SOCIOECONOMIC INEQUALITIES AND MATERNAL HEALTH OUTCOMES IN GHANA

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DECLARATION

I, Clement Adamba, hereby declare that this thesis, except for references to other literature, which have been duly acknowledged, is the result of my own work, produced under supervision, and it has neither in whole nor in part been presented anywhere for the award of a degree.

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SUPERVISORS

This thesis has been carried out and submitted with my approval as supervisor.

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Date: ……2013	Date: ……. 2013	Date: ……. 2013

DEDICATION

I dedicate this work to my father, Mr. Gilbert Aburinya Amwabanina, the man who occasionally allowed me stay off the farm to be with my books, even though, sometimes I took the advantage to run off to play football. The Lord took you off the scene the very year I decided to pursue further studies after my first degree, but your death spirited me to fight to this far. Whilst on your sick mat, when I came home to visit you, you told me to go back to Accra and continue with my studies. Today, with tearful joy, I dedicate this to you.

ABSTRACT

Maternal health outcomes are among the most diverse human indicators of development as well as critical global indicators of socioeconomic standing of a country. While many studies have over the years identified risk factors associated with the occurrence of adverse maternal health outcomes, such studies have tended to be relatively proximal and individually-based. Using the Ghana Maternal Health Survey data in a multilevel modelling design, this study examined the relationship between the socioeconomic status of the area within which women live and the occurrence of maternal mortality, stillbirth, miscarriage and abortion as prime indicators of maternal health. The aim is to understand how, independent of individual level factors, maternal health is affected by the characteristics of the areas within which women live and work. The study used the 2000 Population and Housing Census data to construct a composite index of multiple deprivation to reflect the socioeconomic structure of women's immediate environment. The quantitative analysis was triangulated with qualitative interviews to contextualise the discussions.

The results showed that women living in deprived areas have higher odds of maternal death compared to women living in less deprived areas. The level of deprivation further suppresses the expected positive effect of educational attainment measured at the individual level, indicating that individual level educational qualification is not protective of maternal mortality in a deprived area. The effect of the deprivation status however reduces in areas where the aggregate proportion of females educated up to Senior High School level or higher s high. This means that policies that will provide and ensure educational attainment up to the Senior High School level

for women will be crucial in reducing the risk of maternal mortality. The incidence rate of maternal mortality is also lower in neighbourhoods where coverage of supervised deliveries is higher. Women who live in less deprived neighbourhoods however have a higher likelihood of seeking abortion compared with women in deprived neighbourhoods. Less deprived neighbourhoods are also associated with high odds of suffering miscarriage but lower odds of stillbirth. Controlling for a variety of individual characteristics the results further showed that it is women of middle or wealthy households living in less deprived neighbourhoods who are mostly likely to seek abortion, whilst women of poor households living in less deprived neighbourhood have higher probabilities of reporting miscarriages.

These results setup two important agendas that concern development policy and research. The resulting policy recommendation from the work is that, an expansion of educational opportunities that enable more women to obtain school education up to the Senior High School level and higher will be significant in reducing maternal mortality in Ghana. In terms of research agenda, the findings strengthen the need to broaden the scope of maternal health research to include an understanding of the community within which women live and work. Results from such research agendas will show the need to be more careful in targeting interventions in communities since in many situations the poor living in affluent neighbourhoods are often clouded up by the affluence of the wealthy and kept largely unnoticed for intervention programmes yet they do not enjoy the advantages of being in such neighbourhoods.

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ABBREVIATIONS & ACRONYMS

AIC:	Akaike information criterion
ANC:	Antenatal Care
ANOVA:	Analysis of Variance
BIC:	Bayesian information criterion
CAC:	Comprehensive Abortion Care
CEMACH:	Confidential Enquiry into Maternal and Child Health
CHPS	Community-based Health Planning and Services
D&C:	Dilation and Curettage
DFEP:	Delivery Fee Exemption Policy
DMHIS	District Mutual Health Insurance Scheme
EOC:	Emergency Obstetric Care
ERP:	Economic Recovery Programme
FANC:	Focused-ANC (FANC) programme
FGD:	Focus Group Discussion
FP:	Family Planning Services
GDHS:	Ghana Demographic Health Survey
GDP	Gross Domestic Product
GHS	Ghana Health Service
GMHS:	Ghana Maternal Health Survey
GNA:	Ghana News Agency
GPRS I & II:	Ghana Poverty Reduction Strategy (I & II)
GPRTU:	Ghana Private Road Transport Union
GSS:	Ghana statistical service
GSS:	Ghana Statistical Service
HIRD:	High Impact Rapid Delivery
HIV/AIDS:	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
ICC:	Intra-class Correlation Coefficient
ICD-10:	International statistical Classification of Diseases (10th ed.)
IMF:	International Monetary Fund
IMD:	Index of Multiple Deprivation
IPT:	Intermittent Preventive Treatment
ISSER:	Institute of Statistical Social and Economic Research
JHS:	Junior High School
LEAP:	Livelihood Enhancement Against Poverty
MDG:	Millennium Development Goal
MDGs:	Millennium Development Goals
MHC:	Maternal Healthcare
MMEIG:	Maternal Mortality Estimation Inter-Agency Group
MMR:	Maternal Mortality Ratio
MMRate:	Maternal Mortality Rate
MNRP:	Maternal and Newborn Referral Program
MoH:	Ministry Of Health
MSLC:	Middle School Leaving School Certificate

NDPC:	National Development Planning Commission
NDPC:	National Development Planning Commission
NHIA:	National Health Insurance Authority
NHIA:	National Health Insurance Authority
NHIS:	National Health Insurance Scheme
NHIS:	National Health Insurance Scheme
NSPS:	National Social Protection Strategy
OPD:	Out-Patient Department
PCA:	Principal Component Analysis
PHC:	Population and Housing Census
PMMC:	Prevention Maternal Mortality Programme
PNC:	Postnatal Care
QI:	Quality Improvement
RAMOS:	Reproductive-age Mortality Studies
SAP:	Structural Adjustment Programme
SPD:	Supervised Delivery
SSSCE:	Senior Secondary School Certificate
TBA:	Traditional Birth Attendants
UN:	United Nation Organisation
UNDP:	United Nation's Development Program
UNFPA:	United Nations Population Fund
UNICEF:	United Nations Children's Fund
UNPD:	United Nations Population Division
USAID:	United States Agency for International Development
VAQ:	Verbal Autopsy Questionnaire
VAST:	Vitamin A Supplementation Trial
WB:	World Bank
WHO:	World Health Organisation

CHAPTER ONE

1.0 BACKGROUND

1.1 Introduction

Although Ghana has achieved some progress in the past decade in economic growth and in efforts to achieve the Millennium Development Goals (MDGs), increasing socioeconomic inequalities and geographical disparities in development remain as threats to this progress. One of the MDGs that is especially lagging behind is the maternal health goal. Maternal health has to do with the health of women during pregnancy, childbirth and the postpartum period. While maternal life is often a positive and fulfilling experience, for some women it is full of anxiety, suffering and ill-health. And for households it is a period mixed with hope (happiness for the imminent arrival of a new member), desperation due to uncertainties of the outcome and grief if there is eventual failure of the pregnancy or even death of the woman.

The most commonly discussed outcome of maternal health is the death of a woman in pregnancy, delivery or immediately after delivery. Maternal death is an important indicator of the level of socioeconomic development and of the quality of health care in a country. Technically, maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO, 1992). Maternal death has become a very common occurrence in developing countries. The death of a mother in pregnancy is a calamity for the family, community and society as a whole. Governments and development organisations have been

implementing policies, programmes and strategies to improve maternal health and reduce the incidence of maternal deaths. However, for developing countries the rate at which women continue to die trying to perform their reproductive function remain just too unacceptable.

In Ghana, despite improvements over time in indicators such as healthcare service utilisation, incidence of maternal mortality continues to be high. Ghana's estimated maternal mortality ratio (MMR) in 2010 is 350 (WHO, 2012). Ghana is one among 40 countries classified by the WHO (2012) to have high MMR (defined as MMR ≥300 maternal deaths per 100,000 live births) in 2010. Other maternal health outcomes that continue to be of concern to the health system include adverse pregnancy outcomes such as miscarriage, stillbirth and unsafe abortion.

Evidence of an association between various measures of socioeconomic status and maternal health outcomes exists across and within countries (Agyemang et al. 2009; Banerjee and Hazra, 2004; Anderson et al. 1997). Inequalities in maternal health outcomes in relation to socioeconomic factors have therefore been of great interest in global development analysis and as indicator of economic development of countries. The attention given to health in the MDGs where three out of the eight goals relate to health issues and in particular the spotlight placed on maternal and child health in Goal 5 have added verve to the importance of maternal health in poverty reduction and the whole agenda of social and economic development.

The two targets for assessing progress toward Goal 5 are: reducing MMR by three quarters by 2015 using 1990 as the base year; and to achieve universal access to reproductive health care. Whilst progress is being made in improving universal access to maternal healthcare services in

Ghana, the annual rate of decline of maternal mortality (2.6%) is still less than half of the expected decline rate (5.5%) to half the MMR from the 1990 level by 2015 (WHO, 2012). Even though Ghana's economy grew at a relatively steady rate and poverty also declining over the past two decades (ISSER, 2010; GSS, 2007), progress towards achieving the maternal health goal has been shaky and at best far from being achieved.

Even though maternal mortality is usually the most used indicator of maternal health, outcomes of pregnancies such stillbirth, miscarriage and abortion are also a major problem of development. Stillbirth, miscarriage and abortion are indeed important conditions for maternal mortality besides other known biomedical causes of maternal deaths. Research has associated these maternal health outcomes to critical risk factors that hinge on individual behavioural characteristics such as poor utilisation of maternal healthcare, smoking and alcohol use. Others have also related these to pathophysiological responses to environmental stimulations such as inequalities and depressive outcomes (Sugiura-Ogasawara et al. 2002) and also to direct physical environmental conditions such as pollution and unimproved water used especially in shanty and deprived areas (Borja-Aburto et al. 1999; Hertz-Picciotto, 2000).

Every pregnancy puts a woman at risk of maternal death, but women who have miscarriages, stillbirths or induced abortions are known to have higher risk of maternal mortality than those who have live births (Reardon et al. 2002; Gissler et al. 2004; Hurt et al. 2008). In order to be able to tackle adequately prevailing maternal health problems and ultimately reduce maternal mortality, it is the position of this study that we expand investigations on issues around maternal

health to include characteristics of the communities within which women live. It is within the neighbourhoods that we can examine the risk factors that are fundamental to maternal health.

1.2 Problem statement

Developing countries have higher rates of maternal mortality than developed countries (WHO, 2012) and women of low socioeconomic status face much higher risk of maternal deaths than their counterparts with high socioeconomic status. In developing countries the increasing uncertainty of the outcome of a pregnancy is not only a worry to families but an indication of weaknesses in healthcare delivery and a characteristic of prevailing standards of living which is low. Even though Ghana over the years has made progress in economic growth and poverty reduction, inequalities continue to widen across the various layers of society (Coulombe and Wodon, 2007; Aryeetey et al. 2009). Alongside deepening social inequalities, are also concerns about increasing disparities in access and utilisation of healthcare (NDPC, 2009) and consequent poor maternal health outcomes which appear to display patterns similar to the spread of developmental inequities across communities in Ghana.

There are considerable differences in the incidence of maternal deaths across regions in Ghana for example, with the deprived northern regions showing MMR of over 800 maternal deaths per 100,000 live births (Ghana MDG Report, 2006). A major recommendation in earlier studies is that expanding healthcare services will increase consumption and this will have a positive impact on maternal health and reduce maternal mortality (supply side effects). But evidence abound of women routinely utilising maternal healthcare, yet lose pregnancies and others die while delivering under supervised care (Harrison, 1997; Macfarlane, 2001).

In Ghana, even though institutional data showed that the three northern regions (with high levels of poverty and low literacy rate), which also have low coverage of supervised deliveries have high MMR of over 800 maternal deaths per 100,000 live births (Ghana MDG Report, 2006), recent data from the DHS 2008 showed that while MMR in all regions improved, the MMR for Greater Accra Region worsened by 87.6 per 100,000 even though antenatal and supervised delivery coverage is higher than recorded in other regions (GSS et al. 2009a). In urban areas where access to medical care is less difficult as compared to rural areas, the MMR is also higher than in rural areas (GSS et al. 2009b).

This general pattern of differentials in the incidence of maternal mortality presents a complex scenario to explain. While it is possible to guess that most of the earlier maternal health interventions such as the Ghana VAST Survival Programme and the Roll Back Malaria Programme for example may have been disproportionately implemented in the northern part of Ghana, thus resulting in the improvements in those regions, the same cannot be said for the worsening incidence in urban areas and in Greater Accra where coverage of supervised deliveries and general utilisation of maternal health services is higher. The observed patterns may be a reflection of underlying risk factor(s) that are yet unexplored.

While expanding healthcare services to some extent can guarantee an increase in consumption, this cannot be seen in isolation. A review of the existing literature shows that over the last two or more decades, epidemiological studies and public health research have been enormously successful in identifying risk factors for maternal morbidities and mortality. However, these

studies have focused attention on risk factors that are relatively proximal. Many other studies have questioned the emphasis on such individually-based risk factors and the neglect of basic social and structural conditions of areas within which people live (Link and Phelan, 1995). In this study an argument is made for attention to be paid to the basic social and structural conditions if health reforms are to have maximum effect over time.

There are two reasons for this claim. First individually-based risk factors must be contextualized, by examining what puts people at risk of being exposed to maternal complications, if we are to craft effective interventions and improve maternal health. Second, this study argues that social factors such as socioeconomic status and social conditions of the areas in which people live are "fundamental causes" of poor maternal health, because they embody access to important resources, affect multiple health outcomes through multiple mechanisms, and consequently maintain an association with other health-injuring conditions even when intervening mechanisms change. Without careful attention to these possibilities, we run the risk of imposing individually-based intervention strategies that are ineffective and of missing opportunities to adopt broad-based societal interventions that could produce substantial health benefits for all. This is what has not been given adequate exploration in the Ghanaian literature.

Besides, individually-based policies are resource-exhausting and in a context of resource scarcity, such policies are less worthwhile. For research to be relevant and for policy to have an impact, there is the need to investigate the underlying factors that expose women to the risk of dying from pregnancy-related conditions. This is important to focus policy attention and

implementation of programmes on the community, but is also seen as a more authentic approach to development.

1.3 Objectives

The focus of this study is to explore the nature of the relationship between socioeconomic structure of neighbourhoods and adverse maternal health outcomes. The specific maternal health outcomes studied are stillbirth, miscarriage, abortion and maternal mortality[1].

The specific objectives are:

1. Examine the relationship between socioeconomic status and pregnancy outcomes

2. Investigate the socioeconomic factors that determines maternal mortality outcome

3. Examine the effect of healthcare utilisation on the incidence of maternal mortality using the immediate environment as the focus of analysis

4. Investigate barriers to improving maternal health outcomes

1.4 Research questions

The study is guided by the following research questions:

1. What is the nature of the effect of the socioeconomic characteristics of an area on women's pregnancy outcomes?

2. Is the effect independent of the characteristics of individual women and their households?

3. What is the extent of effect of a high level of healthcare utilisation on the incidence of maternal mortality in an area?

[1]There are other maternal health outcomes that are critical precursors to maternal mortality such as ectopic pregnancies (tubal pregnancies), postpartum complications, including depression as well as problems such as haemorrhage and infection. These outcomes are however difficult to measure reliably with existing data and also require the assistance of a trained medical practitioner to confirm these conditions.

4. What is the effect of deprivation at the small area level on incidences of poor maternal health outcomes?

5. To what extent is the observed effect of deprivation dependent on the locality of residence?

6. From the perspective of users of maternal healthcare, what are the barriers that affect utilisation of maternal healthcare services?

1.5 Usefulness of study

Studies on maternal health issues have often put much focus on the traditional individual demographic, socioeconomic and household characteristics. Where the areas in which people live have been considered, it has largely been limited to cross-country, regional or the dichotomous classification of areas into rural-urban. Health policies based on findings from these analyses often do not meet the desired or intended results because persons or groups of persons most in need of improved and effective healthcare service remain "hidden" behind large population averages and their real needs remain obscure from attention. Policy efforts to reduce maternal mortality therefore remained ineffective because of the lack of appreciation of the effect of the socioeconomic conditions of the neighbourhood that expose women to these outcomes.

This study will highlight the characteristics of neighbourhoods and how these characteristics compound individual and household characteristics and expose women to maternal health risks. An understanding of the combined effect of individual and neighbourhood level factors that increases women's exposure to risks of maternal mortality will help plan intervention strategies that will effectively deal with this exposure. A study that seeks to explore this context is

extremely important to guide policy in deciding what policies and in what form to implement them to reduce the level of exposure to mortality. This will improve the conception and implementation of public policies not through actions on high-risk individuals alone but policies and actions that address the characteristics of high-risk communities.

A major challenge of monitoring progress towards achieving the MDG 5 target of reducing MMR in particular is the problem of maternal mortality estimation. The estimation is extremely difficult particularly in developing countries, even at the national level where data completeness is a problem. Few countries have attempted ever to estimate MMR at sub-national domains even though these estimates are essential for setting priority in targeting the areas with high maternal mortality incidence. These estimates are however important to help in targeting high risk areas. This study's attempt to sift the characteristics of high incidence maternal mortality areas can actually serve to improve the foundation for estimating maternal mortality for Ghana and for smaller areas over time.

1.6 Structure of the study

The study is divided into seven chapters. Chapter 2 provides an overview of developments in the health sector in Ghana. Chapter 3 presents a review of relevant theories and provides a conceptual framework for the study. Chapter 4 discusses the methodology and the datasets used for the study. Chapter 5, the results chapter is subdivided into four sections which presents the quantitative analysis of the data. Chapter 6 presents perspectives for improving maternal health outcomes, and the last chapter (Chapter seven) presents conclusions.

CHAPTER TWO

2.0 OVERVIEW OF HEALTH SECTOR DEVELOPMENT AND MATERNAL HEALTH IN GHANA

2.1 Introduction

The relationship between economic growth and poverty reduction and the possible inconsistency between them as development objectives have long been recognized. Growth is necessary for poverty reduction but is not sufficient: it must be accompanied by an improvement in the living standard of the people. Ghana continues to receive praises for her performance in democratic governance and poverty reduction. Over the last twenty years Ghana's efforts to reduce poverty paid off with a sustained decline in poverty from nearly 52 per cent in 1991/92 to 39.5 per cent in 1998/99 and 28.5 in 2005/06 (GSS, 2007). Due to this performance Ghana was prided as a star performer in the sub-region considering that Ghana started the 1991 year with a poverty rate far above the sub-regional average of 47 per cent but accelerated in her poverty reduction efforts achieving a decline rate faster than that of the sub-regional average. Economic 'watchers' suggested that if the current growth momentum is sustained, Ghana should meet the first MDG of halving 1990 poverty levels before the United Nations (UN) Assembly meets in 2015 (GSS, 2007; Coulombe and Wodon, 2007).

Ghana also continue to experience a period of real growth in the economy (GDP) estimated to have reached 7.2 per cent in 2008, an improvement over 2007 where the economy recorded a

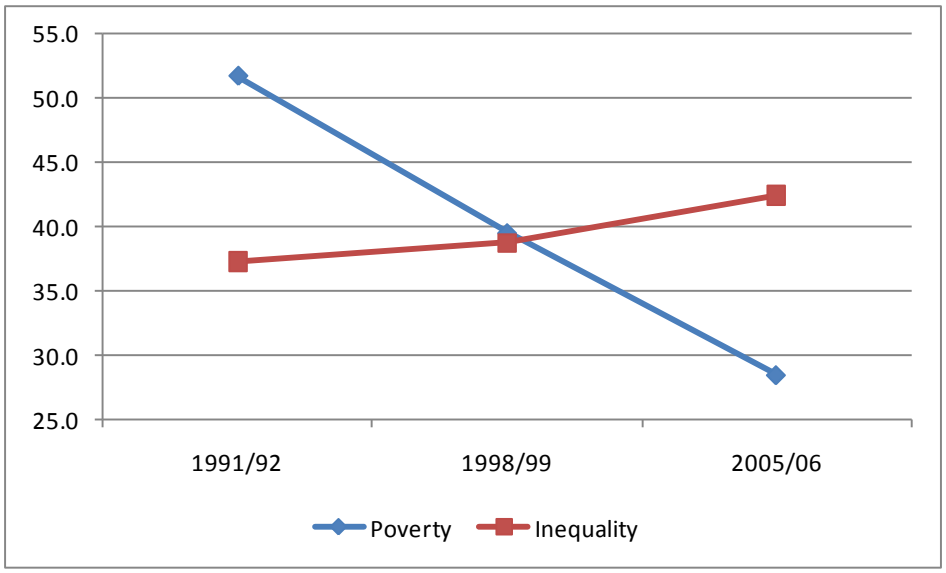
growth rate of 6.3 percent, and an even greater improvement over the average annual rate of 5.6 per cent over 2000-06 (ISSER, 2009 & 2010). The relatively high GDP growth rate impacted positively on the per capita income and consequently raised it by about 9% from US$654 in 2007 to about US$712.25 in 2008 (NDPC, 2009). The growth in the economy allowed for direction of attention and allocation of resources for poverty reduction programmes outlined in the Growth and Poverty Reduction Strategy (GPRS I&II) initiatives in health, education, among others and also in the recent Ghana Shared Growth and Development Agenda.

