigeria Abuja. Federal Ministry of Health & United Nations Population Fund (UNFPA); 2003.
- Feachem RG, Jamison DT, Bos ER. Changing patterns of disease and mortality in sub-Saharan Africa. In: RG Feachem, DT Jamison (Eds.) *Disease and Mortality in sub-Saharan Africa*. Oxford University Press for the World Bank. New York; 1991.
- Feliciano C. Educational selectivity in U.S. immigration: how do immigrants compare to those left behind? *Demography* 2005; 42:131-52.
- Ferraro KF, Kelley-Moore JA. Religious consolation among men and women: Do health problems spur seeking? *Journal for the Scientific Study of Religion* 2000; 39:220-234.
- Feyisetan BJ, Adeokun L. Impact of child care and disease treatment on infant mortality. In: E Van de Walle, G Pison, M Sala-Diakanda (Eds.) *Mortality and Society in Sub-Saharan Africa*. Oxford: Clarendon Press; 1992.
- Field J. *Social Capital*. London: Routledge; 2003.
- Filmer D, Pritchett L. The effect of household wealth on educational attainment: evidence from 35 countries. *Population and Development Review* 1999; 25:85-120.
- Filmer D, Pritchett L. Estimating wealth effects without expenditure data – or tears: An application to educational enrolments in states of India. *Demography* 2001; 38:115-132.
- Findlay A, Rogerson R. Migration, places and quality of life: voting with their feet? In: AG Champion (Ed.) *Population matters: the local dimension*. Liverpool: Paul Chapman Publishing; 1993.
- Ford ME, Adam Kelly P. Conceptualizing and categorizing race and ethnicity in health services research. *Health Research and Educational Trust* 2005; 40:1658-1675.
- Fotso JC. Child health inequities in developing countries: differences across urban and rural areas. *International Journal of Equity in Health* 2006; 5:9.

Fotso J, Ezeh AC, Madise NJ, Ciera J. Progress towards the child mortality millennium development goal in urban sub-Saharan Africa: the dynamics of population growth, immunization, and access to clean water. *BMC Public Health* 2007; 7:218.

Fotso JC, Ezeh A, Oronje R. Provision and use of maternal health services among urban poor women in Kenya: What do we know and what can we do? *Journal of Urban Health* 2008; 85:428-442.

Fotso J, Kuate-Defo B. Measuring socioeconomic status in health, research in developing countries: should we be focusing on households, communities or both? *Social Indicators Research* 2005; 72:189-237.

Franz JS, FitzRoy F. Child Mortality and Environment in Developing Countries. *Population and Environment* 2006; 27:263-284.

Freeman HP. The meaning of race in science – considerations for cancer research: Concepts of special populations in the National Cancer Program. *Cancer* 1998; 82:219-225.

Frei A, Schenker T, Finzen A, Dittmann V, Kraeuchi K, Hoffmann-Richter U. The Werther effect and assisted suicide. *Suicide Life-Threatening Behavior* 2003; 33:192-200.

Fry P. Politics, nationality, and the meaning of 'race' in Brazil. *Daedalus* 2000; 129:83-118.

Fussell E, Gauthier AH. Introduction: dimensions of children's inequality. *Journal of Comparative Family Studies* 2003; 34:1-14.

Galbraith JK. *Created unequal. The crisis in American pay*. New York: The Free Press, 1998.

Galea S, Vlahov D. Urban health: Evidence, challenges, and directions. *Annual Review of Public Health* 2005; 26:341-365.

Galobardes B, Shaw M, Lawlor DA, Lynch JW, Davey Smith G. Indicators of socioeconomic position (part 1). *Journal of Epidemiology and Community Health* 2006; 60:7-12.

Garenne M. Migration, urbanization and child health in Africa: a global perspective. In: M Tienda SE, Findley, E Preston-White (Eds.) *Africa on the move: African migration and urbanization in comparative perspective*. Johannesburg: Wits University Press; 2006

Garenne M, Van Ginneken J. Comparison of retrospective surveys with a longitudinal follow-up in Senegal: SFS, DHS and Niakhar. *European Journal of Population* 1994; 10:203-221.

Gaspar MC, Cossa H, Santos C, Manjate M, Schoemaker J. Inquerito demografico de saude. Maputo: Instituto Nacional de Estatistica e Macro International; 1998.

Gephart MA. Neighborhoods and communities as contexts for development. In: J Brooks-Gunn, GJ Duncan, JL Aber (Eds.) *Neighborhood Poverty, Volume I: Context and Consequences for Children*. New York, NY: Russell Sage Foundation; 1997.

Giashuddin SM, Rahman A, Rahman F, Mashreky SR, Chowdhury SM, Linnan M, Shafinaz S. Socioeconomic inequality in child injury in Bangladesh – implication for developing countries. *International Journal of Equity in Health* 2009; 8:7.

- Glei DA, Goldman N. Understanding ethnic variation in pregnancy-related care in rural Guatemala. *Ethnicity & Health* 2000; 5:5-22.
- Goldscheider C. Population, Modernization and Social Structure. Boston: Little, Brown and Company; 1971.
- Gordon B, Mackay R, Rehfuess E. Inheriting the World: The Atlas of Children's Health and the Environment. World Health Organization: Geneva; 2004.
- Grace M. Child health in an urbanizing world. *Acta Paediatrica* 2002; 91:1-8.
- Graham H. Social determinants and their unequal distribution: clarifying policy understandings. *Milbank Quarterly* 2004a; 82: 101-124.
- Graham H. Tackling health inequalities in England: remedying health disadvantages, narrowing gaps or reducing health gradients. *Journal of Social Policy* 2004b; 33:115-131.
- Griffiths P, Madise N, Whitworth A, Matthews Z. A tale of two continents: a multilevel comparison of the determinants of child nutritional status from selected African and Indian regions. *Health & Place* 2004; 10:183-199.
- Grootaert C. Social Capital: The Missing Link? In: Social Capital and Participation in Everyday Life. London: Routledge; 2001.
- Grusky DB, Takata AA. Social stratification. In: EF Borgatta, ML Borgatta (Eds.) *Encyclopedia of Sociology*. New York: Macmillan; 1992.
- Guidotti T, Gitterman BA. Global Pediatric Environmental Health, *Pediatric Clinics of North America* 2007; 54:335-350.
- Gwatkin D, Rutstein S, Johnson K, Pande R, Wagstaff A. Socio-economic differences in health, nutrition and poverty. HNP/Poverty Thematic Group of the World Bank. Washington, DC: The World Bank; 2000a.
- Gwatkin DR, Rutstein SO, Johnson K, Suliman EA, Wagstaff A, Amouzou A. Socioeconomic differences in health, nutrition and population in Mali, 2000. Washington, D.C.: The World Bank; 2000b.
- Gyimah SO. Cultural Background and Infant Survival in Ghana. *Ethnicity and Health* 2006; 11:101-120.
- Gyimah SO. What has faith got to do with it? Religion and child survival in Ghana. *Journal of biosocial Science* 2007; 39:923-937.
- Haines A, Cassels A. Can the Millennium Development Goals be attained? *British Medical Journal* 2004; 329:394-397.
- Halldorsson M, Cavelaars AE, Kunst AE, Mackenbach JP. Socioeconomic differences in health and well-being of children and adolescents in Iceland. *Scandinavian Journal of Public Health* 1999; 27:43-47.