What remains a concern in Ghana is the persistent widening inequalities in the distribution of wealth in the economy (Aryeetey et al. 2009). Disparities in social and economic well-being are evident among various spatial units and socioeconomic strata across the country. Studies have shown that poverty in Ghana is declining amid widening inequalities which seem to have increased considerably in the last seven years (Coulombe and Wodon, 2007; GSS, 2007) (Figure 2.1). Evidence available indicates that Ghana is becoming richer as a country but with increasing levels of inequalities. The Gini index for consumption per adult equivalent increased from 0.353 in 1991/92 to 0.378 in 1998/99 and to 0.394 in 2005/06 (Coulombe and Wodon, 2007). Aryeetey and others (2009) observed that the prevailing intra-regional inequality is an important driver of aggregate income inequality in the country.

It is argued that whilst inequality between regions across Ghana is historical (Songsore, 2003), socioeconomic inequalities among the population are accentuated by post-colonial development policies and strategies. As Myrdal's regional development proposition of cumulative causation states, once a centre or region moves ahead of others, it will continue to grow due to its attraction

of new socioeconomic investments and people (Aryeetey et al. 2009). The evidence in Ghana support this proposition because the regions that emerged during the colonial period as the 'developed' regions (southern) with enormous economic opportunities have continued to thrive during post-colonial period because of the continuous attraction of these regions to direct and indirect state and private investments relative to northern Ghana (Aryeetey et al. 2009). The current economic orthodoxy of market liberalization also continues to widen rather than decrease these inequalities.

Figure 2.1: Comparison of levels of poverty and inequality in Ghana



Source: Aryeetey et al. 2009

When spatial (regional) inequality coincides with divisions along socioeconomic lines it can produce severe consequences for already poor and underdeveloped societies (Aryeetey et al. 2009). The pervasiveness of inequalities across regions, considered within the overall view of the

country's development process portends a development problem for the country. Prevailing socioeconomic inequalities surely cast a slur on our efforts to improve maternal health outcomes. This is because spatial inequalities reflect inequities in distribution of public services, inequalities in access, inequalities in consumption, and thus inequalities in health outcomes.

2.2 Overview of developments in the health sector in Ghana

The health sector benefited from increased financial investments by the government and development partners as part of efforts to improve access to health services across the country. The result has been increases in outpatient visits to health facilities in the public sector increasing significantly from 0.55 in 2006 to 0.81 in 2009 (NDPC, 2010). This has also been attributed in part to the reduction in financial barrier to health care as a result of the introduction of the National Health Insurance Scheme (NHIS). The NHIS became necessary after years of implementation of cost recovery programmes that nearly jeopardised the gains made in health outcomes immediately after independence.

It is important to observe that Ghana was doing well in terms of major health indicators in the period after independence. Things however deteriorated around the 1980s and the period after when the World Bank and the International Monetary Fund (IMF) pushed in policies of economic recovery (ERP) and structural adjustment (SAP) programmes which emphasised market liberalisation of the economy. This shift had severe effect on the health sector and this has remained over three decades as one of the key triggers of the inequalities in health outcomes in Ghana till date.

At Ghana's independence in 1957, user charges in government health facilities were immediately abolished (Nyonator and Kutzin, 1999). This could be said to have been done in a rush due to the regimes abhorrence for the market system and great preference for socialist's orientations. Minimal user fees were only charged with the enactment of the Hospital Fees Decree 1969, which was later amended into the Hospital Fees Act 1971 following observed difficulties in funding the free medical care for every Ghanaian. In 1985 following the introduction of the SAP however, the Hospital Fees Regulations 1985 (L.I.1313) was broadened to include consultation, laboratory and other diagnostic procedures, medical, surgical and dental services, medical examinations and hospital accommodation in preparation for full cost recovery to be introduced. Government health spending fell during the 1990s, both in real terms and as a percentage of total public spending. The Ministry of Health's (MoH) recurrent expenditure represented 11.1% of the total (excluding interest payments) government recurrent expenditure in 1991 and went down further to 6.9% in 1995 (Nyonator and Kutzin, 1999).

The proponents of the health sector privatization argued that this shift in financing would increase the public's appreciation of health services and prevent overuse (Akin, Birdsall, and de Ferranti, 1987). In responding to arguments of the poor potentially losing out on access to healthcare, the key proponents argued that, revenues from user fees could be used to subsidise those least able to afford care. Exemption schemes were also proposed to get round the threat of poor people being unable to afford adequate healthcare. However, a lot of these did not work out and since then critical health indicators such as healthcare utilisation coverage and maternal and child health remain underachieved. Empirical studies on the effects of the health sector reform

component of the ERP/SAP revealed severely poor consequences for health utilisation (Gilson and Mills, 1995; Asenso-Okyere et al. 1997 & 1998; Nyonator and Kutzin, 1999). The 'Cash and Carry' system of paying for healthcare at the point of service that emerged put an enormous financial pressure on the poor and served as a major barrier to healthcare use. Healthcare access inequalities became widespread, especially around the later part of the 1990s and early 2000.

Social equalisation policies reintroduced under Ghana's new development policy framework - Ghana Poverty Reduction Strategy (GPRS I: 2003 - 2005) have been able to reduce the inequalities but narrowly. One of the major pro-poor policies introduced was the promulgation of the National Health Insurance Act (NHIA Act 2003: Act 650) and the implementation of the NHIS which replaced the 'Cash and Carry' system. The NHIS, unlike the cash and carry system, provided an opportunity for risk pooling and cross-subsidisation of healthcare expenditure of especially those classified as vulnerable. These people are given fee exemptions that allow them to benefit from healthcare services that hitherto would have been inaccessible to them. This protects them from coming directly under the impact of out-of-pocket healthcare expenditure which impeded access to healthcare services.

Under GPRS II (2006-2009) mainstreaming and implementation of a wide range of health interventions were further carried out with the expectation that healthcare access inequalities will narrow further (NDPC, 2009). Free maternal and child health care was brought fully on board the NHIS programme as an additional exempt category for women and newborn children who are often considered vulnerable. Other policies and programmes were directed at recruitment and retention of staff in hard-to-reach districts by providing staff accommodation in such areas. The

training of health aides, medical assistants and traditional birth attendants was also introduced as a short-term measure to address the shortage of health workers in the country. At the end of 2008, even though inequalities in utilisation of healthcare services still remained, the NHIS to a large extent reduced the impact of finance as a barrier to healthcare by limiting out-of-pocket cash payment at the point of service delivery. Out-patient department (OPD) attendance at health institutions increased and delivery of quality healthcare services also improved (NDPC, 2009).

2.3 Maternal health interventions and key outcomes

Various interventions (both institutional and programmatic and also best practice cases) have been implemented over the years to address major maternal health problems and to bring down the levels of maternal mortality. Current programmatic interventions include the Safe Motherhood program, which aims to improve access to Emergency Obstetric Care; Family Planning Program, High Impact Rapid Delivery (HIRD). A range of "Best Practice" cases implemented also included the focused-ANC (FANC) programme. FANC aims to improve the quality of maternal health services through a range of practices including providing comprehensive, focused individualized care, continuous care by the same provider, emphases on birth preparedness and complication readiness, promoting partner support and person involvement and integrating antenatal care (ANC), postnatal care (PNC) and Family Planning (FP) services (The Population Council, 2008; Armar-Klemusu et al. 2006).

The implementation of these interventions, framed largely on existing global insights on successful maternal health interventions, provides important areas that can be focused on to improve maternal health and reduce maternal mortality. These include investing in Family

Planning to prevent pregnancies and reduce fertility rates; skilled care at delivery to prevent pregnancy complications; emergency obstetric care to prevent death by timely management of life-threatening complications; and a strong antenatal and postnatal care system built upon a functioning health system (MoH, 2008; Graham, 2008). In terms of increasing utilisation of skilled care at delivery the Government of Ghana implemented a delivery fee exemption policy (DFEP) in 2003 with the goal of improving the proportion of births supervised by trained medical personnel (Penfold et al. 2007). This was followed by the uploading of a full free maternal care on the NHIS to cater for the needs of maternity women and newborn children.

These interventions have impacted positively on a number of maternal health indicators as reflected in improvements in ANC, Supervised Delivery (SPD), PNC, FP acceptor rates and a reduction in fertility rate (Witter et al. 2007; Penfold et al. 2007; Grepin, 2009; GSS et al. 2009a). Fertility rate declined over the last two decades, reducing on the average by 2 children per a woman between 1988 and 2008 (GSS et al. 2009a). Evaluation of the DFEP and preliminary assessment of the free maternal care component of the NHIS also suggest positive outcomes in terms of increased proportion of births supervised by trained medical personnel and births delivered in facilities (Penfold et al. 2007; Witter et al. 2007; Grepin, 2009). Data from the GDHS show increase in use of antenatal care during pregnancy, supervised delivery and postnatal care (GSS et al. 2009a). These may have contributed to decline in maternal mortality reported at the institutional level.

Many challenges however still remain in achieving most of the intended objectives of reducing to the barest minimum possible the occurrence of adverse maternal health outcomes. Family

Planning (FP) activities in particular continue to face challenges. Uptake of family planning programmes has been slow. Contraceptive prevalence rate among married women is only 17 per cent in 2008 (GSS et al. 2009a), meanwhile about 35 per cent of currently married women have an unmet need for family planning (wish to space next birth or to limit childbearing altogether but are currently not using contraception). Underutilisation of family planning interventions is also noted as well as concerns of contraceptive failures (Ahiadeke, 2001). The possible outcome of a poor family planning practice is a high incidence of unplanned pregnancies with a high propensity for abortion.

The concern is, if contraceptive prevalence is so low, sexual activities much freer and irrepressible and unwanted pregnancies prevalent, then what happens to most of the resultant pregnancies. Clandestine abortion practices may be high. Researches have shown that unwanted or mistimed pregnancies especially to young unmarried women are likely to end in abortion (Ahiadeke, 2001; Lee et al. 2004; GSS et al. 2009a). But abortion, when done under unsafe conditions as it is more often the case in Ghana, can lead to complications and death (Ahiadeke, 2001 & 2002; WHO, 2005). Unsafe abortion contributes about 13 per cent to the global maternal mortality burden (Haddad and Nour, 2009). In Ghana abortion accounted for about 11 per cent of all maternal deaths estimated in 2007 (GSS et al., 2009b).

Equity of access to quality maternal healthcare also continues to be an important concern of successful maternal healthcare. Despite a general trend of low contraceptive use, there are both rural-urban and regional differences. Married women in urban areas recorded a slightly higher rate of use of modern contraceptives (18.6%) compared to rural areas (15.1%). Two broad

drivers implicated in the inequity of coverage of quality maternal care are seen both on the supply of care and demand for care (MoH, 2008). Two of the most pertinent factors that account for the low demand for family planning practices for example are the lack of male involvement in family planning and the misconception about family planning practices (MoH, 2011). Male dominance still weighs on women's ability to freely use family planning methods. Women usually will require expressed permission from their husbands to use family planning. Women themselves also hold several misconceptions about the use of family planning. Young women for instance believe that the use of family planning before first birth affects one's ability to have children in future (MoH, 2011). The use of contraception is also associated with promiscuity and is frown upon by many women.

Closely associated with this is the high incidence of unwanted and mistimed pregnancies prevalent in most societies giving rise to high incidence of clandestine abortion practices pervasive in society today. This may also explain the high fertility rates in rural areas and the three Northern regions, and some southern regions such as the Central region, which continue to be higher than the national average (Agyei-Mensah et al. 2005). It may also be associated with the difficulty in reducing maternal mortality and the growing disparity in the incidence rate across the country; patterns similar to incidence in developed and developing countries.

There are also concerns with inequities in supervised deliveries, indicating a widened gap between regions with the highest and the lowest performance. Supervised delivery is generally low (58.7%) in Ghana (GSS et al. 2009a). But the Northern region and the Volta region have the lowest coverage (below 40%) in 2010 which is attributed in part to unequal distribution of health

personnel across these regions. The Northern region for instance has the second lowest number of midwifes per population. The Volta Region on the other hand experienced a significant reduction in the number of midwifes in 2010 as compared to previous years. The Western region which has the lowest number of midwifes per population also has only a slightly above 40 per cent coverage of supervised deliveries in 2010 (MoH, 2011). Poor staff attitude, unsatisfactory facilities and bias cultural barriers are among the key factors affecting delivery of pregnancies in facilities, besides the unavailability of key personnel in some areas.

The referral-response system also remains a problem in many districts across the country. The major barrier to this is the lack of ambulance services in most districts, poor road network, the poor transport system, poor communication and general sociocultural barriers peculiar to rural communities. Although regional and district hospitals are supposedly well equipped to handle complicated labour cases, the main issue is how to timely transport women in labour to these facilities. The national ambulance service is said to be expensive (and not yet able to ensure district based services). Some districts have adopted innovative ways for transporting women to the nearest higher level facility in their area. Private transport (taxis or motorbikes) where available and road network motorable are being used to provide ambulance services for women in labour. Other districts have set up a telephone directory of all senior health personal and opinion leaders in the community to aid the referral processes.

Maternal mortality in Ghana

According to the WHO/UNICEF/UNFPA/World Bank joint estimates of maternal mortality trends, Ghana's maternal mortality ratio has been declining since 1995 (Figure 2.2). It reached

350 maternal deaths per 100,000 live births in 2010 down 40 per cent from 580 in 1990 (WHO, 2012). It must be noted beforehand that accurate maternal mortality figures are in fact difficult to obtain and where they exist they vary considerably depending on the source. Among many reasons for this are the incomplete civil registration systems and the lack of medical certification of cause of death which is common in both developed and developing countries (WHO, 2012).

In the absence of complete and accurate civil registration systems, maternal mortality data are estimated based on data from a variety of sources – including censuses, household surveys, reproductive-age mortality studies (RAMOS) and verbal autopsies (WHO, 2012). However, few countries have estimates of maternal mortality based on population-based surveys and developing countries are the least expected to have, due to the high financial implications in conducting large population-based surveys often required to estimate maternal mortality. Many countries therefore make do with estimates from demographic and health surveys and others rely on institutional or facility-based estimates. This makes comparison of maternal mortality estimates across countries really difficult.

Over the years, the United Nations Maternal Mortality Estimation Inter-Agency Group (MMEIG), comprising the World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), the United Nations Population Division, and The World Bank, together with a team at the University of California at Berkeley, United States of America have been providing internationally comparable MMR estimates. The MMEIG use both direct estimations where complete and reliable registration data is available and statistical modelling where reliable and complete data unavailable. Globally, the

WHO/UNICEF/UNFPA/World Bank estimated that 287, 000 maternal deaths occurred in 2010 (WHO, 2012). This shows that the benchmark level of 543, 000 maternal deaths estimated in 1990 declined by about 47 per cent. The global MMR was also estimated at 210 maternal deaths per 100,000 live births in 2010. This shows a reduction from 400 maternal deaths per 100,000 live births reported in 1990.

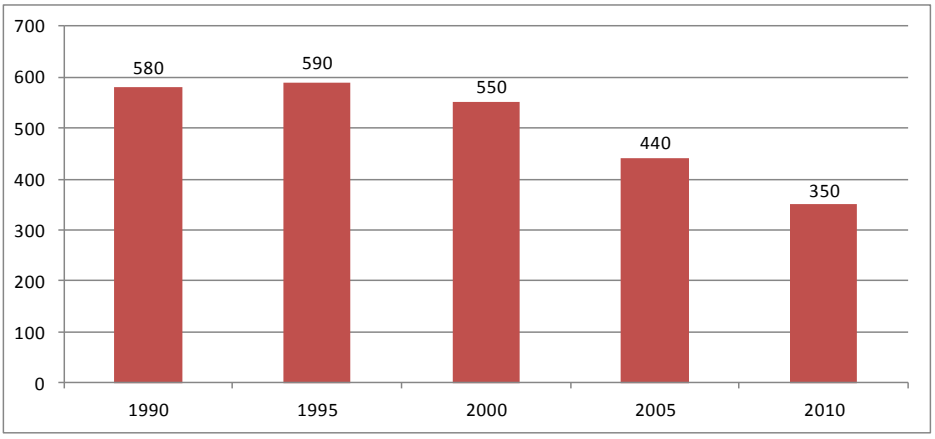
Developing countries accounted for almost all of the maternal deaths recorded in 2010 (99%) and sub-Saharan Africa contributed more than half (56%). The MMR in developing regions (240) was 15 times higher than in developed regions (16). Sub-Saharan Africa also had the highest MMR at 500 maternal deaths per 100,000 live births. Adult lifetime risk of maternal death (the probability that a 15-year-old female will die eventually from a maternal cause) as measured in 2010 which is 1 in 180 is also highest in sub-Saharan Africa (at 1 in 39) as compared to developed regions which is 1 in 3800 (WHO, 2012).

Ghana is one of the countries that maternal mortality is usually estimated via statistical modelling by the WHO/UNICEF/UNFPA/World Bank joint team. Ghana's maternal mortality ratio at 350 per 100,000 live births is about 1.6 times higher than the estimate for the global trend and more than 20 times higher than in developed countries. Adult lifetime risk of maternal death in Ghana in 2010 was 1 in 68 a slight improvement over 2008 which was 1 in 66 and also better as compared to 1 in 39 for sub-Saharan Africa but riskier than the 1 in 150 for all developing countries. Overall, the estimates however showed that Ghana continued to witness a decline in maternal mortality since 1995 (Figure 2.2). MMR reduced by 40 percent between 1990 and 2010, with an annual reduction rate of 2.6% (WHO, 2012).

The general decline evident in the WHO/UNICEF/UNFPA/World Bank estimate is also supported by estimates from both recent nationwide maternal health surveys and also institutional level data. Estimates from the recent nationwide maternal health survey, for example, showed that maternal mortality ratio declined from 503 in 2005 to 451 maternal deaths per 100,000 live births in 2007 (NDPC/UNDP, 2010; GSS et al., 2009b). Comparing population-based survey estimates with estimates from regression modelling and institutional data has to be done with extreme caution due to the intractability of some of the assumptions often made in regression analysis in particular. This study therefore juxtaposes the GMHS estimate with the WHO estimate with caution.

The available institutional data suggest that maternal deaths (per 100,000 live birth) declined from 224 deaths per 100,000 live births in 2007 to 201 per 100,000 live births in 2008 (NDPC/UNDP, 2010). This decline, according to analysts, is attributable partly to successes in interventions such as the Safe-Motherhood Initiative, Ghana VAST Survival Programme, Prevention Maternal Mortality Programme (PMMC) Making Pregnancy Safer Initiative, Prevention and Management of Safe Abortion Programme, Intermittent Preventive Treatment (IPT), Maternal and Neonatal Health Programme and Roll Back Malaria Programme (NDPC/UNDP, 2010).

Figure 2.2: Maternal mortality ratio in Ghana (Per 100,000 live births)



Source: Various reports of the WHO/UNICEF/UNFPA/World Bank joint team

Despite the general decline in maternal mortality in Ghana, a concern (of development) is the disparities across regions and localities. The GMHS data showed that maternal mortality ratio was higher in urban areas than rural. In terms of regional disaggregation, the institutional data showed that the deprived northern regions have MMR of over 800 maternal deaths per 100,000 live births (Ghana MDG Report, 2006). These regions also have low coverage of supervised deliveries especially the Northern region. These are also the regions where poverty levels are high and literacy levels very low (GSS, 2007). Data from the GDHS of 2008 showed that while maternal mortality ratios in all regions improved, maternal mortality ratio in Greater Accra worsened by 87.6 per 100,000 (GSS et al. 2009a). Disparities do exist in the magnitude of importance of the biomedical causes of maternal deaths across the country even though the pattern has not changed from previous years.

The biomedical causes continue to be haemorrhage, hypertensive disorders, obstructed labour, complications of abortion leading to ruptured uterus, sepsis, and other infections (GSS et al. 2009b). The most important causes of death recorded in the GMHS (2007) data, for example, is haemorrhage, complications of abortion, hypertensive disorders and sepsis. Haemorrhage is estimated to have contributed about 24 per cent to maternal mortality cases. Induced abortion accounted for 11 per cent. Hypertensive disorders of pregnancy and sepsis contributed 9% and 7% respectively. In terms of regional distribution, Greater Accra has the highest proportion of maternal deaths due to hypertensive disorders of pregnancy compared to other regions and the lowest attributable to sepsis. It is suggested that the high proportion of hypertensive-related maternal mortality in Greater Accra could be attributed to obesity-related problems among women of reproductive age, whilst the low proportion associated with sepsis could be due to access to high quality antibiotics (GSS et al. 2009b).

The general pattern of inequality presents a difficult scenario to explain on the available evidence. While it is possible to guess that most of the maternal health interventions such as the Ghana VAST Survival Programme and the Roll Back Malaria Programme for example may have been disproportionately implemented in the northern part of Ghana, thus resulting in the improvements in those regions, the same cannot be said for the worsening incidence in urban areas and in Greater Accra where coverage of supervised deliveries and general utilisation of maternal health services are high. The observed patterns may be a reflection of underlying risk factor(s) that are yet unexplored in Ghana.

2.4 Concluding this chapter

This study seeks to use an integrative framework to explore the complex patterns of maternal health outcomes in Ghana. This will allow for personal level causes of maternal health outcomes to be investigated in the context of the neighbourhoods within which people live. This is important in as far as the predispositions of individuals are shaped by the social and physical environment within which they live and work. In the last two decades, this strand of research has grown and researchers and policy makers have begun to place emphasis on the socioeconomic dynamics of society – as opposed to static biomedical factors or disposition of individuals, in explaining differentials in populations' health. This study is motivated in part by this dimension of understanding of health outcomes and largely by new empirical findings that stress that the neighbourhoods within which people live is important in explaining the variations in a population's health beyond individual personal level factors.

CHAPTER THREE

3.0 REVIEW OF THEORIES AND CONCEPTUAL FRAMEWORK

3.1 Introduction

Maternal health outcomes are among the most diverse human indicators of development. Exploring conditions that are associated with an outcome of this nature is certainly important, considering its relevance to development. By understanding the determinants of outcomes of maternal health and their inter-relationships, it is possible to develop policies, seek preventive measures and target high-risk groups, and assess the health implications of changes in the biological, physical, or social environment (Campbell and Graham, 1991). Identifying and intervening against specific risk factors of maternal health is not exclusively within the sphere of bio-medical expertise. A multidisciplinary approach to studying and resolving health problems is certainly imperative (Campbell and Graham, 1991).

Earlier investigations of the determinants of maternal morbidity and mortality have tended to adopt either a condition-specific focus (Bang et al. 1989; Wasserheit et al. 1989) or evolved around methodological issues (Thaddeus and Maine, 1990). Whatever the case, as common with any empirical research, studying the determinants of any health condition requires that we choose a particular outcome of interest, hypothesize the underlying association between the outcome and a certain factor or factors of interest, measure the outcome and factor(s), demonstrate the hypothesised association and specify the nature of the mechanism linking the

factor(s) and the outcome. This section takes a look at these two facets of research in recognition of the underlying assumptions of empirical research.

3.2 Defining maternal health outcomes

Maternal health refers to the health of women during pregnancy, childbirth and the postpartum period. This encompasses either positive or negative outcomes from any cause related to childbearing or its management (Graham and Campbell, 1990; WHO, 1990). The positive or favourable outcomes of maternal health include maternal satisfaction, positive birth outcomes (live births) with or without medical intervention, which also reflects other indicators of maternal health associated with intervention and care and maternal survival of pregnancies. Adverse outcomes of maternal health, on the other hand, include maternal illnesses (morbidities) of various kinds, pregnancy losses and mortality.

There is, however, emphasis on the negative aspects of maternal health for obvious reasons, chief among which is the fact that the negative aspects of maternal health is a reflection of the relationship between a population's health and the level of healthcare in a country and the capacity of the health system in general to protect the health of the population. Indicators of negative maternal health outcomes are also important indicators of the level of socioeconomic development of a country. The other reason for the emphasis on the negative aspect of maternal health may also stem in part from the complexities in measurement and the lack of suitable indicators of positive health indicators (Campbell and Graham, 1991).

By avoiding the complexities of defining and measuring positive maternal health outcomes, analysing adverse outcomes starts with the onset of a pregnancy, complications of any kind incidental to the pregnancy (maternal morbidities) and any related fatality (disabilities or death). Implicit in the conceptualisation of maternal health, maternal morbidity seems an intermediary between pregnancy and mortality. However, there is no clear-cut definition of what constitutes a maternal morbidity (Graham and Campbell, 1990). Maternal morbidity usually relates to serious diseases, disabilities or physical damage caused by pregnancy-related complications. Maternal morbidities take various forms and could arise as a result of pathogenic causes or iatrogenic (medically-induced). Commonly known maternal morbidities include haemorrhage, hypertensive disorder (pre-eclampsia), anaemia, infertility, puerperal infection and sepsis. Others include obstetric fistula, perineal damage, prolapsed uterus, stress incontinence, depression and ectopic pregnancy (See Appendix 1 for a description of some maternal health problems). Common iatrogenic morbidities on the other hand include adverse outcomes of unsafe abortion, complications of caesarean deliveries and side effects of inappropriate prescriptions.

The effect of maternal morbidities can manifest physically or psychosocially. For example, while a pregnancy-related eclampsia has direct physical ill-health or can aggravate underlying essential hypertension (indirect physical ill-health) a woman with untreated vesico-vaginal fistula may experience a combination of physical, mental and social ill-health. The severity of specific morbidities also varies: whilst some are instantaneously lethal, others are elusive and difficult to detect but potentially lethal, and others are simply discomforting. A woman who suffers a serious prolapsed uterus which can no longer support the uterus has a high chance of suffering miscarriage (spontaneous abortion). Globally, haemorrhage is responsible for about 25 per cent

of maternal deaths and eclampsia and sepsis together contribute about 27 per cent (Geubbels, 2006). Women with severe obstetric complications such as hemorrhage, anemia, sepsis and hypertensive pregnancy disorders are also found to have excessively high rate of foetal deaths (Cham, Sundby and Vangen, 2009).

Of the three possible stages a woman passes through pregnancy, morbidity, and mortality, pregnancy and mortality pose the least conceptual problems, although they can also be difficult to measure. Pregnancy is a biological condition that ensues after conditions leading to conception are present and sexual intercourse takes place (Campbell and Graham, 1991). These conditions or factors are relatively well described in Bongaarts and Potter (1983). Identifying pregnancy however requires laboratory tests, clinical examinations, or women's honest reports. Early pregnancies in particular are very difficult to detect. But like in fertility research, the easiest way to establish a pregnancy is following an ensuing birth. Although relying on this is not a good checker of data on pregnancies, pregnancy outcomes can still give an indication of the prevalence of pregnancies in a population.

Normally, a pregnancy should end in a live birth: the complete delivery of a pregnancy, irrespective of its duration, which, after such delivery, breathes, or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached (Kowaleski, 1997). However, in some cases a confirmed pregnancy may end in a miscarriage or stillbirth and others may be aborted for health or other reasons.

Miscarriage is the loss of a pregnancy before the foetus is developed enough to survive on its own usually occurring within the first 20 weeks of gestation and weighs 500g or less. Early miscarriages are those that occur before the 12th week of gestation. Stillbirth, on the other hand is when a foetus that has died in the uterus or during labour or delivery exits a woman. The gestation period for a stillbirth is normally 22 weeks, but it can also happen in full term pregnancies. Abortion is the purposeful interruption of a pregnancy with intentions other than to produce a live-born infant and which ultimately does not result in a live birth (Kowaleski, 1997).

Apart from the live birth, a number of maternal ill-health conditions give rise to the stated adverse pregnancy outcomes. These include chronic health conditions such as high blood pressure, diabetes, kidney disease and thrombophilias (blood clotting disorders). Other conditions may include placental abruption and infections. Pregnancy-induced forms of high blood pressure (such as preeclampsia) increase the risk of foetal death, especially when they recur in a second or later pregnancy (Anathe and Basso, 2010). Infections involving the mother are also important cause of foetal deaths before 28 weeks of pregnancy (Silver et al. 2007). Some infections such as genital and urinary tract infections and certain viruses, such as fifth disease (parvovirus infection) may cause no symptoms in the pregnant woman and may go undiagnosed until they cause severe complications, such as foetal death or preterm birth. Placental abruption which causes heavy bleeding in mothers can also threaten the life of mother and baby and can cause the death of a foetus from lack of oxygen (Eller, Branch and Byrne, 2006).

The ultimate indicator of maternal health is maternal survival or death. Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of

the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (ICD 10). This definition allows for identification of maternal deaths based on their causes as direct obstetric deaths and indirect obstetric deaths (WHO, 2012). Direct obstetric deaths are those resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium). This includes deaths due to, for example, obstetric haemorrhage or hypertensive disorders in pregnancy. It also includes deaths from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of these (Iatrogenic deaths). Indirect obstetric deaths on the other hand refers to deaths resulting from previous existing disease or disease that developed during pregnancy and that were not due to direct obstetric causes but that were aggravated by physiologic effects of pregnancy (Geubbels, 2006).

In practice, it is often difficult to determine the exact cause of death of a pregnant woman particularly when deaths occur outside health facilities. Even where deaths do occur in a health facility, for fear of public reprimand, health facilities fail to record them as maternal deaths. For this reason, a broader definition, namely pregnancy-related deaths; the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death is often used (WHO, 2012). This alternative definition allows measurement of deaths that are related to pregnancy, even though they do not strictly conform to the standard "maternal death" concept, in settings where accurate information about causes of deaths based on medical certification is unavailable. This is expected to make for the problem of lack of data in majority of countries, which also makes it challenging to assess accurately the situation of maternal mortality for comparison purposes across countries.

There are three related measures of the incidence of maternal mortality: maternal mortality rate, maternal mortality ratio and the lifetime risk of maternal mortality. Globally, the maternal mortality ratio measure is common. This expresses the incidence of maternal mortality as the number of maternal deaths per 100,000 live births. Maternal mortality rate, on the other hand, expresses the incidence of maternal mortality as the number of maternal deaths per year per 10,000 women of reproductive age. The lifetime risk of maternal death is the chance of dying from pregnancy for an adult of reproductive age. The maternal mortality ratio is perhaps most widely used because of its computational and conceptual simplicity. This measure only depends on the risk of dying once a woman is pregnant, i.e. the risk of developing a complication multiplied by the risk of dying from that complication. The maternal mortality rate takes into account the annual probability of becoming pregnant for women of reproductive age. The lifetime risk measure is however the most comprehensive measure as it incorporates the annual probability to become pregnant, the length of the reproductive period and the risk of dying a maternal death once pregnant. It is thus a cumulative incidence (WHO, 2012).

In this study adverse pregnancy outcomes and maternal mortality are the chosen outcomes of study. The choice of these outcomes is partly conceptual and partly developmental. As noted earlier, it is complex and conceptually difficult to define and measure illnesses or diseases in a woman as parenthetic to pregnancy or only incidental. Campbell and Graham (1991) noted that the link between pregnancy and specific morbidities is not always so clear and even where morbidity coincides with pregnancy or the puerperium, it is not necessarily maternal morbidity. Maternal morbidity, where it is observed, also takes many forms. It can be an acute or a chronic

condition, which is either recognized as an illness or is not apparent to the respondent and may not be captured in a survey. Specific morbidities may also be associated with a whole spectrum of manifestations. For example, haemoglobin levels are normally distributed, with anaemia, which occurs at the low end of the distribution, ranging from mild to severe. Uterine prolapse, on the other hand, may manifest itself through several symptom complexes, appearing as pain in some women and incontinence in others (Campbell and Graham, 1991).

The conceptual complexities are further compounded by the fact that the forms taken by a particular morbidity may partly be a function of its type and partly due to its interaction with a woman's genetic constitution and underlying health status. Perceptions of symptoms of morbidity may also vary between cultures making it difficult to identify. Whilst a specific morbidity may manifest itself in ways that are physically apparent to all, others are only visible to a trained eye or measurable with particular instruments. This makes it difficult for a comprehensive analysis of pregnancy-related morbidities even though they are crucially important in causing maternal mortality. The other reason for this choice is the developmental context. Incidences of adverse pregnancy outcomes and maternal mortality are critical global indicators of socioeconomic standing of a country. In most instances, these are in fact used as indicators of development.

3.3 Theories of determinants of health status and conceptual framework

From the biomedical conceptualisation of health status as dependent on a tripod of pathogenic agents, a host and the environment, to today’s reliance on neo-materialists theories of health, ideas on health status has grown. The biomedical model of agent-host-environment relationship

that produces health is the earlier conceptualisation of determinants of health status. This proposes that micro-organisms are the causes of infections (Susser, 1985). However, the prominence of non-communicable health problems in society presented less obvious pathogenic causal pathways of health outcomes. This led to a shift in overconcentration on microorganisms to social and economic issues as determinants of health. Researchers from other disciplines (apart from medicine) such as ecology, psychology, demography, sociology and economics, then came in with various concepts and methodological arrangements to explain the differences in health status of populations. In the process, four key models emerged: behavioural model, psycho-social model, the life course approach and the material/neo-material model.

The behavioural model notes that health status is determined by personal behavioural choices (Townsend, Davidson and Whitehead, 1992). The model recognises the role of genetics and culture in producing unhealthy behavioural outcomes. Behaviourists note that people who are less endowed with certain types of personal characteristics, such as intelligence have less control over their circumstances and are therefore more likely to have bad health behaviours. They also argue that culture, as a system of values and meanings, serves as a standard of behaviour and defines the way of life where values, knowledge, and beliefs are shared (Helman, 2000; Blaxter, 1990). Culture may influence people's belief in the nature of a healthy life, use of modern health practices or perception of education. These may in many ways affect health behaviours and their actions or inactions may result in poor health.

The psycho-social model argues that relative position in a social hierarchy affects people’s feelings and imposes direct stress effects on health status (Elstad, 1998; Theorell, 2000). Life

involves challenges, such as financial strains, lack of control at work, lack of social support, and lack of sense of success, all of which induce some psychological stresses. These exposures to stresses may disturb health balance by repeated activation of a 'fight-or-flight' response (Brunner, 1997), which may have multiple health impact on capacity to survive in the face of emergent environmental challenges.

The life-course approach emphasises the accumulated effects of exposures across the life span (Blane, 2006). This model notes that adult health status is a result of complex combinations of physical, social and economic circumstances taking place over time, and accumulated from early childhood (Bartley, 2004). A number of concepts have been used to explain this model. These include the *critical period* concept or *latency* concept, the *risk accumulation* concept, and the *chain of risk* concept (Kuh and Ben-Shlomo, 2004; Hertzman et al., 2001). Critical period concept argues that if a hazard or adverse experience takes place at a certain age, it may have lifelong detrimental effects on the functions of tissues, organs, and body systems that will not be reversed in any easy way by later experience (Hertzman et al., 2001). The accumulation of risk concept assumes that risks or advantages to health accumulate gradually over the life course (Kuh and Ben-Shlomo, 2004). For example, low family socio-economic status is associated with low birth weight, higher stresses, inadequate food, lower quality of education, poor living environment, and health-threatening behaviours, which together lead to later poor adult health.

The chain of risk concept argues on the effect of interactions between risk factors. It argues that, in some cases, an exposure is only damaging to health in certain groups of people because of a sequence of previous exposures. The build-up of harm happens through a pathway – one bad

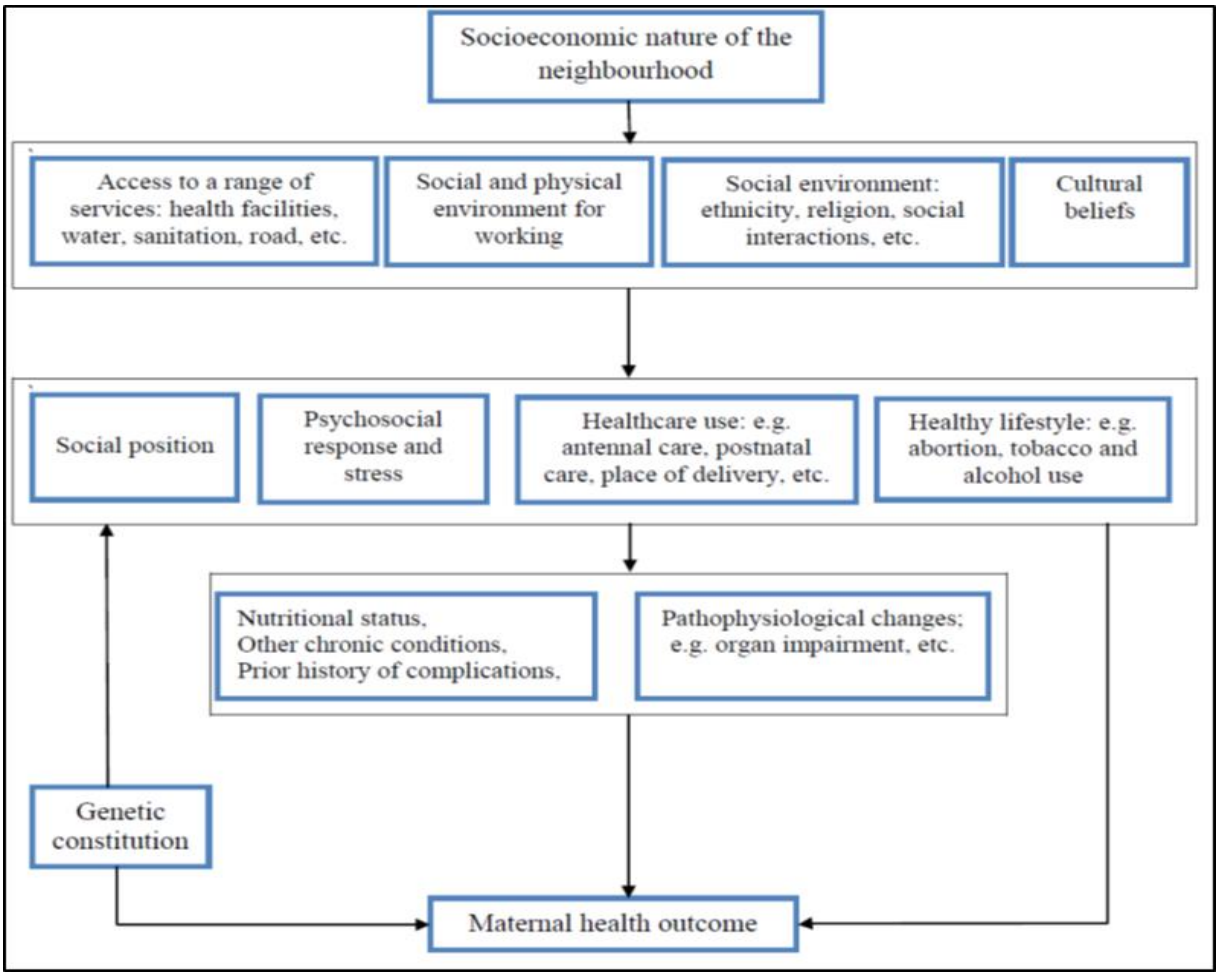
experience or exposure leads to another and so on, which eventually damages health (Hertzman, et al., 2001). An early exposure in a chain of risks may have a trigger effect only for the next exposure and it may be that only the final exposure in the chain has a marked effect on health.

The fourth model is the materialist or neo-materialist model which argues on the side of deprivation and inequalities (Dunn, et al., 2006; Jarvis and Wardle, 2006; Lynch et al., 2000; Mackenbach et al., 1993). These indicate differentials in people's working conditions, living environment, and exposure to physical hazards, all of which have an impact on health. The materialist model espouses that personal wealth determines relative social position, which tends to put psycho-social stress more on individuals of lower social standing and consequently generate health-threatening behavioural responses (Jarvis and Wardle, 2006). The neo-materialist model emphasizes that living conditions such as provision of public service, social and economic policies are also determined by higher-level macro-structural factors (Lynch et al., 2000). These social structures shape social classes, determine the distribution of resources over social strata and consequently affect the quality of various social determinants of health (see Appendix B; Figure 1, for a conceptual representation of the materialist/neo-materialist model).

Fundamentally important in all these models is the distinctive but multidimensional recognition of the various risk factors that affect health. While the life-course models, for instance, emphasise the importance of historical experiences of an individual, the others recognise the temporal dimensions of risk that people are exposed to. These models also recognise the underlining impact of the social structural environment on health status. A combination of these models into an integrative framework will therefore reflect the hypothesis that health outcomes

are both personal responsibilities and social or responsibilities of the neighbourhoods within which one lives (Figure 3.1).

Figure 3.1: Conceptual framework for analysing maternal health outcomes



Source: Adapted from Marmot and Wilkinson (2006)

Due to the intractability of maternal health outcomes and data requirement issues associated with the life course model, its inclusion in cross-sectional analysis is often problematic. This model requires that the research has accumulated information about a respondent's early life-course to be able to link that with current birth outcomes (Blane, 2006; Dannefer, 2003). The framework

adapted for this analysis therefore only integrates the behavioural, psychosocial and the materialist models. This framework recognises health outcomes as both due to individual behavioural choices, and social status, and at the same time emphasises the role of community in shaping health outcomes.

3.4 Neighbourhood studies and application to maternal health

Following Wilson's publication "The Truly Disadvantaged" (1987), which introduced the concept of 'concentration effects', there has been a resurgence of interest in neighbourhood analysis of health outcomes. This was further spurred on by concerns about the limitations of exclusively individual-level research designs (Wen, Browning and Cagney, 2003). Scholars from diverse disciplines (mainly from the social sciences but lately from among social epidemiologists) continue to conceptualise different mechanisms through which the neighbourhood can have effect on a population's health. Macintyre, Ellaway and Cummins (2002) after a review of the literature proposed a conceptual framework that adequately defined exactly what the characteristics of place are that would have an impact on health (Macintyre, Ellaway and Cummins, 2002). Their review provides key indicators that see some neighbourhoods to be healthier than others based on an approach that relies on Maslow's hierarchy of human needs (Weeks et al. 2006).

Conceptually, the neighbourhoods in which people live can have three possible effects on a population's health: the service or infrastructure distribution effect, the sociocultural and attitudinal effect, and the income distribution or inequality hypothesis. The main argument of the inequality hypothesis, for instance, is that health status is related to socioeconomic status across a

gradient. Implying that living in a society marked by strong economic and social gradations, the most advantaged will have better health status than the less advantaged (Macintyre, 1994). Other authors have described this as the "psychosocial effect" or relative deprivation hypothesis as it emphasises the role of shame, trust, and social cohesion as key determinants of health and health behaviours (Wilkinson, 1996 & 1999; Kawachi et al., 1997).