Hallqvist J, Diderichsen F, Theorell T, Teuterwall C, Ahlbom A. Is the effect of job strain on myocardial infarction between high psychological demand and low decision latitude? *Social Science and Medicine* 1998; 46:1405-1415.

Harpham T, De Silva MJ, Tuan T. Maternal social capital and child health in Vietnam. *Journal of Epidemiology & Community Health* 2006; 60:865-871.

Hessol NA, Fuentes-Afflick E. Ethnic differences in rates of neonatal and post neonatal mortality. *Pediatrics* 2005; 115:e44-51.

Hembree C, Galea S, Ahern J, Tracy M, Markham Piper T, Miller J, Vlahov D, Tardiff KJ. The built environment and overdose mortality in New York City neighborhoods. *Health & Place* 2005; 11:147-156.

Hogan DJ, Marandola D. Towards an Interdisciplinary Conceptualisation of Vulnerability. *Population, Space & Place* 2005; 11:455-471.

Homedes N, Ugalde A. Improving the use of pharmaceuticals through patient and community level interventions. *Social Science & Medicine* 2001; 52:99-134.

Hornberg C, Pauli A. Child poverty and environmental justice. *International Journal of Hygiene and Environmental Health* 2007; 210:571-580.

Houweling TAJ. Socio-economic inequalities in childhood mortality in low- and middle-income countries. Thesis ErasmusMC, University Medical Center Rotterdam. The Netherlands; 2007.

Hummer RA, Ellison CG, Rogers RG, Moulton BE, Romero RR. 2004. Religious involvement and adult mortality in the United States: Review and perspective. *Southern Medical Journal* 2004; 97:1223-1230.

Hussain A, Keramat Ali SM, Kvåle G. Determinants of mortality among children in the urban slums in Bangladesh. *Tropical Medicine and International Health* 1999; 4:758-764.

Huynen MMTE, Mar family migration tens P, Hilderink HBM. The health impacts of globalisation: a conceptual framework. *Globalization and Health* 2005; 1:14.

Irwin A, Valentine N, Brown C, Loewenson R, Solar O, Brown H, Koller T, Vega J. The commission on social determinants of health: tackling the social roots of health inequities. *PLoS Medicine* 2006; 3:e106.

Isaacs SL, Schroeder SA. Class: the ignored determinant of the nation's health. *New England Journal of Medicine* 2004; 351:1137-1142.

Jatrana S. Infant Mortality in a Backward Region of North India: Does Ethnicity Matter? Asian Metacentre Research Papers No.14; 2003.
<http://www.populationasia.org/Publications/RP/AMCRP14.pdf>

Jegasothy K. Population and rural-urban environmental interactions in developing countries. *International Journal of Social Economics* 1999; 26:1027-1041.

- Jones C. Invited commentary: Race, racism, and the practice of epidemiology. *American Journal of Public Health* 2001; 154:299-304.
- Jones G, Steketee R, Black R, Bhutta Z, Morris S, and the Bellagio Child Survival Study Group. How Many Child Deaths Can We Prevent This Year? *Lancet* 2003; 362: 65-71.
- Jong-wook L. Public health is a social issue. *Lancet* 2005; 365:1005-1006.
- Kanaiaupuni S, Donato K. Migradollars and mortality: The effect of migration on infant survival in Mexico. *Demography* 1999; 36:339-353.
- Kandula NR, Kersey M, Lurie N. Assuring the health of immigrants: what the leading health indicators tell us. *Annual Review of Public Health* 2004; 25:357-376.
- Kaplan JB, Bennett T. Use of race and ethnicity in biomedical publication. *Journal of the American Medical Association* 2003; 289:2709-2716.
- Karim F, Tripura A, Gani MS, Chowdhury AM. Poverty status and health equity: evidence from rural Bangladesh. *Public Health* 2006; 120: 193-205.
- Kawachi I, Berkman LF. *Neighbourhoods and health*. New York: Oxford University Press Inc, USA; 2003.
- Kawachi I, Kennedy BP. Health and social cohesion: why care about income inequality? *British Medical Journal* 1997; 314:1037-1040.
- Kawachi I, Subramanian SV, Almeida-Filho N. A glossary for health inequalities. *Journal of Epidemiology and Community Health* 2002; 56:647-652
- Khawaja M, Dawns J, Meyerson-Knox S, Yamout R. Disparities in child health in the Arab region during the 1990s. *International Journal for Equity in Health* 2008, 7:24
- Kiros GE, White MJ. Migration, community context, and child immunization in Ethiopia. *Social Science & Medicine* 2004; 59:2603-2616.
- Koblinsky M, Matthews Z, Hussein J, Mavalankar D, Mridha MK, Anwar I, Achadi E, Adjei S, Padmanabhan P, Marchal B, De Brouwere V, van Lerberghe W. Lancet Maternal Survival Series steering group. Going to scale with professional skilled care. *Lancet* 2006; 368:1377-1386.
- Koch JR. Is religion a health resource for the poor? *The Social Science Journal* 2008; 45:497-503.
- Koenen KC, Lincoln A, Appleton A. Women's status and child well-being: A state-level analysis. *Social Science & Medicine* 2006; 63:2999-3012.
- Koenig H, McCullough ME, Larson D. Handbook of religion and health. Oxford: Oxford University Press; 2001.
- Konseiga A, Zulu EM, Yé Y. Assessing the Effect of Mother's Migration on Childhood Mortality in the Informal Settlements of Nairobi. Discussion Paper No. 2295. Institute for the Study of Labor; September 2006.