Implicitly, peoples' perceptions of social position and the negative emotions they foster are translated into anti-social behaviour and less social cohesion within the community. In this way, perceptions of social status have both negative biological consequences for individuals and negative social consequences for how individuals interact and behave in their neighbourhood. Extending the argument to epidemiological outcomes, Wilkinson, Marmot, Kaplan and others argue that individuals' perception of their ranking (low rank) in the social hierarchy produces negative emotions such as shame and distrust that lead to bad health via neuro-endocrine mechanisms, and extend to stress-induced behaviours such as smoking, excessive drinking, living on dangerous drugs, and engaging in other risky behaviours that are injurious to health.

Area-based research has also become part of the growing interest in social determinants of health that researchers have tried to move the health research discussions beyond causal explanations that focus exclusively on the characteristics of individuals. A great deal of the literature focused on deprivation of an area. These studies for instance found that residence in a poverty concentrated area has negative effects for a broad range of health-related outcomes including self-rated health (Luo and Wen, 2002), health behaviours (Yen and Kaplan, 1998), depression (Yen and Kaplan, 1999) and alcohol-related problems (Jones-Webb et al. 1997). Other studies,

using spatial concentration of affluence as the neighbourhood variable, also observed some amount of influence on social conditions that have implications for wellbeing, including self-rated health (Wen, Browning and Cagney, 2003) and health behaviours. Studies linking the social structural and the health status of populations continue to grow, albeit mostly in developed countries with limited attempts in developing countries.

The impact of area on populations' health is therefore not new and the negative effects of living in disadvantaged or deprived areas on health are well documented (Agyemang et al. 2009; Fukuda, Nakamura and Takano, 2007; Anderson et al. 1997; Se´guin et al. 1995). Recent empirical studies have shown that pregnant women living in low-income neighbourhoods for example are significantly more likely than those living in high income neighbourhoods to have preterm births, and miscarriage/perinatal deaths (Agyemang et al. 2009). Kumari and Mengi (2010) also found a fairly large association between measures of adverse pregnancy outcomes and depressive tendencies in expectant mothers which they attribute to the effect of socioeconomic status in neighbourhoods. They noted that the risk of miscarriage and stillbirths are mainly seen in lower class females while females belonging to upper class experienced mainly induced abortions (Kumari and Mengi, 2010). Atkinson and Kintrea (2000) further observed that neighbourhood contextual factors have stronger effect on women than men since women are more involved in the neighbourhood than men. This implies that neighbourhood contextual factors will have more effect on women's health far more than men, evidence which Se´guin and others (1995) earlier found that chronic stressors are embedded within and accrued from the environment that women live.

Even though the theoretical arguments in support of the relationship between the nature of the neighbourhood and maternal health outcomes are strong, the number of studies exploring this relationship is few. The slow growth of interest or research in this area can be attributed to how maternal health and associated outcomes are conceptualised. Earlier studies on maternal health have often conceptualised that a woman's maternal health condition passes through three stages: starting with pregnancy, morbidity (an interface), and mortality, giving rise to three aspects of empirical studies on the determinants of maternal health (Campbell and Graham, 1992). These are determinants of pregnancy, determinants of morbidity, and determinants of mortality. Because these outcomes are often viewed as pathogenic (Leavitt, 1988), over the years, many empirical attempts have tended to focus on biomedical determinants, limiting to genetic and behavioural risk factors. This then implicitly places higher responsibility on individual personalities and choices. To some extent, this notion is limited and raises some concerns of the dynamic nature of biological processes and the fact that there are other causes of morbidity and mortality that are not definitively pathogenic but iatrogenic and also associated with certain socioeconomic risk factors.

Unlike mortality, neither pregnancy nor morbidity is necessarily a single event. Pregnancy for an individual woman comprises a whole range of childbearing, including possible frequencies, pregnancy intervals and positive and negative outcomes, while morbidity may encompass a complex series of repeated episodes of various illnesses. The other thing is that these outcomes may not be the responsibility of only individual biological and behavioural factors. They may occur due to substandard or inappropriate medical interventions (Harrison, 1997; Macfarlane, 2001; WHO, 2010). Complications associated with medically-assisted pregnancies are also well

known (Kennedy, 2005). Iatrogenic morbidities are morbidities occurring incidental on medical procedures or prescriptions. Iatrogenic deaths refer to deaths due to treatment failures or complications of medical procedures (ICD-10). Earlier studies in this field have also failed to recognise the responsibility of communities as producing risk factors that affect individual level determinants (Link and Phelan, 1995).

The view of maternal health as a medical problem has delayed its importance in development analysis. The conceptualisation (Figure 3.1) recognises this by placing the individual level determinants of maternal health within a macro-structural context that allows for an integrative and multidisciplinary approach to the analysis of a chosen maternal health outcomes. As a starting point, differential outcomes of maternal health can be attributed or traced to individual genetic constitution, behavioural choices, and response to emerging environmental phenomena. Behavioural choices will include health lifestyles such as smoking, alcohol use, indulging in unsafe abortion, prolific fecundity, etc. It may also have to do with personal decisions to use healthcare services. These can lead to maternal malnutrition, anaemia, and may suffer other *pathophysiological* changes occurring in major organs that are important for conception and safe delivery.

The framework recognises that individual's personal or behavioural predisposition cannot be abstracted distinctly from the social structure of the communities within which they live. Communities have an overbearing responsibility in shaping the health status of individuals. The community embodies the culture, determines the availability and accessibility of public goods (good water, electricity, roads, etc.), provision of health services (facilities and personnel),

environmental conditions (sanitation), social capital and security. The predominant culture in a community concentrated with one ethnic group for example is responsible when women will not eat otherwise nourishing foods when pregnant. Communities are responsible when unwedded women have to hide pregnancies and clandestinely terminate to avoid reprimand. Communities are responsible when there is no clean drinking water, poor sanitation, or exposed to pollution; and when local public transportation and health care services are not easily accessible. The impact of these on general health has been emphasised.

Health service factors for example, often classified into curative and preventative interventions, have received keen research and reviews over the years. The quality of the health service factors in particular have received enormous research due to the distinguishing importance of iatrogenic or harmful practices and helpful or beneficial ones that have related effect on maternal morbidity and mortality. The accessibility and availability of health services also belong to this category. These studies however do not often place the community at the centre of the research but rather the institution of medical care. In Thaddeus and Maine's (1990) framework on maternal health care utilization where they proposed the three phases of delay relating to availability and accessibility of healthcare: (1) delay in deciding to seek care on the part of the individual, the family or both; (2) delay in reaching a health facility; and (3) delay in receiving adequate care at the facility, a strong point is made by placing both the institution and the community at the centre of the framework.

Research in this dimension in the maternal health literature which moves away from a clinical orientation with its underlying paradigm of biologically causal links and considers a wider range

of determinants is however slow in growing. Meanwhile the development relevance of such medically-oriented epidemiological research has been difficult to implement. These studies fail to recognise the externality effect for instance of a behavioural change on the part of one educated woman on the behavioural choices of others living in the same neighbourhood. Similarly, the fact that women are likely to change their behaviour if they perceive any incipient threat to their health is usually unrecognized, or is ignored because it is considered analytically intractable (Campbell and Graham, 1992). Policy conclusions arising from such studies therefore tend to favour medical interventions without considering mitigating effects of socio-economic factors on the adoption and impact of even advocated interventions (Mosley and Chen, 1984; Akin, 1991).

3.5 Concluding this chapter

Maternal morbidity is difficult to define clearly for various reasons, including the determination of conditions to include and the means of identifying cases. Others have suggested for the consideration of all cases of pregnancy-related ill health, including self-perceived (Alexander et al. 2001). While studying maternal morbidities as critical causes of maternal mortality is important, the difficulty of determining a maternal health condition as morbidity makes it appropriate for medical and epidemiological research. There are also a growing momentum in research into the other indicators of maternal health especially pertaining to abortion and maternal death. What is essentially less clear in these strands of research is the dearth of contextual investigation using an integrative framework analysis.

The importance of this kind of analysis of health has long been discussed in the theoretical literature and its relevance assured. Reproductive factors, including a woman's constitution, age, parity, and general health status are routinely found as factors associated with maternal health outcomes. But these factors may not be less intractable as contextual factors. Besides, classifying women as high risk for interventions based on these factors may not produce the desired outcomes since these are essentially individually-based characteristics. More importantly, it makes little good if we provide a documentation of behavioural choices and outcomes without investigating the context in which such behaviour take place.

CHAPTER FOUR

4.0 METHODOLOGY

4.1 Introduction

The primary aim of this study is to explore the relationship between socioeconomic inequalities at both the individual and community levels and adverse maternal health outcomes. This section proceeds in two ways. First, the basic theoretical framework for the choice of the empirical or analytical models is presented, and then followed by a discussion of the data and measurement of key variables. The empirical modelling strategies are however further expanded under the various sections of the chapter on results. The second part is the use of qualitative information gathered through in-depth interviews and focused group discussions to help explain some of the empirical results and also to present views of the people in terms of perceived barriers to maternal healthcare utilisation and recommendations to improve maternal health.

4.2 Theoretical and analytical discussions

Underlying the conceptual framework presented earlier is an expected wellbeing of maternal health. Even though health status is primarily an individual responsibility, reproduction which is at the centre of maternal health is not a sole decision. It is the responsibility of the family, influenced by their cultural orientation, and shaped by the economic conditions of the country. Actions taken in connection with reproduction and maternal health therefore have multidimensional implications. Assume that it is the responsibility of the couple representing a unified household that takes a decision to reproduce. Their wellbeing which is latent can be taken

as the outcome of a utility maximising behaviour. The theoretical framework will therefore follow the standard health utility maximisation framework that models the household as a utility maximising unit. A hypothetical utility maximising household will therefore seek to maximize their health status by consuming goods and services that will maintain good health whilst engaging in the production and consumption of other goods and services that enhance socioeconomic viability.

This is an approach which assumes a significant pooling of resources and joint decision-making among members of the same household. Other studies have argued that the household may not be a single entity in maximizing utility (Chiappori 1988 and 1992; Strauss and Thomas, 1995). Proponents of dynamic formulations argue that household decisions and allocation of resources are not unilaterally taken and executed but go through bargaining processes, power play and role sharing (Strauss and Thomas. 1995; Chiappori, 1988 and 1992). These models rely on the underlying premise that preferences among different household members are not uniform, implying that each member will seek to allocate resources over which they have control to the goods they most prefer (Meyerhoefer and Sahn, 2006). This study however follows the unitary household decision-making model as the main tool for the analyses, largely due to the nature of the data being used for the study which is cross-sectional and only a one-time (not a panel data) dataset.

To be able to assess the pathway through which socioeconomic factors can impact maternal health outcomes it is useful to formalize the process of household health production using a generalized microeconomic framework. It is believed that an individual's level of productivity is

largely a function of his human capital (e.g. health status and stock of knowledge) and factors such as experience, stock of physical inputs, and so on, which are unobserved. Theoretically, it is assumed that an increase in the human capital increases productivity in the market where the individual produces earnings in the form of income or wages, and at the household level where she produces commodities that form part of her utility function (Grossman, 1972). Thus, for an individual to realize gains in increased productivity there is need for investment to improve the stock of capital. Conversely, any form of disuse, misuse or disinvestment of the stock quickens the pace of depreciation, lowers productivity and eventual failure of economic viability.

Health has been widely viewed as one form of human capital (Grossman, 1972), and the most important compared to other forms of human capital. Whilst a person's stock of knowledge influences his market and nonmarket productivity, his stock of health determines the total amount of time and energy he can spend producing money earnings and commodities. Investment in health care services is therefore an investment for good health. Given this, it seems logical for health economists to be interested in the demand for health itself rather than the demand for health care. However, traditional demand theory assumes that goods and services purchased in the market enter consumers' utility functions. If health is a capital good as taken, then consumers will produce health with inputs of market goods and their own time.

Individuals and households generally demand healthcare to maintain health status. Resources such as time, money and transportation services are used to produce visits and to receive healthcare. Since goods and services are inputs into the production of health, the demand for healthcare will have a derived demand. But the demand for health care is distinct from the

demand for other commodities because the occurrences of health shocks are more irregular and unpredictable. Maternal healthcare however has a uniquely regular and direct demand and associated with positive externalities. In formulating a demand function for maternal health therefore, it must be approached from the perspective of the household production model.

The Behrman and Deolalikar (1988) household farm production model, which was also used by Meyerhoefer and Sahn (2006), is used as the basis. In this model the household is taken to engage in agricultural production as well as the production of health and children. Formally, assuming that a household engages in producing health ($\prod$), non-health related goods (X), and enjoying leisure (η), the household production preference function is specified as;

$$U_i = f(\prod, X, \eta) \qquad \text{Eq. 4.2.1}$$

In this formulation health is embedded in the utility maximizing behaviour of the household. Since the interest is in the health of (household) mothers, we follow Grossman's (1972) model of health as a stock of capital and model health as endogenous to the household production function. Assuming that maternal health is both produced and maintained by investments made in the past and in the current period, we can model the health production function as;

$$\prod^{m}{}_{it} = H(H_{it}, X, \kappa, \sigma) \qquad \text{Eq. 4.2.2}$$

$\prod^{m}{}_{it}$ refers to the individual's current health status (or the household's health bundle); H_{it} is the expected health; X represents total consumption of other goods and services unrelated to health and community or environment-related factors. κ is a vector that captures lifestyles that promote or inhibit healthy life; and σ represents the natural rate of depreciation which comes with age. If

we take it that individuals inherit a given stock of health (H_i), then the state of an individual's health at the current time (H_{it}) will also depend on the level of investment or disinvestment (ϕ) made on that stock of health inherited and general consumption of other goods unrelated to health (X).

$$H_{it} = H(\phi, X) \qquad \text{Eq. 4.2.3}$$

The success or failure of maternal health condition thus depends on the investment made towards improving or maintaining it which is a function of medical care consumed (ϕ), and consumption of other goods and services (X) which are all subject to a budget constraint. The household is assumed to operate under a budget constraint (Y), so that total consumption of health (investment) and other non-health goods and services must not exceed that budget. If P_ϕ is the price that an individual incurs in receiving health care, and Px is the cost of other household consumption goods, then the household's total consumption must be within the budget which can be formulated as;

$$Y = (P_\phi + P_x) \qquad \text{Eq. 4.2.4}$$

Since P_ϕ is the price of receiving health care, the quantity received can also be denoted as

$$\phi = Y - P(Z) \qquad \text{Eq. 4.2.5}$$

The maximization of these investments under various restrictions (the functions of health investments, production of household goods, time and preference for children) generates a collection of functions of reduced demand for health as:

$$U_{ij} = U\left((Y - Z), \eta, \kappa, T, U_{h,} U_{w,}^{51} V_{q,} \rho\right)$$

Eq. 4.2.6

Where η are observable characteristics of household members, κ represents a household's productive assets, and *T*, the time constraints.

$U_i(i = h, w, q)$ represents appropriate community characteristics affecting health, and work demand

$V_\tau(\tau = h, w, q)$ represents the non-observable household characteristics affecting health, earnings, and productivity at household level and ρ is the preference for children by the household.

The decision to visit a health facility to receive healthcare involves a stochastic choice that has to be made. If we assume this, then the probability that a woman will attend, for instance antenatal care can be interpreted as the demand function using a discrete choice model as:

$$U_{ij} = \prod_{ij}(\beta' X) + \varepsilon_{ij} \qquad \text{Eq. 4.2.7}$$

Related to the health of the household is the fertility preference. All other things being equal, the fertility decision of a couple can be taken to be a joint one. However, it is influenced largely by the health status of the woman, education level, and also influenced by culture and competing preferences for other goods or social achievements.[2] The frequency of reproduction and the discordance between desired and actual fertility sometimes compromises maternal health. If we

[2] Other relevant factors that are not added to the empirical model but discussed in the qualitative section include issues of transportation barriers, the need to obtain permission from spouse to seek medical care and traditional or religious limitations to receiving attention from male personnel.

follow the intermediate determinants of maternal mortality framework (McCarthy-Maine), mortality will be assumed to be caused directly by the occurrence of one or more of the following complications: hypertensive disorders, haemorrhage, obstructed labour, frequent miscarriages, stillbirth, abortion, etc. denoted as maternal conditions (M^c). Through backward recursion, current maternal health condition is held to be a function of all previous values of health inputs ($\prod$) as well as the genetically determined initial endowment of health, and other individual, household and community or neighbourhood attributes (X). So that the expected maternal health outcome (mm) function can be stated as a probability function:

$$E(mm)_{ij} = \Pr\left(m^c{}_{ij} = 1 \middle| x_i\right) = F\left(\prod_j, X_i\beta\right) \qquad \text{Eq. 4.2.8}$$

The model maintains the importance of health production as seen in the third equation (Eq. 4.2.2) which is endogenous, and adds the role of social, economic and environmental factors (fundamental causes) in determining the outcome of maternal health.

4.3 Analytical framework

The analytical framework is contingent on the integrative framework which seeks to place the individual within a neighbourhood to understand how the characteristics of the neighbourhood influence major health outcomes. As noted earlier, neighbourhood analysis is not necessarily a new dimension of development research. However, Wilson's (1997) publication, "The Truly Disadvantaged", which introduced the concept of 'concentration effects' brought renewed interest in the area. This was further spurred by the increasing concern about the limitations of

exclusively individual-level research designs (Wen, Browning and Cagney, 2003). Earlier studies in this area however, either suffer "ecological biases" or "atomistic fallacies".

Ecologically-oriented studies focused mainly on the modelling of varying exposures of populations to physical environmental risks and resulting spatial patterns of health outcomes. Research related to this is particularly concerned with the spatial patterning and diffusion of risk factors for diseases in the physical environment, and the biological and spatial attributes of human populations that influence these risks (Barrett, 2000). The ecological framework argues that spatial and group variations of health are due to varying exposures to risk factors, such as environmental pollution (air, water, noise, radiation, and chemical), climate change, risks of accidental injuries, or housing quality.

The ecological framework, however, lacks power in explaining how unequal distribution of population and environmental risk factors are manipulated by various social and economic forces (Meng, 2010). An ecological fallacy arises when aggregate or group level measurements intended for explaining variations among groups or between groups is used to draw inferences on personal-level relations. This is because relationships observed between groups may not necessarily hold at the individual level. The atomistic view on the other hand arises if inferences regarding inter-group variability are incorrectly drawn from personal-level studies (Hox, 2002).

The integrative framework however shows that the interplay of risk exposure and environmental impacts on health is through the triangulation of three interrelated groups of factors, namely personal and genetic constitution, behavioural factors and environmental. This is similar to the

ecological landscape framework which triangulates population, habitat and behaviour (Meade and Earickson, 2000). However in this framework an attempt is made to establish mechanisms that link the personal and environmental risk factors and also the environmental and the behavioural factors. Behaviour represents social organization, social norms, beliefs and technological resources of societies. The interaction of these three groups of factors determines the health inequalities in the population.

Some neighbourhood macrostructural properties can be obtained by aggregating individual characteristics, such as average neighbourhood income, which represent the composition of individual members if no intra-neighbourhood correlation exists. Some are based on the collective relationships between members, such as the social networks within a neighbourhood. Thus, the effects of neighbourhood relations on maternal health outcomes may not be identifiable with individual risks. A multilevel design can effectively model the construction and interaction of aggregations and their members at different levels to identify their different effects on a dependent variable (Meng, 2010). Other statistical methods, such as Bayesian spatial hierarchical modelling, disease mapping, and clustering analysis, are also sometimes used depending on the focus of the research (Lawson et al. 1999; Clayton and Kaldor, 1987).

Using a multilevel modelling strategy allows us to separate the independent impacts of individual and area level influences. It also enables further consideration of more complex relationships between individual and area factors, for example, the extent to which variables at different levels interact to influence an outcome variable. When dealing with sophisticated conceptual problems, social scientists tend to disaggregate higher-level information to individual

level and utilize traditional personal-level multiple regression methods in the analysis. By this arrangement, implicitly, the unmeasured contextual influences are pooled into a single individual error term in the model. Contextual impacts mean that individuals within the same social context will have correlated errors, which violates a basic assumption of multiple regressions that the error term should be uncorrelated with the independent variables. A model which ignores context also mistakenly implies that social processes behave in the same way in different contexts to influence individual characteristics. It is therefore theoretically and empirically relevant to use an appropriate multilevel design to conduct studies of health outcome inequalities (Meng, 2010).

A multilevel framework is also generally appropriate when using a dataset that is hierarchically structured, to which a failure to account for that could lead to incorrect estimations and possibly incorrect inferences. Multilevel modelling is conceptually more capable of simultaneously handling outcomes at both the micro- and the macro-level within a single model and also capable of appropriately adjusting standard errors to account for the hierarchical structure of the dataset.

Despite the established statistical strength of multilevel modelling in testing social and contextual environmental factors, a review of 169 studies of income inequalities and population health by Wilkinson and Pickett (2006) showed that only 43 used a multilevel design, while most of the other studies used ecological or personal level analyses, despite the possibilities of "ecological" and "atomistic" fallacy respectively (Meng, 2010). Clearly, researchers have tended to use analytic tools that cannot adequately handle hierarchical constructs or the structural impact of health risk factors. This study uses a multilevel modelling framework to develop the

regression models for the analyses. A two-level spatial structure of level-1 units nested within level-2 neighbourhoods is designed.

The first step in multilevel modelling is to assess and confirm whether or not neighbourhood impacts exist and to what extent they are evident. Neighbourhood risk factors can be multi-dimensional. Significant variations may exist from neighbourhood to neighbourhood, as compared to within variations. In other words, the occurrence of individual incidences may be correlated within each neighbourhood (due to potential neighbourhood risks), but uncorrelated between neighbourhoods. When that happens, high incidences of adverse maternal health outcomes are observed in some neighbourhoods while low occurrence observed in others. The intra-class correlation coefficient (ICC) provides a direct quantitative measure of examining these differences.

Among many different estimators for ICC, such as the Fleiss and Cuzick (FC) estimator (Fleiss and Cuzick, 1979), the Pearson pairwise estimator (discussed at length in Karlin, et al. 1981), the analysis of variance (ANOVA) estimator (Fleiss, 1981), the moment estimators (Yamamoto and Yanagimoto, 1997), the extended quasi-likelihood and pseudo-likelihood estimators (Nelder and Pregibon, 1987), the most widely used estimator of ICC is the generalized linear mixed effects model estimator implemented under the random effects models (Meng, 2010). In this framework[3], if we take a traditional two-level model with a logit link function constructed with maternal mortality as the outcome of interest, the probability model can be constructed as:

[3] This framework is set only as a general framework and will not apply in the discussion under the incidence of maternal mortality which uses a Poisson modeling strategy

$$\text{Maternal mortality} \sim \text{binary}\left(p_{ij}\right)$$

$$\text{Level 1 (}\textit{personal}\text{)}: \quad \text{logit}\left(p_{ij}\right) = \beta_{0j} + \beta_{1j} X_{ij}$$

$$\text{Level 2 (}\textit{neighbourhood}\text{)}: \quad \beta_{0j} = \gamma_{00} + \nu_{0j}$$

This model is a random effects or a mixed effects logistic probability model with the log-odds of success ($Y_{ij} = 1$) being a function of both a fixed effect and a random effect (Ten Have et al., 2004). Under this model, the variance of the random effect ν_{0j}; σ^2, represents the between-neighbourhood variation, whilst the within-neighbourhood variation is $\pi^2/3$ representing the variance of the fixed effects logistic distribution. The ICC can then be written as:

$$ICC = \sigma^2 / \left(\sigma^2 + \pi^2/3\right)$$

This method is used for assessing the ICC in this study. A probit model can also be fitted to estimate the ICC similar to the logit model, but with a probit link function.

The STATA software, version 11 is used as the main statistical tool for all the quantitative analysis.

4.4 Data for the study

The study used three sets of data: the Ghana Maternal Health Survey 2007 (GMHS); the 2000 Population and Housing Census (PHC 2000)[4]; and a qualitative data collected in two selected districts in two regions in Ghana. The GMHS, the main dataset for the study has three components: a household level data, an individual level women data and a verbal autopsy data. The study used the data from the individual women-specific survey and the verbal autopsy.

[4] Even though the most recent 2010 PHC is available, redemarcation of enumeration areas (EAs) makes it inappropriate to use it for this analysis because the design and sampling of EAs and households for the GMHS which is the main data for this study was based on the 2000 PHC.

4.4.1 The GMHS and its design (sampling issues and questionnaires)

The GMHS is the main large scale high-quality data on maternal health available in Ghana today. The GMHS is a nationally representative sample survey that collected information on maternal health and causes of maternal deaths from households and women of reproductive age (15-49). This survey was principally intended to serve as a source of data on maternal health and maternal death for policymakers and the research community. More importantly, the survey was meant to help Government and major partners to launch series of collaborative efforts to expand women's access to modern family planning services and comprehensive abortion care (CAC), reduce unwanted fertility, and reduce severe complications and deaths resulting from unsafe abortion.

The survey was conducted by the Ghana Statistical Service (GSS) with collaborative assistance from the Ghana Health Service (GHS). Macro International Incorporated (Macro) and Guttmacher Institute provided technical assistance. A standardised questionnaire was administered mainly through face-to-face interviews with adults.

Sampling and survey instruments (questionnaires)

The survey involved a multi-stage sampling design and administered a total of four different questionnaires at various stages. The survey was also done in two phases. The first stage of sampling which was done in phase 1 of the survey, a nationally representative sample of 1600 clusters (primary sampling units consisting of wards drawn from the 2000 Population and Housing Census) was selected across all 10 administrative regions of the country and across

urban and rural areas, for mapping and listing. This first phase was essentially to identify households for the second phase of women-specific questions and the administration of a verbal autopsy instrument. During this first phase of mapping and listing a short household questionnaire (first survey instrument) was administered simultaneously to identify deaths to women age 12-49 that occurred in the five years preceding the survey. A total of 227,715 households were covered in the first phase of data collection.

In the second stage, which involved the second phase of fieldwork, 400 clusters were randomly selected from the 1600 clusters sampled in the first phase. This was equally nationally representative. In these 400 clusters stratified by region and urban-rural residence, households with women age 15-49 were randomly selected. A household questionnaire and women-specific questionnaire was administered yielding 10,858 completed household interviews and 10,370 individual women specific interviews. The household interview was essentially used to identify women eligible for the second instrument which is the women specific questionnaire.

The women-specific questionnaire was meant to explore a wide range of maternal health-related issues pertaining to pregnancies, live births, abortions and miscarriages, and utilization of health services. Also included in this questionnaire is a sibling history. Based on the overarching focus of the survey, the women-specific instrument included questions that captured pregnancy-related deaths if a deceased sibling was a female; during pregnancy, delivery or after delivery. This information allowed for direct calculation of maternal mortality. The second phase also included the administration of a verbal autopsy questionnaire (VAQ) in all households identified with a death to women age 12-49 years in the 5 years before the survey in Phase 1. This was meant to

identify the specific causes of death. The VAQ involved 4,203 women age 12-49. A summary of the survey design is presented in the appendix (Appendix C: Table 1).

Data limitations as pertain to this study

General limitations of the data have been pointed out in the GMHS Report as they pertain to the estimation of maternal mortality ratios and fertility issues (GSS et al., 2009b). Some of these limitations are also important for this study. First, in the women-specific questionnaire which collected information on pregnancy-related deaths to siblings, no further information is collected of the sibling about healthcare use behaviour prior to death (whether used ANC, PNC or Supervised delivery or delivered in a hospital). This limited the ability of this study to explore such behaviour at the individual level and the risk of maternal mortality as envisaged in the conceptual framework. Nevertheless, empirical studies have tried to aggregate this at the neighbourhood level and the outcome has always been as robust as would be if they were captured at the individual level (Robinson and Wharrad, 2001; Sloan et al., 2001; Shiffman, 2000).

Despite the limitations of the data, information collected in this survey remains the only nationally representative available data for the study of maternal mortality in Ghana. This data is also comprehensive enough, especially with the addition of the verbal autopsy, to provide insights into maternal health outcomes in general and can, with some degree of approximation, be used in calculating standard indicators that can be used to estimate maternal mortality at the sub-national level, something that has been difficult especially in many developing countries.

4.4.2 The 2000 Population and Housing Census

The second data set is the 2000 Population and Housing Census (2000 PHC) of Ghana, collected by the Ghana Statistical Service. The Census data is used for constructing the community or neighbourhood level variables. The Population Census is the single most important source of data on the population and its characteristics in the country. It provides information on the size, growth, composition and distribution of the entire population, and for subpopulations, as well as for geographical areas, to the lowest levels, below the district level such as localities, villages and settlements, and residential areas. In the absence of a reliable civil registration system, population census is the only source of data from which population dynamics can be analysed (GSS, 2005). Census data is therefore an indispensable source of data for development analysis in a country.

The 2000 PHC is the fourth census conducted in post-independence Ghana after earlier ones in 1960, 1970 and 1984. The most recent census is the 2010 PHC. The 2000 PHC is used in this study instead of the recent 2010 PHC for three reasons. The first is that the GMHS 2007 sample design was pulled from the 2000 PHC global population and the selection of sampling clusters was as delimited in the census. This makes the use of this census data a natural case. The second is that over the years (2000-2010) there have been series of redistricting, redemarcation and reclassification of localities (urban status) and enumeration areas. Using this census data may thus be inappropriate since the sampling units may have changed in several ways and the power dynamics obviously would have changed. The third reason is that the reference period for the relevant questions on mortality goes back to the past five years. Since 2007 neighbourhood dynamics may have changed and to use such recent dynamics (2010 PHC) to analyse passed

experiences is obviously and analytically inappropriate. Current developments or conditions cannot be said to have retrospective effect on health outcomes.

The census enumeration areas are used as the neighbourhoods for analysis. The data used in the analysis is based on households who responded to the Census 2000 long form. As a result, the estimates may differ somewhat from the 100-percent figures that would have been obtained if all housing units including people living in group quarters. The main modules covered in the 2000 census were geographical location, demographic and social characteristics, economic characteristics, literacy and education, fertility and mortality. The 2000 PHC classified all localities with a population size of 5,000 or more as urban, and otherwise less as rural. For the first time the question of ethnicity was also successfully included in the 2000 PHC after being particularly excluded in the 1970 and 1984 censuses because it was believed that tribal affiliation was incompatible with national development (Agyei-Mensah and Owusu, 2010).

One of the problems associated with neighbourhood analyses is the issue of measurement error. However, in this study the large population data used to estimate the neighbourhood aggregate variables is expected to reduce any expected bias in measurement error (Prentice and Sheppard, 1995; Salway and Wakefield, 2008). Prentice and Sheppard (1995) by means of a Monte Carlo experiment found that when the population size used in constructing aggregate level variables is usually equal to 100, the bias was about −2.0%, with a 95% confidence interval of (−3.8%, −0.1%). They also found that the correction they proposed to reduce the measurement bias, which is superior asymptotically, in practice was not worthy when the sample size was at least

100. Salway and Wakefield (2008) also found that even when the sample size is as small as 25, the bias is only about 6%.

In this study the number of households per a Census enumeration area varies from as low as 53 to as large as 100 households. Using this data to construct the neighbourhood variables makes the fear of bias associated with measurement error negligible.

4.4.3 Qualitative study

The third data is the qualitative data. This was essentially to help explain some of the results coming from the quantitative data and also to provide perspectives for improving maternal health outcomes. The opportunity to carry out this component of the study was supported by an opportunity offered to work with one of my dissertation advisors on a project "Evaluation of the Maternal and Newborn Referral Project" in Ghana. This project had three components: quantitative, qualitative and cost-effectiveness analysis. The primary aim of this project is to improve access to maternal and newborn health (MNH) services and health outcomes in rural Ghana by using a quality improvement (QI) approach to improve referral processes and ultimately to reduce maternal and neonatal mortality.

This project was being carried out in two regions, Northern Region and Central Region, which are among the least performing regions in terms of maternal health outcomes in Ghana (GSS et al. 2009a). Three districts in each of these regions were selected for the study: Nanumba North, Nanumba South and Gushegu districts in the Northern Region; and Asikuma Odobea Brakwa,

Assin North and Gomoa West districts in the Central Region. The survey was carried out between mid-May 2012 and mid-June 2012.

A number of strategies were used to collect the qualitative data. These included in-depth interviews, birth narratives and focus group discussion (FGD). The in-depth interviews were conducted with women who experienced recent pregnancies (last 3 years) and their husbands, local leaders and informal and formal healthcare providers in the community. A birth narrative guide was used for women who experienced recent pregnancies and their husbands if any. This was done separately for both men and women. Specific interview guides were also used to interview local opinion leaders and healthcare service providers in the communities. Local healthcare providers interviewed included traditional birth attendants (TBAs), Chemical store operators and community health volunteers.

The FGDs were held with health personnel at selected health facilities in the chosen districts. The qualitative component of the project was conducted in one each of the three districts chosen in each of the two regions: Nanumba North District in the Northern Region and Assin North District in the Central Region. To obtain multiple perspectives on barriers to improving maternal health outcomes participants in the FGDs, birth narratives and the facility interviews were selected to cut across different communities in the two districts so that specific barriers related to geographic location could be identified. In all 44 in-depth individual-level, birth narratives and eight FGDs were conducted. A breakdown of the different types of interviews used in collecting the qualitative data is presented in appendix (Appendix C, Table 2).

4.5 Key variables and measurement issues

4.5.1 Dependent variables

1. Adverse pregnancy outcomes: There are four things that can happen to a confirmed pregnancy: result in live birth, miscarriage, stillbirth or it is aborted. These outcomes are not ordinal and not necessarily polytomous responses. Adverse pregnancy outcomes are measured as dichotomous outcomes (1 = if woman experienced stillbirth, miscarriage, or aborted the last pregnancy, and 0 = if otherwise). It is possible for a woman to experience all four situations in her life, but the scope of this study is limited to an experience of any one of these outcomes at the given reference period that the data was collected.

2. Maternal mortality: Maternal mortality is captured both as a dichotomous and a count variable. The dichotomous maternal mortality is implemented in a case-control design analysis where the dependent variable is as 1 if woman died of pregnancy condition and 0 if a woman survived delivery of a pregnancy. The count measure of maternal deaths was simply the number of maternal deaths recorded in a neighbourhood. This was multiplied by 1000 and used in a Poisson model to estimate maternal mortality rates at the neighbourhood level.

4.5.2 Independent variables (Individual, household and neighbourhood level)

Socioeconomic status is usually used as a shorthand expression for variables that characterize inequality in the placement of persons, households, or communities with respect to the capacity to create or consume goods that are valued in a large or specific society. Thus, socioeconomic status may be indicated by income (or poverty), by household wealth, by educational attainment, by occupational standing, or by tangible possessions—such as household home appliances,

houses, cars, boats, etc. In this study wealth, education, marital status, and employment are used as measures of socioeconomic status.

a. Variables measured at the individual and household level

i. Wealth: Three different approaches are commonly used to measure wealth: income, consumption and assets (non-money-metric measure). Whilst interest in the use of the first two is weaning, criticisms of the third approach is also growing. Notwithstanding, the use of the non-money-metric measure is more appealing today as more is said in favour than against it. Each approach however suffers some errors in measurement. Hence choosing one method over the other is sometimes a matter that is rather more involuntary (surveys that do not collect data on incomes and consumption), rather than by choice (as a better option). As Wagstaff and Watanabe (2003) noted, it however makes little difference in the measured degree of socioeconomic inequalities in a health outcome whether one measures socioeconomic status by consumption or by an asset-based wealth index.

The GMHS, like most Demographic and Health Surveys, did not collect information on incomes and consumption. Instinctively, the asset-based wealth approach becomes the only approach feasible under the circumstance as there is information on household assets. With the help of a principal component analysis (PCA) a wealth index for each household is constructed. The result of a typical application of PCA is an asset index for each household according to the formula (Ferguson et al. 2002):

$$A_i = f_1\left(a_{i1} - a_1\right)/\left(S_1\right) + \ldots + fN\left(a_i A - aA\right)/\left(SA\right)$$

where f_1 is the scoring factor for the first asset as determined by the PCA procedure, a_{i1} is the $i\text{-}th$ household's value for the first asset and a_i and S_1 are the mean and standard deviation of the first asset variable over all households. The weights used are normally the first component of the PCA (Filmer and Pritchett, 1999 & 2001), this being the linear combination of the original variables that maximizes the variance in the observed indicators (Wagstaff and Watanabe, 2003). Hence, in the end it is possible to ascribe meaning to what the variables represent.

ii. *Educational status:* Educational status is measured for both individuals and households. Household educational status is measured using the highest degree achieved by all adult household members. This is measured at four and five levels depending on the size of data points available. Where feasible education is categorised into five as: "1" No education; "2" Primary School education; "3" Middle School Leaving Certificate Examination (MSLCE)/Junior High School Education (JHS); "4" Senior Secondary School Certificate Examination (SSCE)/Senior High School (SHS) education; and "5" College/Tertiary/Higher education. Owning to the fact that analysing some of the objectives extract only relevant respondents or people with required characteristics, sometimes it is not possible to have this elaborate categorisation. In that case four categories are used by combining "4" and "5" to form SHS/Higher whilst the others remain.

iii. *Marital status:* Five categorical variables measure the marital status of an individual: married, consensual union, separated or divorced, widowed, and never married.

iv. Media exposure: Three sources of media coverage are collected in the data: a person listens to radio, watches television and reads newspaper. A composite variable via a PCA is measured that captures the level of exposure as: less exposed, relatively exposed and well exposed.

v. *Other variables of interest*

1. Age of woman measured in years as a continuous variable

2. Number of children as continuous variable

3. Household size as a continuous variable

4. Religion as a categorical variable

5. Ethnicity as a categorical variable

6. Place of residence (1 = urban or 0 = rural)

7. Locality type (Large city, small city, town and rural)

b. Contextual level variables (neighbourhood level)

Contextual determinants operate at different spatial scales such as neighbourhood, district, and higher scales such as region and locality. For the purpose of this study, neighbourhoods are selected as the higher level units of analysis. Due to a lack of standardised definition, neighbourhoods are often represented by political boundaries, such as census enumeration areas (census dissemination blocks, postal code areas, or planning divisions in other jurisdictions). The selection of an appropriate scale to represent neighbourhoods is often determined by the homogeneity of socio-economic conditions of spatial units at this scale, perceived sense of neighbourhood by the local residents, and the zones of influence of community organizations. It may also be statistically determined by the distance at which the greatest spatial clustering of the outcome is studied and the clustering of socio-economic status obtained.

At a higher spatial scale, rural-urban divisions and the division of different districts, municipalities or regions are “natural” divisions, since public policies may operate differently

from district to district and from region to region. These higher scale units may be appropriate administrative units for the analysis of policy impacts on maternal health. At the smaller spatial scale, since the census enumerations areas are the most homogenous spatial divisions with appropriate sample sizes and spatial coverage, they are used as a surrogate of neighbourhoods for this analysis.

Variables measured at the neighbourhood level include a measure of index of multiple deprivation, proportion of people employed (females and males disaggregated), and the proportion of education level of a neighbourhood (females and males disaggregated). Ethnic and religious diversity are also neighbourhood level variables.

i. The Index of Multiple Deprivation (IMD)

Socio-economic classifications for areas have been developed from a number of theoretical and practical perspectives (Social Disadvantage Research Centre, 2001 & 2003; Salmond and Crampton, 2001). Emphasis include access to means of production (Marx, 1981), possession of knowledge and skills (Edgell, 1993), employment relations (Rose and O'Reilly, 1997), social standing related to occupation (Davis et al. 1997, Rose and O'Reilly, 1997), and access to material and social resources (Townsend 1987, 1993). Socio-economic deprivation describes access to material and social resources and has to some extent underpinned conceptions of social class and socio-economic status (Salmond and Crampton, 2001). It has been defined as a state of observable and demonstrable disadvantage relative to the local community or the wider society or nation to which an individual, family or group belongs (Townsend, 1987).

The deprivation index is often a composite score obtained by combining selected variables usually taken from small area Census data. The scores are a measure which reflects access to those "goods and services, resources and amenities and of a physical environment which are customary in society" (Carstairs and Morris, 1991). The scores are not a measure of the extent of individual material wellbeing or relative disadvantage but are rather a summary measure applied to populations contained within small geographic localities (McLoone, 2004). The index of multiple deprivation measures a neighbourhood's socioeconomic status and has been used in several neighbourhood or area-based studies in economics, geography, psychology and sociology. Other related measures of a neighbourhood's socioeconomic status include the measure of standard of living, poverty and affluence, advantaged and disadvantaged, urbanised and less urbanised. The deprivation index as measured in different studies and in different countries use different but contextually relevant variables as the domain of indicators (See Appendix D, Table 1).

In this study a bundle of contextually relevant domain of indicators (being accessed or used by households) are used to measure the index of multiple deprivation (IMD) similar to the Townsend material deprivation index (Towsnend, 1987). The 2000 PHC contained questions that can be used to measure deprivation. Ten deprivation indicators derived from this information were: having no access to good dwelling; 15>aged <60 without secondary education; not living in family-owned home; living in households below equivalised[5] bedroom occupancy threshold; aged 18-60 unemployed; no access to good lighting; no access to improved water source; use unimproved waste disposal system (solid and liquid); have no improved toileting system.

[5] Equivalisation is a method which allows comparisons between households of different composition.

Unemployment and education are included to also capture source of vulnerability as used in other studies. The selection of these indicators was after a thorough review of the Ghanaian literature on socioeconomic wellbeing of communities and received validation from a broad range of opinions and expected to represent material disadvantage of communities. See Appendix D, Table 1 for a complete list of the indicators used and also showing other places where the indicators have been used in constructing the index.

Following the method of Townsend (1987) and Carstairs and Morris (1991), each variable was standardised to have a population weighted mean of zero and a variance of one. The percentages produced for unemployment and overcrowding are transformed using the natural log function. The reason for the standardising procedure was to control the relative contribution of each variable in the score; a variable with a relatively large variance would result in the eventual score being unduly influenced by that variable. Standardising will allow each variable to have an equal influence on the resultant score. Subtracting the all-population mean from each variable and dividing the result by the standard deviation of that variable was the process of standardisation. This is called the z-score method and the sum of these new standardised variables produces the deprivation score for each neighbourhood.

The resulting deprivation scores range between negative and positive (- +). Positive scores indicate greater levels of deprivation whilst negative scores mean greater levels of advantaged or affluence. The index ranged between -10.12 indicating affluent or less deprived areas to 4.89 for deprived neighbourhoods. The average for Ghana is 0.13 indicating a relative deprivation status. The most deprived region is the Upper west region with about 70 per cent of neighbourhoods

being deprived. The least deprived region is Greater Accra with only 25 per cent of neighbourhoods captured as deprived. The proportion of deprived areas in each region is shown in Appendix D (Figure 1).