Koupil I. Tackling health inequalities in the enlarged European Union. *British Medical Journal* 2005; 331:855-856.

Korenromp EL, Arnold F, Williams BG, Nahlen BL, Snow RW. Monitoring trends in under-5 mortality rates through national birth history surveys. *International Journal of Epidemiology* 2004; 3:1293-1301

Kramer MS, Chalmers B, Hodnett ED, Sevkovskaya Z, Dzikovich I, Shapiro S, Collet JP, Vanilovich I, Mezen I, Ducruet T, Shishko G, Zubovich V, Mknuk D, Gluchanina E, Dombrovskiy V, Ustinovitch A, Kot T, Bogdanovich N, Ovchinnikova L, Helsing E; PROBIT Study Group (Promotion of Breastfeeding Intervention Trial). Promotion of Breastfeeding Intervention Trial (PROBIT): a randomized trial in the Republic of Belarus. *Journal of the American Medical Association* 2001; 285:413-420.

Kravdal Ø. A simulation-based assessment of the bias produced when using as contextual variables in multilevel models. *Demographic-Research* 2006; 15:1-20.

Krieger N. Discrimination and Health. In: LF Berkman, I Kawachi (Eds.) *Social Epidemiology*. Oxford: Oxford University Press; 2000.

Krieger N. Theories for social epidemiology in the 21st century: an ecosocial perspective. *International Journal of Epidemiology* 2001a; 30:668-677.

Krieger N. A glossary for social epidemiology. *Journal of Epidemiology and Community Health* 2001b; 55:693-700.

Krieger J, Higgins DL. Housing and health: time again for public health action. *American Journal of Public Health* 2002; 92:758-768.

Kristiansen M, Mygind A. Health effects of migration. *Danish Medical Bulletin* 2007; 54:46-47.

Krieger N, Waterman P, Chen JT, Soobader MJ, Subramanian SV, Carson R. Zip code caveat: bias due to spatiotemporal mismatches between zip codes and US census-defined geographic areas – The Public Health Disparities Geocoding Project. *American Journal of Public Health* 2002; 92:1100-1102.

Krieger N, Williams DR, Moss NE. Measuring social class in US public health research: concepts, methodologies, and guidelines. *Annual Review of Public Health* 1997; 18:341-378.

Ku L, Matani S. Left out: Immigrants' access to health care and insurance. *Health Affairs* 2001; 20:247-256.

Kuate-Defo B. Determinants of infant and early childhood mortality in Cameroon: the role of socioeconomic factors, housing characteristics, and immunization status. *Social Biology* 1994; 41:181-211.

Kuate Defo B. Areal and socioeconomic differentials in infant and child mortality in Cameroon?, *Social Science & Medicine* 1996; 42:399-420.

Kunitz S. *The Health of Populations: General Theories and Particular Realities*. Oxford, England: Oxford University Press; 2006.

- Larsen K, Merlo J. Appropriate assessment of neighborhood effects on individual health: integrating random and fixed effects in multilevel logistic regression. *American Journal of Epidemiology* 2005; 161:81-88.
- Lee S-H. Demand for immunization, parental selection, and child survival: Evidence from rural India. *Review of Economics of the Household* 2005; 3:171-197.
- Lenz K, Bauer-Dubau K, Jelinek T. Delivery of Medical Care for Migrants in Germany: Delay of Diagnosis and Treatment. *Journal of Travel Medicine* 2006; 13:133-137.
- Le Grand J. *The strategy of equality: redistribution and the social services*. London, George Allen and Unwin; 1982.
- Leon DA, Walt G, Gilson L. International perspectives on health inequalities and policy. *British Medical Journal* 2001; 332:591-594.
- Levy BS, Sidel VW. *Social justice and public health*. Oxford: Oxford University Press; 2006.
- Lillie-Blanton M, Laveist T. Race/ethnicity, the social environment, and health. *Social Science & Medicine* 1996; 43:83-91.
- Liljestrand J. Strategies to reduce maternal mortality worldwide. *Current Opinion in Obstetrics and Gynaecology* 2000; 2:513-517.
- Lopez AD, Salomon J, Ahmad O, Murray CJL, Mafat D. Life tables for 191 countries for 2000: Data, methods, results. GPE Discussion Paper No. 9. Geneva: World Health Organization; 2001. [<http://www.who.int/healthinfo/papers09.pdf>]
- Lu Y. Test of the “healthy migrant hypothesis”: A longitudinal analysis of health selectivity of internal migration in Indonesia. *Social Science & Medicine* 2008; 67:1331-131339.
- Lumbiganon P, Panamonta M, Laopaiboon M, Pothinam S, Patithat N. Why are Thai official perinatal and infant mortality rates so low? *International Journal of Epidemiology* 1990; 19:997-1000.
- Lynch J, Kaplan GA. Socioeconomic position. In: Berkman LF, Kawachi I (Eds.) *Social Epidemiology*. New York: Oxford University press; 2000.
- Macassa G, Ghilagaber G, Bernhardt E, Diderichsen F, Burstrom B. Inequalities in child mortality in Mozambique: differentials by parental socioeconomic position. *Social Science & Medicine* 2003; 57:2255-2264.
- Macassa G, Ghilagaber G, Bernhardt E, Barnstorms B. Contribution of household environment factors to urban childhood mortality in Mozambique. *East African Medical Journal* 2004; 81:408-414.
- MacIntyre S, Ellaway A, Cummins S. Place effects on health: how can we conceptualise, operationalise, and measure them? *Social Science & Medicine* 2002; 55:125-139.
- Macinko J, Starfield B, Shi L. The contribution of primary care systems to health outcomes within Organization for Economic Cooperation and Development (OECD) countries, 1970-1998. *Health Services Research* 2003; 38:831-865.