For the purpose of the analysis, the continuous distribution of the deprivation scores was split into quintiles, with each quintile representing exactly one-fifth of the small areas as measured. This meant that each quintile included close to one-tenth of the population. This was further regrouped into three categories for the purpose of simplifying the interpretation: 1 as less deprived (affluent), 2 as middle level (relative deprivation), and 3 refers to highly deprived (disadvantaged).

ii. Ethnic and religious diversity

Ethnic diversity is measured by taking the ethnic division of the population and calculating each ethnic group's share of the total population of the area, summing the squared shares, and subtracting the value from one (Osei-Akoto and Adamba, 2011; Vigdor, 2002; Alesina, Baqir and Easterly, 1999).

$$EthDiv_j = 1 - \sum_{i=1}^{n} Share_{ij}^{\ 2}$$

A perfectly homogeneous society receives a diversity score of zero, while a society composed of many ethnic groups receives a score approaching one. The index is interpreted as the probability that two randomly selected individuals will not be of the same ethnic group (Easterly and Levine, 1997; Alesina et al. 1999). The same procedure is used to measure religious diversity (Osei-Akoto and Adamba, 2011). Lower values of the index, up to zero, indicates greater concentration

and capture the extent to which a minority group for instance is exposed to only its own members. Such isolated groups are more likely to experience concentrated disadvantage and bad health outcomes.

Concerns with neighbourhood level measures

Even though area-based classifications of socio-economic deprivation have been developed over several years ago, conceptual concerns about its influence and interpretation in estimations still exist. Since neighbourhood level variables are usually based on aggregated personal or household information, Diez-Roux (1998) notes that whenever they are used in analyses, they are assumed to be capturing both aggregated compositional properties of the individuals in the neighbourhood and contextual properties of the area extrinsic to individuals, such as public amenities. The contextual factors may be shaped by the properties of the group or themselves may shape the properties of the group. For example, lack of amenities may be the result of lack of money to support them or alternatively, a lack of health facilities may be the reason for women delivering babies at home.

The composite measure of deprivation, then, is a variable reflecting both aggregated compositional properties of the area and probably also contextual properties of the area. When the unit of analysis is an area, there is no cross-level problem with interpretation. However, when used where individuals are the unit of analysis, there are two possible interpretations, one of which is problematic (Salmond and Crampton, 2001). The first interpretation considers the area of residence as an attribute of individuals. The deprivation of the area of residence is then also an

attribute of individuals and thus a micro-level variable. In this case there is no cross-level interpretive difficulty, although reductionist causal pathways may be elusive.

The second interpretation that the area measure is created from aggregated data and can be regarded as a rough approximation for an individual characteristic and interpreted as a micro-level variable is an ecological fallacy. That is the error arising as a result of making inferences about individuals on the basis of aggregated data (Gilman., Somervaille and Griffiths, 1994, Schwartz 1994). For example, as a result of likely heterogeneity of people in an area, it cannot be assumed that every resident of a deprived area is deprived. Even though in health research, an increasing number of studies are finding an association between area-level deprivation and health outcomes (Anderson et al. 1997; Duncan, Jones and Moon, 1999; Reijneveld 1998), Macintyre and Ellaway (2000) points out that there is frequently a lack of clarity about whether the area-based measures are being used as neighbourhood indicators, or as if they characterise the individual – either as an attribute, or as a characteristic measured with error.

Researchers have however found that the use of small spatial areas such as Census enumeration areas diminishes the extent of measurement error (Crayford et al. 1995, Hyndman et al. 1995). Other studies have also argued that the heterogeneity that exists within neighbourhoods when small size area level measures are used could mean that any likely relationship between the deprivation and the studied outcome is operating at both the area level and the individual level and any socio-economic gradient in the outcome of interest is being under-estimated (Salmond and Crampton, 2000). The associations between neighbourhood deprivation measures and health outcomes however need to be made clear to inform health interventions. Researchers should be

clear about the extent to which these associations refer to contextual information and/or to individual information measured with acceptable error and/or to average individual information in the area.

This theoretical clarity is important since health interventions would be designed to operate at the level at which the significant risk or mitigating factors operate. In this study the neighbourhood IMD is measured and used as a contextual level variable to represent the socioeconomic status of the neighbourhood within which a woman lives and operate. Using the Census enumeration area as the smallest unit of measurement of the deprivation index is also likely to reduce the within neighbourhood heterogeneity while maintaining a reasonable degree of statistical robustness.

4.6 Concluding this chapter

The objectives of this thesis require the examination of location variations of adverse pregnancy outcomes and maternal mortality incidence and variations in the associations between incidence and explanatory variables. This implies both individual and contextual level analysis to be established so that strategic policy making and health resources allocations can be made accordingly as the expected outcome of the study. Statistical methods such as multilevel modelling are used to test key assumptions in the study. Since the analysis is based largely on existing data obtained from various sources, preliminary analysis was carried out before the qualitative data was added.

The choice of the covariates used in the analysis is based on the published literature where cohort studies and cross-sectional, or intervention trials have suggested that there is a relationship

between a covariate and a specific cause of health outcome. There is indeed an extensive literature on choosing covariates in these circumstances, including forward and backward stepwise regression approaches, constrained regression analysis, Bayesian variable selection, and other covariate selection methods. Because of multicolinearity, including all possible covariates in a model often yields implausible signs on covariates or unstable coefficients. The stepwise selection approach is used to ensure that covariates fits well so that it becomes possible predicting out of sample estimates for neighbourhoods with no data or very limited data.

CHAPTER FIVE

5.0 RESULTS OF DATA ANALYSES

This chapter is divided into four sections. Section one (5.1) takes a look at how socioeconomic status of individuals, households and the neighbourhoods within which women live determines the occurrence of miscarriages and stillbirths. Section two (5.2) also looks at how socioeconomic status of both individuals and neighbourhoods influence the decision to obtain abortion. Sections three (5.3) and four (5.4) present an analysis of the chances and incidence of maternal mortality respectively.

5.1 Socioeconomic status and Neighbourhood Deprivation as Determinants of Miscarriage and Stillbirth

5.1.1 Introduction

As indicated in the preceding chapters, Ghana has made remarkable progress in achieving overall decline in fertility rate, averaging a reduction rate of about 2 children from 6.4 to 4.0 children per a woman between 1988 and 2008 (GSS et al., 2009b). Utilisation of maternal health services has also improved significantly: antenatal care (ANC) use increased by 13% (82-95%) whilst supervised delivery by 19% (40-59%) between 1988 and 2008 (GSS et al. 2009a), even though supervised delivery and postnatal care attendance is still low in relation to antenatal care attendance. Notwithstanding these moderate successes, adverse pregnancy outcomes (stillbirth, miscarriage and elective abortion) are still high. Data from the GMHS suggest that a fifth of all

pregnancies do not end in live birth (GSS et al., 2009b). About 9.3%, 7.1% and 1.8% of pregnancies ended in miscarriage, abortion, and stillbirth respectively.

Every pregnancy puts a woman at risk of maternal death, but women who have miscarriages, stillbirths or induced abortions have higher risk of maternal mortality than those who have live births (Gissler et al. 2004; Reardon et al. 2002; Hurt et al. 2008). Abortion for example contributed about 11 percent to the MMR in Ghana's 2007 estimate of maternal mortality whilst miscarriage contributed about 4%. Even though incidence of abortion and its contribution to the maternal mortality rate is of concern, incidences of miscarriage and stillbirths are of extreme concern due to their involuntary nature. Research in this area over the years, however, has been relatively narrow, focusing primarily on socio-demographic characteristics of women and sometimes rural-urban dichotomies. Whilst some of the factors associated with these outcomes, no doubt, are biomedical, there are related aspects of the social and economic organization of the society that generate and compound complications associated with pregnancies, leading to miscarriages or still birth (Poeran et al. 2011; Timmermans et al. 2011).

The literature seems to be bereft of studies in Ghana exploring the relationship between the areas within which a woman lives and how that affects chances of having a safe delivery of a pregnancy (live birth). This section investigates the extent to which the level of deprivation and ethnic diversity of neighbourhoods within which a woman lives influences the probability of suffering a miscarriage or a stillbirth.

Level of deprivation and other measures such as ethnic diversity usually measured at the area, neighbourhood (county/districts, wards, census clusters or enumeration areas, etc.) or even country level have been shown in several studies to be critical in determining birth outcomes (Platas, 2010; Poeran et al. 2011; Timmermans et al. 2011). Even though Ghana's economy shows a decline in poverty over the past two decades, inequality is widening (UNDP, 2007; Aryeetey et al. 2009). The anticipation is that with rapid urbanisation, spurred by intense rural-urban migration, with widening inequities in the distribution of social and public services there will produce in the system areas of geographic concentration of advantaged and disadvantaged. This will present challenges for different aspects of health outcomes. Considering the problem of poor pregnancy outcomes in the light of this, this section of the thesis examined how, beyond the individual and household characteristics, characteristics of the neighbourhood within which a woman lives influences the likelihood of suffering a miscarriage or a stillbirth.

5.1.2 Review of related literature

Studies linking a population's health status and the characteristics of a community or neighbourhood in which they live are not new (Wen and Christakis, 2005**;** Wen, Browning and Cagney, 2003; Wilson, 1987). Maternal health just like any aspect of a population's health is determined by a number of hierarchical influences: from proximal (personal-level/biological and psychological), intermediate-level (behavioural factors, interpersonal and organizational factors such as home and family influences, work and social settings, and civic organizations), to distal-level; community and societal determinants (Hanson et al., 2005; McCarthy and Maine, 1992). In the past, personal-level risk factors have been recognized by health professionals and person-based health interventions were widely practiced.

However, at the contextual-level, although social and environmental determinants are seen as the key determinants of health, socioeconomic inequalities of health have been observed at cross-country, county, and at the neighbourhood levels (Marmot and Wilkinson, 2006; Raphael, 2004). A number of studies exploring neighbourhood level factors and maternal health found psychosocial pathways as important in explaining adverse pregnancy outcomes (Agyemang et al. 2009; Masi et al. 2007; Dejin-Karlsson et al. 2000). Pregnant women living in low-income neighbourhoods for example are found to be significantly more likely than those living in high income neighbourhoods to have preterm births, and miscarriage/perinatal deaths (Agyemang et al. 2009).

Other studies have found an association between measures of adverse pregnancy outcomes and depressive tendencies in expectant mothers which are attributable to the effect of socioeconomic status in the neighbourhood. Risk of miscarriage and stillbirths are mainly seen in lower class females while females belonging to upper class experienced mainly induced abortions (Kumari and Mengi, 2010). Exploration of determinants of adverse pregnancy outcomes have over the years been limited to individual personal level factors in Ghana with the majority others only including locality (rural or urban) to capture the effect of location on the outcome of stillbirth or miscarriage. The focus of this section is to move beyond this to include a single measure of deprivation at the neighbourhood and to see the differential effect of this characteristic on miscarriage and stillbirth in Ghana.

5.1.3 Data and analytical model

The data on pregnancy outcomes is from the women-specific component of the GMHS, whilst the neighbourhood variables are generated from the 2000 PHC. The women-specific questionnaire administered included modules on utilization of maternal health services, pregnancy histories (miscarriage, stillbirth and abortion), contraceptive use and other related questions. Adverse pregnancy outcomes refer to pregnancies that do not result in live births (stillbirth, miscarriage and abortion). This section presents discussions on only the first two that are involuntary.

Miscarriage is usually a spontaneous abortion; the loss of pregnancy before the foetus is developed enough to survive on its own. It is the discharge of a foetus from its mother weighing 500g or less. Early miscarriages are those that occur before the 12th week of gestation, with late miscarriage being those that occur from 12-20 weeks of pregnancy, and weighs 500g or less. Stillbirths is the death of a foetus that has reached a birth weight of 500 g, or if birth weight is unavailable, gestational age of 22 weeks. Stillbirth and miscarriage are captured as dichotomous outcomes (1, if respondent ever had stillbirth or miscarriage; and 0, if otherwise).

Analytical model

A multilevel logistic model is used as the analytical approach in estimating the determinants of the outcomes of interest; stillbirth and miscarriage. Theoretically, as described in the conceptual framework (Figure 3.1), social determinants of health inequalities operate at multiple levels, from personal risks through to community and society determinants. Group-level or neighbourhood-level risks or properties are associated with personal-level characteristics, but are not necessarily

based on attributes of individual members (Luke, 2004). Usually, a traditional ordinary least squares (OLS) regression model is constructed as:

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i \qquad \text{Eq. 5.1.1}$$

where Y_i is the response or dependent variable and X_i is the predictor or independent variable, β_0 denotes the intercept coefficient and β_1 denotes the slope coefficient of X_i. The ε_i term is the independent random error term. In this model the conceptualization is that the predictor has a fixed linear effect on the response, and it operates only at one level. If Y denotes miscarriage and X denotes maternal education, this model suggests that education has a fixed effect on the probability of a miscarriage everywhere or for everyone regardless of where they live or which group they belong to. Because of the potential neighbourhood effects on personal factors, personal achievements and on the chances of a miscarriage for instance, the multilevel design becomes more appropriate. A basic two-level linear regression model was then written as:

$$\begin{aligned} &\text{Level 1 (personal):} && Y_{ij} = \beta_{0j} + \beta_{1j} X_{ij} + \varepsilon_{ij} \\ &\text{Level 2 (neighbourhood):} && \beta_{0\mathrm{j}} = \gamma_{00} + \gamma_{01}\delta_j + \nu_{0j} \\ & && \beta_{1\mathrm{j}} = \gamma_{10} + \gamma_{11}\delta_j + \nu_{1j} \end{aligned} \qquad \text{Eq. 5.1.2}$$

These equations delineate the multilevel nature of the model. The level 1 part is similar to the typical OLS model in Equation (1). However, instead of a single model, the j subscripts imply that for each level-2 unit or each neighbourhood, j, a different level-1 model is being estimated. In the above example, each neighbourhood may have a different average miscarriage risk ($\beta_{0\mathrm{j}}$) and a different effect of education on this risk (β_{1j}). Thus, the multilevel model allows the intercept and

slope to vary across the neighbourhoods. It conceptualizes that level-1 intercepts and slopes are the outcomes of level-2 predictors.

The two level-2 equations model the level-1 intercept and slope as functions of level-2 predictors and variability. In the first level-2 equation, β_{0j} is the level-1 intercept in level-2 unit j; γ_{00} is the mean of the level-1 dependent variable, controlling for level-2 effects; γ_{01} is the effect of the level-2 predictor δ_j on level-1 intercept; ν_{0j} is the error term for the level-1 intercept in unit j. Similarly, in the second equation, β_{1j} is the level-1 slope in level-2 unit j; and γ_{10} is the mean of the level-1 slope; controlling for level-2 effects; γ_{11} is the effect of the level-2 predictor δ_j on the level-1 slope; and ν_{1j} is the unmodeled variability for the level-1 slope in unit j. Substituting the level-2 equations into the level-1 equation, a single equation is obtained as:

$$Y_{ij} = \left(\gamma_{00} + \gamma_{10}X_{ij} + \gamma_{01}\delta_j + \gamma_{11}\delta_j X_{ij}\right) + \left(\nu_{0j} + \nu_{1j}X_{ij} + \varepsilon_{ij}\right) \qquad \text{Eq. 5.1.3}$$

Where the first term (bracket) on the right-hand side correspond to the fixed or average parameters and the second term correspond to the random or variance parameters. This model is compact and clearly shows which part is composed of fixed effects and which part is composed of random effects. It also shows that the level-1 parameters (β) are not directly estimated, but are indirectly estimated through the level-2 parameters (γ).

Modelling pregnancy outcomes with their conventionally binary outcome measure (where the value 1 represents having a miscarriage or stillbirth and the value 0 otherwise) however violates

the normality and continuity assumptions of the response variables especially after controlling for covariates. However, by including a necessary transformation and an appropriate error distribution for the dependent variable, by assuming that the underlying probability distributions for the binary outcomes are Bernoulli with estimated mean, p, which is interpreted as the probability of the event occurring, Equation (2) can be modified as:

Adverse health outcome ~ binary $\left(p_{ij}\right)$

$$\text{Level 1 (}\textit{personal}\text{):} \quad \text{logit}\left(p_{ij}\right) = \beta_{0j} + \beta_{1j} X_{ij}$$

$$\text{Level 2 (}\textit{neighbourhood}\text{):} \quad \beta_{0\text{j}} = \gamma_{00} + \gamma_{01}\delta_j + \nu_{0j}$$

$$\beta_{1\text{j}} = \gamma_{10} + \gamma_{11}\delta_j + \nu_{1j} \qquad \text{Eq. 5.1.4}$$

where p_{ij} is the probability of having an adverse pregnancy outcome for individual i in neighbourhood j, which follows a binary or Bernoulli distribution. There is no random term for the level-1 errors. The variance for a binary variable is completely determined by the mean and thus is not a separate term to be estimated. Level-2 models remain as constructed before.

Instead of using p_{ij} directly, a link function; $\text{logit}\left(p_{ij}\right) = \log\left(p_{ij} / \left(1 - p_{ij}\right)\right)$ is used. The Logit function is a typical transformation for a binomial model, connecting the linear predictors to the mean of the outcome variable and not directly to the outcome variable itself. The use of the logit function instead of the probability function is recommended since a linear specification of the probability of adverse pregnancy outcome variable does not restrict the estimated values to lie within the limits [0, 1]. However, this restriction is crucial since the conditional expectation of a negative pregnancy outcome is interpreted as the probability of an event occurring given the value of all the explanatory variables. A linear specification becomes even more problematic if data

clusters near the limits. The specification of the logit function overcomes this limitation by restricting the conditional expectation to lie within the range [0, 1].

Individual and household level measures of socioeconomic status such as marital status, woman's educational qualification, and wealth are explored in this section. Other variables at the individual level also explored are age, ethnicity and religious background. At the neighbourhood level are the level of deprivation and a measure of ethnic diversity. The level of deprivation is stratified into 3 classifications (with 1 indicating very deprived, 2 is fairly or intermediate level, and 3 indicates less deprived). Similarly, the ethnic diversity index is stratified into three (1 = perfectly or nearly homogenous; 2 = intermediate level; and 3 = perfectly or nearly heterogeneous). The inclusion of ethnic diversity is to capture the effects of social interaction; competition and social support (social capital).

5.1.4 Incidence of miscarriages and stillbirths in Ghana

Miscarriages and stillbirths recorded in the GMHS data constituted 9% and 1.8% of all pregnancy outcomes, respectively. The pattern of reported miscarriages is slightly different from stillbirth. The proportion of pregnancies that ended in miscarriage increased with the age categories (Table 5.1.1). The amount of miscarriages occurring among the highest extreme age group (45-49) is nearly four times the proportion occurring among the lowest extreme age group (15-19). Maternal educational attainment has a positive association with the proportion of miscarriage. There are a lot more miscarriages among women with higher education[6] than with lower education. The same

[6] Due to inadequate data points for education level such as college or tertiary in this sample, the few women with that level of education where added to those with Senior High School education to form one category. This is similar to the classification used in the GMHS main report.

is observed with household wealth. The proportion of pregnancies that ended in miscarriage increases with wealth status from 5% among women in low wealth or poorer households to 15 per cent among women in higher or richer households.

The proportion of pregnancies that ended in miscarriage was 4% points higher in urban areas (12%) than in rural areas (8%). The northern regions have lower levels of miscarriages compared to regions in southern Ghana. The proportion of women who had miscarriages in the past five years was above 10 per cent for all regions in southern Ghana except Brong Ahafo which recorded 7.5% similar to the Upper west region (7.9%). The Upper east region and the Northern region recorded the lowest proportions of miscarriages 3 and 4% respectively, whilst the Central Region recorded the highest (12%).

Stillbirth does not seem to have an observable pattern of occurrence. It is nearly the same among all age groups except that it nearly does not occur among the last extreme age group (45-49). In terms of pregnancy order, stillbirths appear to occur slightly more among women experiencing their first pregnancies than the more experienced ones with more than one pregnancy experience. There was no clear pattern of inequality associated with incidence of stillbirths in education and wealth. Stillbirths are, however, slightly higher in urban areas than in rural areas.

Table 5.1.1: Distribution of pregnancies ending in live birth, stillbirth and miscarriage

Characteristics	Live birth	Stillbirth	Miscarriage	Number of pregnancies
Maternal age				
15-19	75.4	2.1	6.3	1,008
20-24	80.7	1.9	8.6	2,080
25-34	84.5	1.2	9.4	3,729
35-44	81.7	2.8	11.0	1,409
45-49	73.6	0.0	23.2	96
Pregnancy order				
1	78.0	2.4	8.1	1,627
2	81.2	1.4	10.0	1,487
3	84.7	1.4	8.8	1,404
4	82.0	1.5	9.8	1,145
5+	83.0	1.9	9.6	2,659
Maternal Education				
No education	90.9	1.4	5.9	2,670
Primary	81.6	1.8	9.6	1,916
JSS/MSLC	77.5	2.1	10.7	3,055
SSSC/Higher	66.6	1.4	15.4	680
Wealth quintile				
Lowest	91.1	1.5	5.2	1,760
Second	88.1	2.3	7.1	1,718
Middle	82.7	1.1	9.2	1,648
Fourth	76.5	1.7	10.3	1,672
Highest	69.0	2.2	15.4	1,523
Region				
Western	77.3	0.7	11.7	710
Central	80.8	2.2	12.1	823
Greater Accra	73.6	1.2	11.1	828
Volta	81.7	1.7	11.2	764
Eastern	78.5	2.6	10.0	964
Ashanti	78.3	1.5	10.5	1,646
Brong Ahafo	82.5	2.7	7.5	911
Northern	93.4	1.9	4.1	1,128
Upper East	95.7	1.0	3.0	313
Upper West	91.2	1.0	7.9	235
Locality				
Urban	73.2	2.3	12.0	2,937
Rural	86.6	1.4	7.8	5,385
Total	81.8	1.8	9.3	8,322

Source: GSS et al. (2009b)

*Percentages do not add up to 100 because abortion numbers are not part of this analysis

5.1.5 Factors associated with the probability of stillbirth or miscarriage

An unconstrained model with no level-1 and level-2 predictors is first performed to describe the intra-group and inter-group distributions of the outcome of interest and to calculate how much of the total variation can be attributed to individual variation and group variation respectively. This model forms the starting point for building five more models with various specifications.