- Macro International Inc. An assessment of the quality of health data in DHS-I surveys. Calverton, Maryland: Macro International Inc.; 1994
- Mahy M. Measuring child mortality in AIDS-affected countries. Workshop on HIV/AIDS and adult mortality in developing countries. New York: Population Division, Department of Economics and Social Affairs, United Nations Secretariat; 2003.
- Makepeace G, Pal S. Effects of birth interval on child mortality: evidence from a sequential analysis. *World Health Population* 2006; 8:69-82.
- Manuh T. Women in Africa's development: Overcoming obstacles, pushing for progress. *Africa Recovery* 1998; 11.
- Marinacci C, Spadea T, Biggeri A, Demaria M, Caiazzo A, Costa G. The role of individual and contextual socioeconomic circumstances on mortality: analysis of time variations in a city of north west Italy. *Journal of Epidemiol Community Health* 2004; 58:199-207.
- Marmot M. *Status syndrome*. London, Bloomsbury; 2004.
- Marmot M. Social determinants of health inequalities. *Lancet* 2005; 365:1099-1104.
- Marmot M. Health in an unequal world. *Lancet* 2006; 368:2081-2094.
- Marmot M, Wilkinson R. *Social determinants of health*. New York: Oxford University Press; 1999.
- Martin D. Neighbourhoods and area statistics in the post 2001 census era. *Area* 2004; 36:136-145.
- Matijasevich A, Victora CG, Barros AJD, Santos IS, Marco PL, Albernaz EP, Barros FC. Widening ethnic disparities in infant mortality in Southern Brazil: Comparison of 3 birth cohorts. *American Journal of Public Health* 2008; 98:692-698.
- Mayberry RM, Mili F, Ofili E. Racial and ethnic differences in access to medical care. *Medical Care Research and Review* 2000; 57:108-145.
- Mays VM, Yancey AK, Cochran SD, Weber M, Fielding JE. Heterogeneity of Health Disparities among African American, Hispanic, and Asian American Women: Unrecognized Influences of Sexual Orientation. *American Journal of Public Health* 2002; 92:632-639.
- Mberu BU. Who moves and who stays? Rural out-migration in Nigeria. *Journal of Population Research* 2005; 22:2.
- McGinnis JM, Williams-Russo P, Knickman J. The case for more active policy attention to health promotion. *Health Affairs* 2002; 21:78-93.
- McGuire JW. Basic health care provision and under-5 mortality: A cross-national study of developing countries. *World Development* 2006; 34:405-425.
- Mekonnen Y, Mekonnen A. Factors influencing the use of maternal healthcare services in Ethiopia. *Journal of Health, Population and Nutrition* 2003; 21:374-382.

- Mercado S, Havemann K, Sami M. Urban poverty: an urgent public health issue. *Journal of Urban Health* 2007; 84:i7-i15.
- Merchant AT, Pitiphat W, Ahmed B, Kawachi I, Joshipura K. A prospective study of social support, anger expression and risk of periodontitis in men. *Journal of the American Dental Association* 2003; 134:1591-1596.
- Merlo J, Yang M, Chaix B, Lynch J, Rastam L. A brief conceptual tutorial on multilevel analysis in social epidemiology: investigating contextual phenomena in different groups of people. *Journal of Epidemiology and Community Health* 2007; 59:729-736.
- Mintz E, Bartram J, Lochery P, Wegelin M. 2001. Not just a drop in the bucket: Expanding access to point-of-use water treatment systems. *American Journal of Public Health* 2001; 91:1565-1570.
- Morris SS, Black RE, Tomaskovic L. Predicting the distribution of under-five deaths by cause in countries without adequate vital registration systems. *International Journal of Epidemiology* 2003; 32:1041-1051.
- Mondal NI, Hossain K, Ali K. Factors Influencing Infant and Child Mortality: A Case Study of Rajshahi District, Bangladesh. *Journal of Human Ecology* 2009; 26:31-39.
- Montgomery MR, Hewett PC. Urban poverty and health in developing countries: Household and neighbourhood effects. Policy Research Division, Working Paper No. 184. The Population Council, Inc.; 2004.
- Montgomery JD, Stren R, Cohen B, Reed H. Cities transformed: demographic change and its implications in the developing world. Washington, DC: National Academy Press; 2003.
- Mosley WH, Chen LC. An analytic framework for the study of child survival in developing countries. *Population and Development Review* 1984; 10:25-45.
- Mturi AJ, Curtis SL. The determinants of infant and child mortality in Tanzania. *Health Policy and Planning* 1995; 10:384-394.
- Mung'ala VO, Snow RW. Death registration on the Kenyan Coast. *East African Medical Journal* 1994; 71:747-750.
- Murphy M, Bobak M, Nicholson A, Rose R, Marmot M. The widening gap in mortality by educational level in the Russian Federation, 1980-2001. *American Journal of Public Health* 2006; 96:1293-1299.
- Mustapha A. Ethnic Structure, Inequality and Governance of the Public Sector in Nigeria Democracy, Governance and Human Rights United Nations Research Institute for Social Development (UNRISD); 2006.
- Muszynska M, Kulu K. Migration and union dissolution in a changing socio-economic context: The case of Russia. *Demographic Research* 2007; 17:803-820.
- Mutunga C. Environmental determinants of child mortality in urban Kenya. Nairobi: University of Nairobi; 2004.