The results of the regression analysis are presented in Table 5.1.2. Model 1 & 2 includes individual level variables and area level factors such as the index of deprivation and ethnic diversity separately. Model 3 examines both the individual main effects and, simultaneously, the neighbourhood level constructs of deprivation and ethnic diversity. Model 4 presents cross-level effects with the inclusion of interactive terms. One major shortcoming in earlier studies in this domain is the lack of examination of cross-level interactions between neighbourhood characteristics and individual socioeconomic status. This is handled in Model 4 by introducing interactive terms to establish if there are "compositional" effects other than "contextual" effects on the probability of suffering a stillbirth and miscarriage.

Individual and household-level factors

The regression results for the individual and household level variables are generally consistent with expectations and similarly consistent with previous studies showing the role of individual and household-level factors that are significantly associated with the likelihood of losing a pregnancy to stillbirth or to miscarriage. At the individual level important factors that are associated with the likelihood of a woman losing a pregnancy to miscarriage or stillbirth include the age of the woman, number of pregnancies ever conceived, level of education of the woman,

level of media exposure (listening to radio, watching television and reading newspapers), and the woman's marital status (Table 5.1.2). These factors remained consistent even after controlling for locality of residence (dummy for rural-urban dichotomy).

The effect of maternal education was particularly most consistent in all two indicators of pregnancy loss. For example, women with higher level of education (College education or higher) shows significantly higher odds of suffering a stillbirth (Odds ratio, 2.4: $p<0.05$) in all models as compared to women with no education (Table 5.1.2; Model 1). Women with Junior High School (JHS) and Senior Secondary School (SSSCE) education also have higher odds (Odds ratio, 1.5 and 1.8 respectively for JHS and SSSCE) of suffering miscarriages as compared to women with no education. However, these results are somewhat counterintuitive. For instance, it is difficult to imagine the positive relationship between higher level education and increase likelihood of having a stillbirth or miscarriage. This is because, all other things being equal, it is expected that women with higher formal education are more aware of the risks associated with reproductive health and may adopt preventive health behaviour strategies that will avert these pregnancy outcomes.

Widowed women have lower odds of having a miscarriage as compared to married women (Odds ratio; 0.56: $p<1\%$). This may not be surprising since these women may have reduced sexual activities tremendously in their lives or stopped giving birth altogether. The odds ratio associated with stillbirth and miscarriage for women who have increasing numbers of pregnancies is higher than for women with fewer pregnancies. For every additional pregnancy after the third, for instance, the odds in favour of suffering a miscarriage was 1.4 times ($p<0.001$) that of women

who have experienced three or less number of pregnancies. Women who reported currently using a modern contraceptive have lower odds of reporting stillbirth (Odds ratio; 0.7: $p<0.1$) and miscarriage (Odds ratio; 0.7: $p<0.1$) as compared to those who have stopped using.

Muslim women were found to have significantly higher odds of reporting a miscarriage (odds ratio; 1.5: $p<0.1$). There is not any clear and statistically significant gradient in the odds of reporting miscarriage among women of different wealth status. Assuming a lower statistical significance level, being in the fourth quintile however have a reducing effect on the chance of experiencing a stillbirth (Odds ratio; 0.6: $p<0.1$). In terms of ethnicity, Ewe women have higher chance of suffering miscarriages (Odds ratio; 1.4: $p<0.05$) relative to women who are Akan.

Level of deprivation and ethnic diversity as determinants of miscarriage and stillbirth

The results showed that while living in less deprived neighbourhoods have a lower effect on women's probability of having stillbirth, it has a higher effect on the probability of miscarriage (Table 5.1.2; Model 1). In other words, compared to deprived neighbourhoods, less deprived neighbourhoods are associated with higher probabilities of miscarriages (Odds ratio; 1.4: $p<0.1$) whilst having lower odd ratios for stillbirths (Odds ratio; 0.64: $p<0.1$).

In Model 2 we included level of ethnic diversity which captures least diverse (ethnically concentrated or homogeneous neighbourhood), intermediate or fairly diverse and highly diverse neighbourhoods and excluded the level of deprivation factor. We find that this index has strong effect on the probability of experiencing miscarriage but not significant for stillbirth. The probability of getting miscarriage increases with increasing ethnic diversity in a neighbourhood

(Odds ratio; 1.5 and 1.6: $p<0.001$ for intermediate level and high diversity respectively). In other words, the level of ethnic diversity has a positive and linearly increasing effect on the probability of having miscarriage but not on the probability of stillbirth. All the individual or household level variables remained the same. In Model 3 high level of ethnic diversity continues to be associated with higher probability of miscarriage, even with the presence of level of deprivation. Being Ewe also remained positively associated with higher probability of suffering a miscarriage.

Subsequent models introduced separately, interactive terms for household wealth status (wealth quintiles) and level of deprivation, wealth status and ethnic diversity, and deprivation and ethnic diversity. Based on the interpretation of the Bayesian information criterion (BIC) and the Akaike information criterion (AIC) estimates which say that the model that has the smaller value on the information criterion is better, Model 4 is discussed. In this model the neighbourhood contextual factors; level of deprivation and ethnic diversity, and all the interactive terms remained in the regression.

First, for miscarriage the effect of deprivation lost its significance. Ethnic diversity, even though remained statistically significant, the level of significance reduced from $p<0.001$ to $p<0.05$ for a fairly or intermediate level diversity and $p<0.001$ to $p<0.1$ for a highly diverse neighbourhood. Even though women living in less deprived neighbourhoods (affluent) and those living in ethnically diverse neighbourhoods positively increases the odds towards miscarriage in Model 3, interacting the two terms did not show that an affluent neighbourhood that is also ethnically diverse has any severe effect on miscarriage. Similarly, it is not clear that women living in least

ethnically diverse neighbourhoods (high concentration of an ethnic group) that are also deprived are significantly different in terms of experiencing stillbirths or miscarriages.

Model 4 showed that living in ethnically diverse neighbourhoods have an independently positive effect on the probability of suffering miscarriage, whilst affluent or less deprived neighbourhoods have a negative effect on stillbirth. In other words, stillbirths are lower in less deprived neighbourhoods. A possible gradient effect emerges when poor households are interacted with less deprived neighbourhoods. The result showed that there is nearly a two-fold likelihood of miscarriage for a woman of a poor household (1^{st} quintile) living in an affluent neighbourhood (Odds ratio, 1.8; $p<0.05$) compared to wealthy households living in less deprived neighbourhoods. Similarly, living in ethnically diverse neighbourhoods increases the chances of a woman of a poor household (1^{st} quintile) experiencing a miscarriage (Odds ratio; 2.04; $p<0.1$). The effect of these interactions on stillbirth are however not significant.

On the other hand, a woman of a wealthy household (5^{th} quintile) living in a deprived neighbourhood is associated with about 66 per cent reduction in the odds of experiencing a stillbirth (Odds ratio; $p<0.1$). But if such a woman lives in an affluent neighbourhood her chance of suffering a stillbirth reduces by about 34 per cent (Odds ratio; $p<0.05$). Whilst ethnic diversity and affluent neighbourhoods are associated with high likelihood of miscarriage, the effect appears to be severe for women of poor households. In terms of stillbirth, even though living in less deprived neighbourhoods is protective, it is women of wealthy background that are associated with a statistically significant chance of a reduced risk of stillbirth.

Table 5.1.2: Multilevel logistic regression of predictors of miscarriage or stillbirth

Characteristic	Model 1		Model 2		Model 3		Model 4	
	Stillbirth	Miscarriage	Stillbirth	Miscarriage	Stillbirth	Miscarriage	Stillbirth	Miscarriage
Age	0.98	0.99	0.98 *	0.99	0.98 *	0.99 *	0.98 *	0.986
Number of life pregnancies	1.38 ***	1.42 ***	1.39 ***	1.43 ***	1.38 **	1.43 ***	1.39 ***	1.431 ***
Employed	1.22	1.01	1.21	1.00	1.19	1.01	1.16	0.978
Education (No education = ref)								
Primary	0.84	1.33	0.83	1.34	0.84	1.34	0.84	1.353 *
JSS/MSLC	1.28	1.55 **	1.26	1.54 ***	1.29	1.53 ***	1.29	1.557 **
SSSC/Voc.	1.40	1.86 ***	1.34	1.83 ***	1.37	1.81 ***	1.36	1.832 ***
College/Higher	2.38 *	1.61	2.32 *	1.57	2.37 *	1.56	2.37 *	1.570
Marital status (Married = ref)								
Loose union	1.16	0.88	1.19	0.88	1.17	0.88	1.17	0.868
Widowed	0.78	0.56 *	0.79	0.55 *	0.78	0.55 *	0.81	0.564 *
Divorced/Separated	1.04	0.92	1.01	0.93	1.04	0.92	1.02	0.911
Never married	1.41	1.26	1.39	1.28	1.40	1.27	1.46	1.288
Media exposure (Less exposed = ref)								
Relative exposed	1.11	1.17	1.10	1.14	1.10	1.14	1.11	1.139
Well exposed	0.89	1.23	0.86	1.22	0.88	1.21	0.90	1.191
Contraceptive use (Stopped use = ref)								
Still use	0.66 *	0.71 ***	0.67 *	0.71 ***	0.67 *	0.71 ***	0.66 **	0.711 ***
Never used	1.01	1.05	1.03	1.07	1.03	1.07	1.05	1.086
Religion (Pentecost/Charismatic = ref)								
Catholic	1.42	0.89	1.45	0.90	1.43	0.91	1.45	0.924
Protestant groups	0.77	0.81	0.77	0.83	0.78	0.83	0.78	0.840
Islam	1.13	1.49 *	1.12	1.44 *	1.12	1.45 *	1.11	1.415 *
Tradition/Spiritual/Others unidentified	0.83	1.22	0.84	1.27	0.84	1.27	0.84	1.267
Ethnicity (Akan = ref)								
Ga_Damgme	0.87	1.23	0.80	1.21	0.84	1.18	0.84	1.160
Ewe	1.40	1.43 **	1.28	1.39 **	1.34	1.37 *	1.32	1.387 **
Mole_Dagbani	1.46	0.99	1.36	0.99	1.48	0.94	1.42	0.979
Grusi/gruma	0.84	1.05	0.79	0.97	0.81	0.95	0.86	0.983
Other groups	0.97	0.94	0.90	0.91	0.97	0.87	0.96	0.894
Household wealth (1st quintile = ref)								
2nd quintile	1.08	1.18	1.09	1.14	1.06	1.16	1.47	2.029 **
3rd quintile	0.77	1.20	0.78	1.15	0.75	1.19	1.02	2.061 **
4th quintile	0.60 *	1.04	0.60 *	0.98	0.57 *	1.01	0.78	1.77 *
5th quintile	0.72	0.99	0.68	0.92	0.66	0.93	1.29	1.99 *
IMD (Highly deprived = ref)								
Intermediate level	0.67	1.25			0.67	1.28	0.45 **	1.12
Less deprived	0.64 *	1.40 *			0.61 **	1.36 *	0.38 ***	1.24
Level of ethnic diversity (ethnic concentration = ref)								
Fairly diverse			0.93	1.45 ***	0.92	1.46 ***	0.85	1.48 **
Highly diverse			1.17	1.55 ***	1.24	1.50 ***	1.11	1.52 *
Highly deprived#Least ethnically diverse							0.70	1.11
Less deprived#Most ethnically diverse							1.34	0.92
Poor household (1st quintile)#Most ethnically diverse neighbourhood							0.36	2.04 *
Poor household (1st quintile)#Less deprived neighbourhood							2.24	1.80 *
Wealthy household (5th quintile)#Highly deprived neighbourhood							0.34 *	0.51
Wealthy household (5th quintile)#Less deprived neighbourhood							0.66	0.82

Significance level: * p<0.1; ** p<0.05; and *** p<0.01
*Odds ratios reported

Miscarriages remain significantly associated with women of Ewe ethnic background compared to women of Akan background (largest ethnic group in Ghana). In the full model (Model 4), relative to Akans, women who are Ewes are nearly two times likely to suffer a miscarriage. An interaction

of Ewe and the measure of ethnic diversity (Ewe in high and least ethnically diverse neighbourhood) showed that Ewe women living in least ethnically diverse neighbourhoods (synonymous with ethnic homogeneity) are 2 times likely to suffer a miscarriage. Based on the fact that Ewes are predominantly concentrated in the Volta region of Ghana, the data from the Volta was dropped and the model ran. The results showed no significant relationship, even though positive, between being Ewe and suffering a miscarriage. The Ewe - ethnic diversity interactive term also lost its significance. It is possible that after dropping the Volta region from the data we may have fewer data points for the Ewe ethnic dummy and this may have led to it being insignificant in the analysis at that stage.

5.1.6 Discussion

The challenges of demographic-oriented analyses of health outcomes have received some attention and many recent analyses have seen the need to adopt integrative approaches in the context of multisectoral interventions for improving general health (Meng, 2010; Macintyre, Ellaway and Cummins, 2002). Although reducing health inequalities remains an important goal in Ghana, setting priorities for and developing appropriate public health intervention programmes remains a challenge, at least in part because there are insufficient studies revealing which subpopulations are most in need of intervention. Population-based studies of the association between socioeconomic inequalities and pregnancy outcomes can provide essential information for targeted public health programmes.

Intervention programmes that consider at-risk subpopulations from both individual and community perspectives may help to achieve maximal benefits in reducing inequalities in

maternal health. The results of recent studies suggest that measures of neighbourhood socioeconomic status based on small geographic areas can be used to reflect socioeconomic gradients in health outcomes from a community perspective (Krieger et al. 2003a & 2003b). Among such measures, the index of deprivation measure seems to be the best for revealing socioeconomic gradients at the small area level.

The level of deprivation which was calculated as a composite score using indicators such as the proportion of population unemployed, proportion of households without access to improved water, without access to light, proportion of households not living in owner-occupied houses and overcrowding as an adult-equivalent measure of room density among other indicators is a crucial measure of the living conditions of people in an area. Highly deprived areas can be seen as living in "unimproved or disadvantaged" neighbourhoods whilst less deprived neighbourhoods are seen as "advantaged" or affluent settings. The middle-level areas are the "transitional neighbourhoods". This measure reflects the development differentials across neighbourhoods/communities.

The results of the regression analysis show that the probability of suffering a miscarriage or stillbirth is associated with personal and neighbourhood level risk factors including behavioural, individual and household socio-economic status, psycho-social, and environmental risks factors. Even though miscarriage and stillbirth share many of the same risk factors, the difference lies in the direction and the magnitude of effect.

There are inequalities associated with an areas' level of deprivation and women's chances of suffering miscarriage or stillbirth. The direction and size of effect however differs. Women living in less deprived neighbourhoods, associated with improved lighting, improved water, and housing are 0.38 times less likely to report stillbirths as compared to deprived neighbourhoods. However, in the case of miscarriage, whilst the first model shows that women living in less deprived areas are 1.4 times likely to report miscarriage as compared to women in most deprived neighbourhoods, the cross-level augmented model shows that it is women from poorer households living in less deprived neighbourhoods who are more likely to have miscarriages (1.8 times) as compared to their wealthy counterparts who live in the less deprived neighbourhoods.

Two pathways that can be used to explain this outcome is the scientific evidence and the "relative deprivation" hypothesis. In the scientific literature miscarriages are known to be caused by chromosomal or structural abnormalities. Scientists also hypothesized that environmental factors such as interaction with chemicals in food, water, air, and soil can also influence miscarriages. Evidence is available from Mexico and other places that a strong association exist between miscarriage and high concentration of compounds such as heavy metals (e.g. lead), solvents, phthalates, polychlorinated biphenyls and pesticides (Hertz-Picciotto, 2000; Borja-Aburto et al. 1999). In less deprived neighbourhoods where there is expected to be improved water systems, poorer households who live in these areas tend to live on the fringes where quality water is hard to come by. This is compounded by their inability to treat unclean water before use and largely unable to protect themselves from the vagaries of urban live, thereby constantly exposing themselves to agents of health risk in such areas.

It is normally assumed that urban neighbourhoods are better places than rural areas for accessing social services, safe and convenient water and sanitation services, but a more nuanced analyses show that access to urban services often differ widely depending on the level of deprivation of the neighbourhood. Deprived neighbourhoods in urban areas have insufficient access to improved water and have poor sanitation. These are the places the poor who live in urban areas or affluent neighbourhoods live and work. People living in such deprived neighbourhoods without adequate water and sanitation suffer epidemics of diseases such as pneumonia, tuberculosis, diarrhoea and other communicable diseases.

The "relative deprivation" hypothesis also suggest that poor people living in affluent neighbourhoods may be stressed from perceived income inequality and thus suffer from depression and emotional trauma associated with relative standing in society (Jencks and Mayer, 1990; Mayer and Jencks, 1989). In a case-control design using Life Events and Difficulties Schedule analysis, O'Hare and Creed (1995) found psychosocial stress as an important factor in the aetiology of miscarriage. One of the assumptions of neighbourhood analysis is that in a given neighbourhood the fortunes or misfortunes of neighbours are usually evident and social comparisons are a daily occurrence. Pregnant women in the poorest quintile (1^{st} quintile) living in less deprived neighbourhoods which are coterminous with affluence presents a context where poor women suffer high levels of depression and emotional trauma due to their relative position in the society and hence their being associated with higher likelihood of suffering miscarriages in early pregnancy.

The growth in the poor population and the switch from subsistence to a "moneyed" economy is also likely to have a dramatic change in women's health behaviour. First of all, seeking healthcare for the poor in affluent neighbourhoods can be a problem precipitating a habit of self-medication instead of seeking facility-based care which is dangerous for safe reproductive health. In affluent areas where private market actors predominate without the presence of subsidised healthcare the influence on self-medication is even higher. Hence over-indulgence in self-medication may explain the high incidence of miscarriage among poor women living in affluent neighbourhoods.

In terms of ethnicity and ethnic diversity, the results showed that ethnically diverse neighbourhoods are associated with high probabilities of miscarriage. Women living in ethnically diverse neighbourhoods and neighbourhoods with intermediate level diversity are about 1.5 times likely to experience miscarriage as compared to neighbourhoods where there is low ethnic diversity (ethnic homogeneity). In other words ethnic diversity matters much more for miscarriage than ethnic concentration. This result persisted both in magnitude and significance in the full model when other factors have been controlled for. The interactive model showed that poor women living in high ethnically diverse neighbourhoods have double the odds of suffering a miscarriage in ethnically concentrated neighbourhood. This seems to support the "double jeopardy" hypothesis, which suggests that the harmful effects of individual poverty could be further intensified for those who live in diverse neighbourhoods (Wen and Christakis, 2005).

This is because, ethnically diverse neighbourhoods are noted to be generally associated with higher levels of deprivation and poverty, poor housing and social isolation, lower levels of quality of life, and increased levels of societal (ethnic, religious and migrant) tensions (Davies et al.

2011). These neighbourhoods also have weak social capital (Laurence, 2009). The double jeopardy hypothesis argues that the probability of a woman suffering a miscarriage will increase with poor women living in neighbourhoods with high ethnic diversity. The results based on the cross-level interactive term shows that women of poorer households living in ethnically diverse neighbourhoods are 2.04 times more likely to have miscarriage as compared to their counterparts in less diverse neighbourhoods.

The other argument is the social capital hypothesis. Social scientists have observed greater importance in social network and social support (source of social cohesion) and the fact that they can have powerful effects on productivity and health. These concepts are intrinsically interconnected and overlap (Gottlieb and Bergen, 2010). Social support is generally defined in terms of the availability of people who individuals trust, and on whom they can rely and who will care for them (Berkman and Kawachi, 2000). Social networks are the structures through which social support is obtained. The core idea is that social networks have value both to the people in the networks and also have "externality" effects on bystanders (Putnam, 2004).

Social networks and social support are increasingly becoming prominent because social and ethnic diversity is rapidly increasing everywhere, and social and economic inequalities are equally increasing in magnitude. The process of becoming more ethnically diverse weakens social networks and social support especially in urban areas. The social radius within which people feel obliged to act mutually is smaller in ethnically diverse neighbourhoods, probably even narrowed to the people who are part of an ethnic group. This is because ethnic diversity as a consequent of immigration of ethnic groups tends to be a socially isolating experience, as family and community

ties are left behind in the place of origin, whilst new ties take time to construct, even though when constructed can also be enduring.

The effect of this on general measures of health status are all too unequivocal (Berkman and Kawachi, 2000; Berkman et al. 2000) and more importantly, extremely very meaningful for maternal health outcomes. Women living in ethnically diverse neighbourhoods have higher probability of suffering miscarriages and particularly so for women of poor households. This is because social support is weak in such neighbourhoods and extremely weak for poor people. Lack of social support is a known important risk factor for maternal well-being and quality of life during pregnancy, and has adverse effects on pregnancy outcomes (Elsenbruch et al. 2007). Pregnant women with poor social networks are at increased risk for emotional and behavioural problems both to mothers and their children (Kita, 2000).