- Najman JM. A general model of the social origins of health and well-being. In: R Eckersley, J Dixon, B Douglas (Eds.) *The Social Origins of Health and Well-being*. Cambridge, England: Cambridge University Press; 2001.
- National Population Commission (NPC). *Nigeria Demographic and Health Survey 2003*. Calverton, Maryland: National Population Commission and ORC Macro; 2004.
- National Population Commission (NPC) [Nigeria] and ORC Macro. *Nigeria Demographic and Health Survey 2008*. Abuja, Nigeria: National Population Commission and ICF Macro; 2009.
- Nazroo JY. The structuring of ethnic inequalities in health: economic position, racial discrimination, and racism. *American Journal of Public Health* 2003; 93:277–284.
- Ndong I, Gloyd S, Gale J. An evaluation of vital registers as sources of data for infant mortality rates in Cameroon. *International Journal of Epidemiology* 1994; 23:536-539.
- Northridge ME, Sclar E. A joint urban planning and public health framework: contributions to health impact assessment. *American Journal of Public Health* 2003; 93:118-121.
- Nullis-Kapp C. The knowledge is there to achieve development goals, but is the will? *Bulletin of the World Health Organization* 2004; 82:804-805.
- Nyarko P, Pence B, Debpuur C. Immunization status and child survival in rural Ghana. Population Research Division Working Paper No. 147, Population Council, New York; 2001.
- Ogunjuyigbe P. Under-five mortality in Nigeria: Perception and attitudes of the Yorubas towards the existence of “Abiku”. *Demographic Research* 2004; 11:43-56.
- Oladepo O, Sridhar MKC. Traditional public health practices in Nigeria. *Journal of the Royal Society for the Promotion of Health* 1987; 107:186.
- Onah HE, Ikeako LC, Iloabachie GC. Factors associated with the use of maternity services in Enugu, southeastern Nigeria. *Social Science & Medicine* 2006; 63:1870-1878.
- ORC Macro. MEASURE DHS STATcompiler; 2005. [<http://www.measuredhs.com>], August 16 2005.
- Osifo OD, Evbuomwan I, Efobi CA. Management of childhood abdominal masses by Nigerian traditional doctors: A worrisome cause of delay in presentation. *Pakistan Journal of Medical Science* 2007; 23:809-813.
- Osmond S, Manda M. Unobserved family and community effects on infant mortality in Malawi. *Genus* 1998; 54:143-164.
- Osoyole O, Ajaiyeoba E, Bolaji O, Akinboye D, Fawole O, Grace Gbotosho, Ogbole O, Ashidi J, Abiodun O, Falade C, Sama W, Oladepo O, Itiola O, Oduola A. A survey of treatment
- Ostberg V, Vågerö D. Socio-economic differences of mortality among children. Do they persist to adulthood? *Social Science & Medicine* 1991; 32:403-410.
- Osobor KM, Fatusi AO, Chiwuzie JC. Maternal health-seeking behaviour and associated factors in a rural Nigerian community. *Maternal and Child Health* 2006; 10:159-169.

- Osunderu OA. Sustainable production of traditional medicines in Africa. In: EK Yanful (Ed.) *Appropriate technologies for environmental protection in the developing world*. Springer Science: Netherlands; 2009.
- Passchier-Vermeer W, Passchier WF. Noise exposure and public health. *Environmental Health Perspectives* 2000; 108:123-131.
- Pearl M, Braveman P, Abrams B. The relationship of neighborhood socioeconomic characteristics to birthweight among five ethnic groups in California. *American Journal of Public Health* 2001; 91:1808-1824.
- Pickett KE, Pearl M. Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *Journal of Epidemiol and Community Health* 2001; 55:111-122.
- Politzer RM, Yoon J, Shi L, Hughes RG, Regan J, Gaston MH. Inequality in America: the contribution of health centers in reducing and eliminating disparities in access to care. *Medical Care Research and Review* 2001; 58:234-248.
- Pongou R, Ezzati M, Salomon JA. Household and community socioeconomic and environmental determinants of child nutritional status in Cameroon. *BMC Public Health* 2006; 6:98:19.
- Powell DL, Stewart V. Children: the unwitting target of environmental injustices. *Pediatric Clinics of North America* 2001; 48:1291-1305.
- Pritchett L, Summers LH. Wealthier is healthier. *Journal of Human Resources* 1996; 31:841-868.
- Pyle RE, Davidson JD. The Origins of Religious Stratification in Colonial America. *Journal for the Scientific Study of Religion* 2003; 42:1:57-75
- Pyle RE, Koch JR. The religious affiliations of American elites 1930s to 1990s: A note on the pace of disestablishment. *Sociological Focus* 2001; 34: 125-137.
- Rahman MM, Kabir M, Amin R. Relationship between survival status of first child and subsequent child death. *Journal of Biosocial Science* 1996; 28:185-191.
- Rashbash J, Steele F, Browne W, Prosser B. *A User's Guide to MLwiN version 2.10*. London: Centre for Multilevel Modelling, Institute of Education, University of London; 2008.
- Raudenbush SW, Bryk AS. Hierarchical linear models: applications and data analysis methods. London: Sage; 2002.
- Rauh VA, Andrews HF, Garfinkel R. The contribution of maternal age to racial disparities in birthweight: a multilevel perspective. *American Journal of Public Health* 2001; 91:1815-1824.
- Reidpath DD. Population health. More than the sum of the parts? *Journal of Epidemiology & Community Health* 2005; 59):877-880.
- Reijneveld SA, Verheij RA, de Bakker D. The impact of area deprivation on differences in health: does the choice of the geographical classification matter? *Journal of Epidemiology and Community Health* 2000; 54:306-313.
- Rose G. *The strategy of preventive medicine*. Oxford: Oxford University Press; 1992.

- Rostas SA. A grass roots view of religious change amongst women in an indigenous community in Chiapas, México. *Bulletin of Latin American Research* 1999; 18:327-341.
- Rothman RA. *Inequality and stratification*, 4th ed. Upper Saddle River, NJ: Prentice-Hall; 2002.
- Rutstein SO. Factors associated with trends in infant and child mortality in developing countries during the 1990s. *Bulletin of the World Health Organization* 2000; 78:1256-1270.
- Sachs JD, McArthur JW. The Millennium Project: a plan for meeting the Millennium Development Goals. *The Lancet* 2005; 365:347-353.
- Sampson RJ. What 'community' supplies. In: R Ferguson, W Dickens (Eds.) *Urban problems and community development*, Washington DC: Brookings Institute; 1999.
- Sampson RJ, Morenoff JD, Ganon-Rowley T. Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science* 2002; 277:918-924.
- Sastry N. Community Characteristics, Individual and Household Attributes, and Child Survival in Brazil. *Demography* 1996; 33:211-229.
- Schell CO, Reilly M, Hans R, Stefan P, Anna ME. Socioeconomic determinants of infant mortality: A worldwide study of 152 low-, middle-, and high-income countries: *Scandinavian Journal of Public Health* 2007; 35:288-297.
- Schulpen TWJ, van Wieringen JCM, van Brummen PJ, van Riel JM, Beemer FA, Wester SP, Huber J. Infant mortality, ethnicity, and genetically determined disorders in the Netherlands. *European Journal of Public Health* 2006; 16:290-293.
- Schulz AJ, House JS, Israel BA, Mentz G, Dvornch JT, Miranda PY, Kannan S, Koch M. Relational pathways between socioeconomic position and cardiovascular risk in a multiethnic urban sample: complexities and their implications for improving health in economically disadvantaged populations. *Journal of Epidemiology and Community Health* 2008; 62:638-646.
- Scrambler G. Critical realism, sociology and health inequalities: social class as a generative mechanism and its media of enactment. *Journal of Critical Realism* 2001; 4:35-42.
- Sedgh G, Henshaw S, Singh S, Åhman E, Shah I. Induced abortion: estimated rates and trends worldwide. *Lancet* 2007; 370:1338-1345.
- Sen A. *Development as freedom*. Oxford: Oxford University Press; 1999.
- Shaw M, Dorling D, Gordon D, Davey Smith G. *The Widening Gap: Health Inequities and Policy in Britain*. Bristol: Policy Press; 1999.
- Simondon KB, Simondon E, Costes R, Delaunay V, Diallo A. Breast-feeding is associated with improved growth in length, but not weight, in rural Senegal toddlers. *American Journal of Clinical Nutrition* 2001; 73:959-967.
- Singer JD, Willett J B. *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*. Oxford: Oxford University Press; 2003.

- Sluzki CE. 1998. Migration and the disruption of the social network. In: M McGoldrick (Ed.), *Re-Visioning Family Therapy: Race, Culture and Gender in Clinical Practice*. New York: Guilford Press; 1998.
- Smith KR, Samet JM, Romieu I, Bruce N. Indoor air pollution in developing countries and acute lower respiratory infections in children. *Thorax* 2000; 55:518-532.
- Snow RW, Trape JF, Marsh K. The past, present and future of childhood malaria mortality in Africa. *Trends in Parasitology* 2001; 17:593-597.
- Snow KR, Samet JM, Romieu I, Bruce N. Indoor pollution in developing countries and acute respiratory infections in children. *Thorax* 2000; 55:518-532.
- Snijders T, Bosker RJ. *Multilevel analysis – an introduction to basic and advanced multilevel modelling*. Thousand Oaks, California: Sage Publications; 1999.
- Solari C, Mare RD. The effects of housing and neighbourhood crowding on children's well-being. California Center for Population Research On-line Working Paper Series CCPR-2008-058; 2008.
- Songsore J. Towards a better understanding of urban change: the Ghana case study, Urban Change Working Paper 2. International Institute for Environment and Development, London; 2000.
- Sorensen G, Emmons K, Hunt MK, Barbeau E, Goldman R, Peterson K, Kuntz K, Stoddard A, Berkman L. Model for incorporating the social context in health behavior interventions: Applications for cancer prevention for working-class, multiethnic populations. *Preventive Medicine* 2003; 37: 188-197.
- Spiegelhalter DJ, Best NG, Carlin BP, van der Linde A. Bayesian measures of model complexity and fit. *Journal of the Royal Statistical Society Series B Statistical Methodology* 2002; 64:583-639.
- Ssengonzi R, De Jong GF, Shannon Stokes C. The effect of female migration on infant and child survival in Uganda. *Population Research and Policy Review* 2002; 21:403-431.
- Stafford M, Bartley M, Mitchell R, Marmot M. Characteristics of individuals and characteristics of areas: investigating their influence on health in the Whitehall II study. *Health & Place* 2001; 7:117-129
- Starfield B. Basic concepts in population health and health care. *Journal of Epidemiology and Community Health* 2001; 55:452-454.
- Starfield B. Equity and health: a perspective on non-random distribution of health in the population. *Revista Panamericana de Salud Pública* 2002; 12:384-387.
- Starfield B. State of the Art in Research on Equity in Health. *Journal of Health Politics, Policy and Law* 2006; 31:11-32.
- Starfield B, Robertson J, Riley AW. Social Class Gradients and Health in Childhood. *Academic Pediatrics* 2002; 2:238-246.

Statistics South Africa. Measuring poverty in South Africa. Pretoria, South Africa. Statistics South Africa; 2001.

Stephenson R, Ong TA. Contextual influences on reproductive wellness in northern India. *American Journal of Public Health* 2003; 93:1820-1829. N

a

Stern N, Dethier JJ, Rogers H. *Growth and empowerment: making development happen*. Cambridge, MA, MIT Press; 2004.

Stewart MK, Stanton CK, Ahmed O. Maternal health care. In: DHS Comparative Studies Issue 25 Calverton, Maryland, Macro International Inc; 1997.

Strong K, Mathers C, Leeder S, Beaglehole R. Preventing chronic diseases: How many lives can we save? *Lancet* 2005; 366:1578-1582.

Stronks K, van De Mheen H, Looman CWN, Mackenbach JP. The Importance of Psychosocial Stressors for Socio-economic Inequalities in Perceived Health. *Social Science & Medicine* 1997; 46:611-623.

Subramanian SV. The relevance of multilevel statistical methods for identifying causal neighborhood effects. *Social Science & Medicine* 2004; 58:1961-1967.

Suwal JV. The main determinants of infant mortality in Nepal. *Social Science & Medicine* 2001; 53:1667-1681.

Sullivan J, Rustein SO, Bicego G. Assessment of the quality of DHS data used in direct estimation of infant and child mortality. Assessment of the quality of DHS data. Methodological reports, No. 1, Columbia, MD: Institute for Resource Development; 1991.

Szklo M, Nieto FJ. *Epidemiology: beyond the basics*. Aspen Publishers Inc, Gaithersburg, Maryland; 2000.

Tabutin D, Akoto E. Socio-economic and cultural differentials in mortality in sub-Saharan Africa. In: E van de Walle, G Pison, M Sala-Diakanda (Eds.) *Mortality and Society in Sub-Saharan Africa*. Clarendon Press, Oxford; 1992.

Tam L. Rural-to-Urban Migration in Bolivia and Peru: Association with child mortality, breastfeeding cessation, maternal care, and contraception. Demographic and Health Survey; 1994.

Taylor JE, Martin P. Human capital: Migration and rural population change. In: BL Gardner, GC Rausser (Eds.) *Handbook for agricultural economics*. Elsevier Science: New York; 2001.

Theall KP, Scribner R, Cohen D, Bluthenthal RN, Schonlau M, Farley TA. Social capital and the neighborhood alcohol environment. *Health & Place* 2009; 15:323-332.

Terra de Souza AC, Peterson KE, Andrade FM, Gardner J, Ascherio A. Circumstances of post-neonatal deaths in Ceara, northeast Brazil: mothers' health careseeking behaviors during their infants' fatal illness. *Social Science & Medicine* 2000; 51:1675-1693.

Teshome Nega G. Patterns, causes and consequences of urban-ward migration in Ethiopia: The case of Kombolcha town. A Thesis Presented to The School of Graduate Studies, Department of Geography, Addis Ababa University; June 2002.

Titaley CR, Dibley MJ, Agho K, Roberts CL, Hall J. Determinants of neonatal mortality in Indonesia. *BMC Public Health* 2008, 8:232.

Torres-Cantero AM, Miguel AG, Gallardo C, Ippolito S. Health care provision for illegal migrants: may health policy make a difference? *European Journal of Public Health* 2007; 17:483-485.

Tulloch J. Integrated approach to child health in developing countries. *Lancet* 1999; 354:SII16-SII620.

United Nations. General assembly, 56th session. Road map towards the implementation of the United Nations millennium declaration: report of the Secretary-General (UN document no. A/56/326). New York: United Nations; 2001.

United Nations Development Programme (UNDP). United Nations Development Programme (UNDP). *Human development report 2000: Human rights and human development*. New York: Oxford University Press; 2000.

United Nations. *The Millennium Development Goals report 2007*. New York, United Nations; 2007. [<http://www.un.org/millenniumgoals/pdf/mdg2007.pdf>]. [Accessed 1 July 2008].

United Nations. *World contraceptive use 2007, wall chart*. New York, United Nations, Department of Economic and Social Affairs, Population Division; 2008.

United Nations Development Programme (UNDP). *Nigeria 2000/2001 Human Development Report Millennium Edition*, Lagos; 2001.

United Nations Development Programme (UNDP). *Human development report 2005 – International cooperation at a crossroads: aid, trade and security in an unequal world*. New York, NY: United Nations Development Programme; 2005.

United Nations Development Programme (UNDP). *2008 statistical update country factsheets*. New York; 2009. [<http://hdr.undp.org/en/countries/alphabetical2008>]

UNFPA. State of World Population 2003: Investing in Adolescents' Health and Rights. United Nations Population Fund; 2003.

UN-Habitat. The challenge of the slums. Global Report on Human Settlements 2003. United Nations Human Settlements Programme: Geneva; 2003.

United Nations Children's Fund (UNICEF). Progress since the world summit for children: a statistical review. New York: UNICEF; 2001.

United Nations Children's Fund (UNICEF). *The State of the World's Children 2004: Childhood under threat*. New York: The United Nations Children's Fund (UNICEF); 2004. [http://www.unicef.org/pubsgen/wethechildren-stats/sgreport_adapted_stats_eng.pdf] [Accessed 25th April 2005].

United Nations Children's Fund (UNICEF). *The State of the World's Children 2007: Women and children. The double demand of gender equality*. UNICEF: New York; 2006.

United Nations Children's Fund (UNICEF). *The state of the world's children 2009: Maternal and newborn health*. United Nations Children's Fund (UNICEF); 2008.

United Nations Children's Fund (UNICEF). *The State of the World's Children 2008: Child survival – where we stand*. UNICEF: New York; 2007.

United Nations Children's Fund (UNICEF). *The State of the World's Children 2005: Childhood under threat*. UNICEF: New York; 2004.
[[http://www.unicef.org/publications/files/SOWC_2005_\(English\).pdf](http://www.unicef.org/publications/files/SOWC_2005_(English).pdf)]

United Nations Children's Fund (UNICEF). The “Right” start to life: a statistical analysis of birth registration. New York: UNICEF; 2005

United Nations Children's Fund (UNICEF). Progress for children. New York, UNICEF; 2007.
[http://www.childinfo.org/files/progress_for_children_2007.pdf]. [Accessed 3rd March 2009].

United Nations Millennium Project. Who's got the power? Transforming health systems for women and children. In: *Task force on child health and maternal health*. Sterling, VA: Earthscan; 2005.

United Nations Statistics Division. World and regional trends: Millennium indicators database based on data provided by United Nations Children's Fund and World Health Organization; 2009.
[<http://millenniumindicators.un.org>]. [Accessed 27th April 2005].

United Nations. *Levels and trends of contraceptive use as assessed in 2002*. New York, United Nations, Department of Economic and Social Affairs, Population Division; 2004.

United States Census Bureau. *Census tracts and block numbering areas*; 2007.
[http://www.census.gov/geo/www/cen_tract.html]. [Accessed 13th August 2008].

Van de Poel E, O'Donnell O, Van Doorslaer E. Are urban children really healthier? Evidence from 47 developing countries. *Social Science & Medicine* 2007; 65:1986-2003.

Uyanga J. Rural-urban migration and sickness/health care behaviour: a study of eastern Nigeria. *Social Science & Medicine* 1083; 17:579-583.

Van Poppel F, Liefbroer AC, Schellekens J. Religion and social mobility in nineteenth-Century The Hague. *Sociology of Religion* 2003; 64:247-271.

Vargas Valle ED, Fernández L, Potter J. Religious affiliation, ethnicity, and child mortality in Chiapas, Mexico. *Journal for the Scientific Study of Religion* 2009; 48:588-603.

Verhoef MJ, Balneaves LG, Boon HS, Vroegindewey BN. Reasons for and characteristics associated with complementary and alternative medicine use among adult cancer patients: A systematic review. *Integrative Cancer Therapies* 2005; 4:272-286.

Victora CG, Wagstaff A, Schellenberg JA, Gwatkin D, Claeson M, Habicht J. Applying an equity lens to child health and mortality: more of the same is not enough. *Lancet* 2003; 362:233-241.

- Vitzthum VJ. The home team advantage: reproduction in women indigenous to high altitude. *Journal of Experimental Biology* 2001; 204:3141-3150.
- Vokó Z, Csépe P, Németh R, Kósa K, Kósa Z, Széles G, Ádány R. Does socioeconomic status fully mediate the effect of ethnicity on the health of Roma people in Hungary? *Journal of Epidemiology and Community Health* 2009; 63:455-460.
- Waddington C, Sabates-Wheeler R. Poverty, vulnerability and migration choice. Working Paper T3, Development Research Centre on Migration, Globalisation and Poverty, University of Sussex, Brighton; 2004.
- Wagstaff A. Unpacking the causes of inequalities in child survival: the case of Cebu, the Philippines. Washington: The World Bank; 2000.
- Wagstaff A, Bustreo F, Bryce J, Carson M. Child health: reaching the poor. *American Journal of Public Health* 2004; 94:726-736.
- Wagstaff A, Nguyen N. *Poverty and survival prospects of Vietnamese children under Doi Moi*. Washington, DC: World Bank; 2001.
- Wagstaff A, Watanabe N. *Socioeconomic Inequalities in Child Malnutrition in the Developing World*. Washington, DC: World Bank; 2000.
- Walker N, Schwartlander B, Bryce J. Meeting international goals in child survival and HIV/AIDS. *Lancet* 2002; 360:284-289.
- Wardle J, Steptoe A. Socioeconomic differences in attitudes and beliefs about healthy lifestyles. *Journal of Epidemiology and Community Health* 2003; 57:440-443.
- Whitley E, Gunnell DJ, Dorling D, Davey Smith G. Ecological study of social fragmentation, poverty and suicide. *British Medical Journal* 1999; 319:1034-1037.
- Whitehead M. The concepts and principles of equity and health. *International Journal of Health Services* 1992; 22:429-445.
- Whitehead M, Burström B, Diderichsen F. Social policies and the pathways to inequalities in health: a comparative analysis of lone mothers in Britain and Sweden. *Social Science & Medicine* 2000; 50:255-270.
- Whitehead M, Dahlgren G. Leveling up (Part 1): a discussion paper on concepts and principles for tackling social inequities in health. Studies on social and economic determinants of population health, No. 2, WHO Europe. Copenhagen, Denmark: World Health Organization Regional Office for Europe; 2006.
[<http://www.euro.who.int>. [Accessed 14th October 2008].
- World Health Organization (WHO). *The world health report 2002: Reducing risks, promoting healthy life*. Geneva: World Health Organization; 2002a.
- World Health Organization (WHO). *WHO traditional medicine strategy 2002-2005*. World Health Organization: Geneva; 2002b.

World Health Organization (WHO). *The World Health Report 2003: Shaping the Future*. Geneva: World Health Organization; 2003.

World Health Organization (WHO). *Priorities to Take Forward the Health Equity Agenda: Report from the Task Force on Health System Research Priorities for Equity in Health*. Copenhagen: World Health Organization; 2004a.

WHO. Commission on Social Determinants of Health (CSDH). *Towards a Conceptual Framework for Analysis and Action on the Social Determinants of Health*. Discussion paper for the Commission on Social Determinants of Health [draft]; 2005.

World Health Organization (WHO). *World Health Statistics 2006*. Geneva: World Health organization; 2006.

WHO & UNICEF. *The Africa Malaria Report 2003*. United Nations Children's Fund (UNICEF), New York; 2003.

Wilkinson R. Socioeconomic determinants of health: Health inequalities: relative or absolute material standards? *British Medical Journal* 1997; 314: 591-595.

Williams D. Race and health: basic questions, emerging directions. *Annals of Epidemiology* 1997; 7:322-333.

Williams DR, Collins C. Racial residential segregation: a fundamental cause of racial disparities in health. In: TA Laveiest (Ed). *Race, ethnicity and health: A public health reader*. San Francisco: Jossey Bass; 2002.

Williams D, Jackson J. Race/ethnicity and the 2000 census: Recommendations for African American and other black populations in the United States. *American Journal of Public Health* 2000; 90:1728-1730.

Woldemicael G. The Effects of Water Supply and Sanitation on Childhood Mortality in Urban Eritrea. *Journal of Biosocial Science* 2000; 32: 207-227

Woodward A, Kawachi I. Why reduce health inequalities? *Journal of Epidemiology and Community Health* 2000; 54:923-929.

Wootton JC, Sparber A. Surveys of complementary and alternative medicine: part 1. General trends and demographic groups. *Journal of Alternative and Complementary Medicine* 2001; 7:195-208.

World Bank. Environment and Social Development Unit South Asia Region. World Bank; 2001a.

World Bank. *Health and Environment*. Background paper for the World Bank Environment Strategy. Washington, D.C.; 2001b.

World Bank. *World development report 2006: Equity and Development*. The World Bank: Washington, D.C.; 2005.

World Bank. Nigeria Country Brief. Washington: World Bank; 2007.
[<http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/NIGERIAEXTN/0,,menuPK:368906~pagePK:141132~piPK:141107~theSitePK:36889>

6,00.html]

World Bank. Poverty data: A supplement to World Development Indicators. Washington D.C; 2008.

[<http://siteresources.worldbank.org/DATASTATISTICS/Resources/WD108supplement1216.pdf>]

Yen IH, Syme SL. The social environment and health: A discussion of the epidemiologic literature. *Annual Review of Public Health* 1999; 20:287-308.

Zulu E, Dodoo FN, Ezeh CA. Sexual risk-taking in the slums of Nairobi, Kenya, 1993-98. *Population Studies* 2002; 56:311.323.