The fact that relative to women of Akan origin, which is the largest ethnic group in Ghana, women from Ewe ethnic group have a significantly high probability of miscarriage even after all the other factors have been taken care of. In the full model (Model 4) relative to Akans, women who are Ewes are nearly two times likely to suffer a miscarriage. The result remained strong for Ewe women living in least ethnically diverse neighbourhoods (synonymous with ethnic homogeneity) implying that there is something unique or peculiar about the Ewe ethnic group that may be associated with the high likelihood of miscarriage. Based on knowledge of the distribution of ethnicity in Ghana, that Ewes are predominantly concentrated in the Volta region of Ghana, the supposition is that this outcome could be associated with the women's likely engagement in activities such as smoking of fish and gari processing, which may expose them to severe heat.

This however requires further investigation by isolating especially other ethnic groups whose predominant economic activity is fish mongering and gari processing.

5.1.7 Concluding this section

Studying pregnancy outcomes presents some challenges: challenges emanating from the classification of these outcomes into the appropriate compartments, considering that there is a significantly small difference between outcomes such as miscarriage and stillbirth, and also considering that due to fear of societal disapprobation women who actually committed abortions are likely to report miscarriages. Whilst the ultimate cause of miscarriage and stillbirth may be biomedical, distal or macrostructural factors beyond the individual, are equally important in influencing the probability of stillbirth and miscarriages. Deprive neighbourhoods are generally areas with limited access to basic health needs. This is compounded by an increase in the level of ethnic diversity. Deprived neighbourhoods which are also ethnically diverse are also associated with high levels of competition for livelihood opportunities with reduced or weak social support. The effect of this phenomenon on women's health is critical. In this context, there is the need for targeted provision of services to poor people in affluent enclaves (non-notified slums).

The effect of poverty and relative position in society has also been shown to be important in explaining the chances of suffering a stillbirth or a miscarriage. The negative effect of living in less deprived neighbourhoods on poor women which is associated with high probability of miscarriages may be due to the prevalence of private health actors, such as private clinics and pharmacies in these areas and the lack of subsidised health facilities which constrains access of

the poor with adverse behavioural consequences involving non-seeking of healthcare or indulgence in self- medication.

The other challenge for research is that issues concerning pregnancies that do not result in live births generally lack accurate information due to traditional norms and taboos associated with their occurrence. In particular, there is a general reluctance among different ethnic groups to discuss these issues with other people due to varying sociocultural interpretation of stillbirth and miscarriages. Whilst in some societies any of these may be viewed as one of a tragic occurrence, in others it can be attributed to an angry reaction of some supernatural being. Similarly, due to the "medicolegal" restrictions to abortion in Ghana, women who report miscarriages may have committed abortions, yet fail to report it as such just to hide the shame and legal consequences that come with illegal abortion. This analysis has demonstrated however, that, controlling for a variety of respondent characteristics, women of poor households living in less deprived neighbourhood and ethnically diverse areas are associated with higher levels of miscarriages. The issue to consider therefore relates to adequate planning that will seek to cater for the poor who live in affluent neighbourhoods. The provision of improved water, proper sanitation and targeted subsidised healthcare are all important for these people.

5.2 Socioeconomic status and Neighbourhood Deprivation as Determinants of Elective Abortion in Ghana

5.2.1 Introduction

High fertility especially in developing countries is seen as one major factor limiting efforts to reduce the rate of maternal deaths. Reducing the fertility rate has therefore been made a central theme in national efforts towards reducing maternal mortality, to which contraceptive use is focal. Acceptance rate however is still very low in Ghana. Modern contraceptive prevalence rate among married women in Ghana was 17 per cent in 2008 (GSS et al. 2009a), when about 35 per cent of currently married women have an unmet need for family planning (wish to space next birth or to limit childbearing altogether but are currently not using contraception). The possible outcome of a poor family planning practice, including low contraceptive use is a high prevalence of unplanned or unintended pregnancies. Data from the Ghana Demographic Health Survey (GDHS) showed that about 40 per cent of all pregnancies in 2003 were unwanted or mistimed and this declined to 37 per cent in 2008 (GSS et al. 2009a). The majority of these pregnancies get terminated prematurely through unsafe means which sometimes leads to complications and deaths.

Elective abortion (foetal wastage) is a term used to describe the early termination of a confirmed pregnancy. Elective abortion involves a conscious effort to terminate a pregnancy. Abortion is closely associated with the increasing difficulties to reduce maternal mortality globally, as every year, globally, about 42 million women with unintended pregnancies choose abortion, and nearly half of these are unsafe (Haddad and Nour, 2009).

Unsafe abortion is one of the leading causes of maternal mortality and also contributes to the incidence of other long-term health complications (WHO, 2007). An unsafe abortion is defined as "a procedure for terminating an unintended pregnancy carried out either by persons lacking the necessary skills or in an environment that does not conform to minimal medical standards, or both (WHO, 1992). Globally, unsafe abortion contributes about 13 per cent to maternal mortality cases (Haddad and Nour, 2009). In Ghana abortion currently accounts for about 11 per cent of maternal deaths (GSS et al. 2009b). Its contribution to the rate of maternal mortality could even be higher considering that the act is most often clandestinely carried out hence undocumented and unreported in household surveys. Even though research has advanced methods such as the sisterhood approach to understand the causes of maternal mortality, Ghana's current abortion law constrain "sisters" from reporting death of their siblings or adequately telling the true cause of death even if the death is known to be the result of an illegal abortion.

Up until 1985, Ghana's criminal code prohibited abortion, except under a condition where a woman's life was considered to be endangered by her pregnancy. An amendment to the code however expanded it to allow abortion to be carried out if it is found that the continuation of a pregnancy poses risk to the life or injury to the physical or mental health of the pregnant woman; or if there is substantial risk that the child, if born, might suffer from or later develop a serious physical abnormality or disease; or if the pregnancy results from rape, incest or the defilement of a mentally handicapped woman (Law No. 102; 1985). The law further provides that abortion shall be carried out by a qualified gynaecologist or other specialised registered medical practitioner in a government health facility or other registered private hospital or clinic. This is to ensure that

abortion, if it must be done, is done in an environment that is safe and hygienic and by a skilled person. Any act of termination of a pregnancy outside these conditions is considered illegal.

If you take these legal requirements: that a woman demonstrates that her life would be endangered if she carried her pregnancy to term or to show that an abortion is necessary to protect her physical or mental health, it will require that a physician examines the woman to confirm that an abortion is necessary to protect her life or physical health (and perhaps an additional physician to corroborate her own physician's finding; though not explicit in the law) or a licensed psychiatrist might be required to confirm that an abortion was necessary on mental health grounds. If an abortion is to be obtained on grounds of rape or incest a law enforcement officer might be required to certify that the woman had reported being sexually assaulted. Navigating these "medicolegal" constellations to obtain clearance for abortion is certainly arduous. These complex requirements of the law certainly make legal and perhaps safe abortion difficult to access, hence illegal and unsafe abortion becomes inevitable. In other words, the alternative to a legal abortion is an unsafe and an illegally obtained abortion.

It has to be stated that the decision to discard a pregnancy before term is a posterior decision and often takes some time to arrive at; it is complex, and involves mental and social bargaining. Anytime the decision is taken, it is a reflection of the interaction between the individual and household factors precipitated by unobserved factors within the environment within which the individual lives. The neighbourhood within which a person lives is essentially a socioeconomic arena shaped by social norms, values and orientations that are powerful in shaping peoples' thinking, responses and behaviours towards events that can have an effect on their health. An

ecological framework suggests that within a neighbourhood, defined as a shared local environment, a variety of characteristics, including the availability of goods and services, norms (values and behaviours) and opportunity structures (such as employment, medical care providers and educational opportunities), may independently influence a range of reproductive health outcomes (Mosher et al., 2003).

Drawing on the ecological framework, we examine the influence of a neighbourhood's level of deprivation on decision to abort a pregnancy whilst controlling for individual socio-demographic factors and household characteristics. We also explore possible mechanisms that can explain this decision. There are few Ghanaian studies that have focused on how the neighbourhood in which an individual (or the household) lives influences health behaviour such as seeking abortion (Bleek, 1981). To the extent that carrying out an unsafe abortion is clearly a response to dominant social and economic circumstances including education, employment and social position, neighbourhood analysis of the decision to abort a pregnancy is crucial for policies towards reducing the high incidence of unsafe abortion and abortion-related maternal deaths. This section presents possible channels via which neighbourhood factors could influence this behaviour.

5.2.2 A brief review of related literature

Abortion is perhaps one of the most researched and most discussed reproductive health issue in the literature, due to a number of reasons, chief among which are contribution to the maternal mortality burden and also the clandestine nature of its execution. The question that several of these studies and discussions have sought to unravel is the question of why some women who find themselves pregnant will continue with the pregnancy, while others opt for abortion even

though the pregnancy does not pose any health risk to them? Two important views that have engaged discussions have been those who associate the demand for abortion to individual characteristics and personal behavioural responsibilities (Asamoah and Agardh, 2012; Schwandt et al. 2011; Oliveras et al. 2008; Ahiadeke, 2001) and those who associate it with factors or circumstances in the communities within which women live (Kumar, Hessini and Mitchell, 2009; Yang et al. 2007; Lee et al. 2004; Aggleton, Parker and Mulawa, 2003; Wilson et al., 1992; Garlick et al., 1993).

Studies in Ghana using both facility-based and population-based surveys have found that women reporting abortion experience were likely to be younger and more likely to be unmarried. They were also more likely to be better educated (Oliveras et al. 2008). Using a population-based sample in Ghana, one study reported that the majority of women who reported having an induced abortion were younger than 30 years, nulliparous and more likely to be Christian than Muslim (Ahiadeke, 2001). Better educated women have greater odds of obtaining an abortion, possibly because they are more aware of the law and how to overcome the legal complexities. Similar evidence is found in other countries (Kumari and Mengi, 2010; Paramita and Benjamin, 2010; Pallikadavath and Stones, 2006). Identifying individual and related characteristics of induced abortion patients is the first step towards targeted policies and programmes aimed at reducing unsafe abortion in Ghana (Schwandt et al. 2011).

Other personal behavioural factors that have been found to be positively associated with demand for abortion are lifestyles such as alcohol and tobacco use and use of contraceptive (Asamoah and Agardh, 2012; Moore and Rosenthal, 1993). Excessive use of alcohol is associated with high risk

of being exposed to unprotected sex which could lead to unplanned pregnancy which may have a high likelihood of being aborted. The chances of alcohol consumption in relation to maternal deaths from induced abortion have been studied much recently in Ghana (Asamoah and Agardh, 2012). In a review of data from the United Kingdom (UK), Moore and Rosenthal (1993) found that teenage "abortees" are more likely than those who carry their pregnancies to full-term to be contraceptive users. This may partly be attributed to contraceptive failures and mistiming of contraceptive use.

Individual characteristics, however, may not be strong enough to explain the critical underlying reasons for selecting abortion to end a pregnancy. Some other studies have suggested a look beyond individual characteristics to the communities in which women live to explain the demand for abortion (Kumar, Hessini and Mitchell, 2009; Yang et al. 2007; Lee et al. 2004; Aggleton, Parker and Mulawa, 2003; Wilson et al., 1992; Garlick et al., 1993). Kumar, Hessini and Mitchell (2009) argued that the decision to terminate a pregnancy is contextual in terms of culture and community, even though it also lies within an individual's life trajectory. Lee and others (2004) using a measure of social deprivation as a community variable, have noted a strong relationship between a community status on this measure and conception outcomes such as rates and abortion. Smith (1993) also argued that even though conception is highly more frequent in deprived areas, as opposed to affluent areas, a lot more conceptions are terminated prematurely in affluent areas than in deprived areas In other words abortion is higher in affluent areas than in deprived areas. Many other studies found similar correlation (McLeod, 2001).

The neighbourhood influences an individual's propensity for abortion in a number of ways. Theoretically, the neighbourhood could have two important possible effects on a population's health behaviour; directly, through such mechanisms as the availability and accessibility of health services and related infrastructure; and indirectly through the effect of dominant attitudes towards health and health related behaviours, and lack of social support (Macintyre et al. 1993, Macintyre et al. 2002). The second effect which is more subtle lies in the psychosocial environment of the neighbourhood. This implicitly underlines the role of shame, trust, and social cohesion as key determinants of health behaviours (Wilkinson, 1996 & 1999; Kawachi et al., 1997; Bleek, 1981

Perceptions of social position and the negative emotions that they foster are translated into less social cohesion within the community and anti-social behaviour. In this way, perceptions of social status have both biological consequences for individuals and social consequences for how individuals interact and behave. Extending this argument further, it can be stated that individuals' perception of ranking in the social hierarchy can produce negative emotions such as shame and distrust generating stress-induced behaviours such as taking to smoking, excessive drinking, taking dangerous drugs, and engaging in other risky activities (File et al. 2001; Miller et al. 1974).

Another pathway through which the neighbourhood can influence the decision to seek abortion is the "competitive market effect" or the effect of prevailing macroeconomic processes. Macroeconomic processes create conflicts between the production of goods and the improvement of well-being. In economic terms competition is good for the markets (e.g. labour market), but it is associated with discrimination in employment and deprivation of employment privileges (e.g. maternity leave for women), a phenomenon more prevalent in urban areas especially large cities.

Here competition for jobs is intense and allocation of opportunities is skewed in favour of men and educated women. In that context, frequently "foliaceous" women have limited opportunities of economic mobility as compared to their less prolific counterparts. In order to win, keep or to remain occupying a niche in the economic space, in fact, raises the opportunity cost for childrearing. The effect of this on a woman's decision to keep a pregnancy to term can be very challenging especially for the less educated whose job is normally less well protected. The macroeconomic condition of the neighbourhood can therefore be a relevant determinant of the probability of a woman to consider abortion as option to end a pregnancy.

Research on the effect of neighbourhood economic measures has been part of the growing interest in the social determinants of health and in moving beyond causal explanations that focus exclusively on the characteristics of people. Neighbourhood contextual measures commonly explored in the development literature include poverty or affluence concentration, socioeconomic deprivation, and measures of advantaged and disadvantaged neighbourhoods. Spatially concentrated affluent or poverty areas are known to exert strong influence on neighbourhood-level social conditions in different directions and magnitude that have implications for health behaviours.

The neighbourhood-level effect hypothesis however has not been given enough application to specific health behavioural outcomes such as abortion in Ghana. The incidence of abortion in Ghana points to a need to move beyond individual characteristics to understand other factors at the community or neighbourhood level that will help us explain the phenomenon. This is particularly important considering that studies in sociology, psychology and public health have

shown that abortion is surrounded by social stigma, abhorred by religious fundamentalism and unsupported by cultural norms and values. These are values that are particularly crucial at the community level and shape lives and interactions of people. Analyses such as these will provide a more nuanced understanding of the phenomenon of elective abortion. Drawing on the neighbourhood analysis literature, this study postulates that elective abortion is high among affluent neighbourhoods (less deprived neighbourhoods) and women that will be most involved will be women of middle level or wealthy households living in less deprived neighbourhoods.

5.2.3 Data and analytical model

The data on elective abortion is also from the women-specific component of the GMHS, whilst the neighbourhood variables are generated from the 2000 PHC. The women-specific questionnaire administered also included modules on family planning practices (contraceptive use) and abortion. One of the important objectives of the GMHS survey was to help Government and interested development partners launch series of collaborative efforts to expand women's access to modern family planning services and comprehensive abortion care, reduce unwanted fertility, and reduce severe complications and deaths resulting from unsafe abortion. The data for the analysis included only women who sought abortion for reasons that where not health related. This is because considering the legal status of abortion, it may be spurious to attempt to offer other explanation for it other than for the reasons given to justify their selection of abortion instead of keeping the pregnancy to term.

Analytical model

The survey elicited information about all abortion experiences in a woman's life; and the second restricts respondents to only the last abortion(s) preceding the survey (2002-2007). The analysis is based on data from two sets of respondents: those who ever had an abortion and those who never had an abortion within the referenced period. This is measured as a dichotomous variable (1, if respondent had an abortion; and 0, if otherwise). The multilevel logistic regression model is used for the analyses.

As indicated earlier, abortion is a choice that is made between keeping a pregnancy and terminating it prematurely for reasons either personal or passively induced/influenced. The theoretical position is that whatever decision is made it is meant to achieve maximum utility that the woman (the couple as the case may be) receives or expects to receive. This can be expressed as a function of characteristics specific to the individual. Define the indirect utility received by the pregnant ith-individual choosing alternative A as:

$$U_{iA} = \sum_{j=1,N} \beta_{jA} X_{ij} + u_{iA} \qquad \text{Eq. 5.2.1}$$

where A is either choice 0 (keep to term) or 1 (abortion), j is an index representing 1 through N variables, and u , is a random error term associated with each equation. There is an unobservable (latent) random variable that captures the difference in utilities between the two choices such that the two equations indicated by (1) can be expressed as:

$$y_i^* = U_{i1} - U_{i0} = w_i + u_i = \sum_{j=1,N} \beta_{jA} X_{ij} + u_i \qquad \text{Eq. 5.2.2}$$

where $\beta_j = \beta_{j1} - \beta_{j0}$, $\mathrm{u_i} = u_{i1} + u_{i0}$, and $X_i = 1$. However, we are limited to observations on the outcomes of the decision-making process where;

$$y_i = \begin{cases} 1 \text{ if } \mathrm{U_{i1}} > U_{i0} \text{ or } \mathrm{u_i} > -w_i \\ 0 \text{ otherwise} \end{cases}$$

If the disturbances in (1) are independently and identically distributed as normal then a probit model is specified for maximum likelihood estimation of the parameters β_j, as:

$$P_i = \Pr ob(y_i = 1) = \Pr ob(u_i > -w_i) = \Pr(\beta_0 + \beta_1 X_i + u_1 \geq 0) \qquad \text{Eq. 5.2.3}$$

But evaluating $\beta_0 + \beta_1 X_{i1}$ depends on the distribution assumed for the error term (u**)**. Assuming u follow a standard logistic distribution then:

$$\Pr(u_i \leq \beta_0 + \beta_1 x_i) = F(\beta_0 + \beta_1 x_i) \qquad \text{Eq. 5.2.4}$$

where F(·) is the cumulative distribution function (cdf) of a standard logistic. The model being estimated is:

$$\text{logit}\left(p_i \big/ 1 - p_1\right) = \beta_0 + \beta_1 X_i \qquad \text{Eq. 5.2.5}$$

The logit link function is the preferred typical transformation for a binomial model, connecting the linear predictors to the mean of the outcome variable and not directly to the outcome variable itself. The use of the logit function instead of the probability function is its ability to deal with the inappropriateness associated with the normal distribution assumption for the error term when a binary outcome is involved and the possibility of obtaining predicted response probabilities

outside the (0, 1) range. This restriction is crucial since the conditional expectation of an abortion is interpreted as the probability of a choosing to have an abortion given the value of all the explanatory variables. The logit specification overcomes this limitation by restricting the conditional expectation to lie within the range [0, 1].

Considering that the critical hypothesis is that conditions within the neighbourhood are important in explaining some of the variations in abortion, a two-level random intercept model for the probability function, p , just as for any continuous variable has to be specified as:

$$y_{ij}^{*} = \beta_0 + \beta_1 X_{ij} + u_j + \varepsilon^{*}_{ij} \qquad \text{Eq. 5.2.6}$$

where ε is a level 1 residual with mean zero and variance $\sigma_{\varepsilon^{*}}^{2}$.

Independent variables of interest

Abortion largely being considered an economic choice (King et al. 1992; Deyak and Smith, 1976) is expected to be influenced by the direct price of the activity. However, the direct price of obtaining an abortion is unavailable in the dataset. But this is likely to be unimportant compared with opportunity cost factors (King et al. 1992). This is plausible since the decision to obtain an abortion is a posterior decision and surpasses price of any kind. This is equivalent to assuming that the abortion decision is perfectly inelastic to the real direct price. Nevertheless, the important assumption for consistent estimation is that the price of the procedure does not vary systematically with any of the explanatory variables, and thereby its omission imparts no bias (King et al. 1992).

Given that the full price of an abortion is directly related to the time-intensive activity of birth and childrearing, an attempt is made to measure the opportunity cost of abortion using different dimensions of the value of the respondent's time. The primary measure of opportunity cost of time, predicted hourly wages (considering employment selection bias), acts a proxy for the value of time and is expected to be positively related to the probability of an abortion (Deyak and Smith, 1976). A categorical variable that denotes unemployment rate in the local labour market is another opportunity cost measure. The unemployment rate is a measure of the probability of a woman finding a job in a neighbourhood or an economy. Theory indicates that the higher the unemployment rate, the lower the probability of abortion since the lower probability of finding or holding a job lowers the expected cost of withdrawal from the job market (King et al. 1992). In this study the variable included to capture opportunity cost is dichotomous variable showing 1 if employed and 0 if otherwise.

Other individual level variables explored in this section include maternal age, education, marital status, level of use of the media, status of contraceptive use, religion woman follows and the wealth status of the woman's household. Education is usually considered to be important in reproductive health matters since it is known to have a positive effect on maternal health outcomes. In this section education is categorised into five groups: none attained (either did not go to school at all or attended but did not complete any level); primary level; middle school leaving certificate or junior high school (MSLC/JSS); senior secondary school (SSSCE) and higher level education. Level of media exposure is defined here as media exposure: less exposed, relatively exposed, and well exposed. Contraceptive use is defined as "always use contraceptive, stopped using contraceptive, and never used contraceptive". The key neighbourhood variable is

the level of deprivation which has been stratified into 3 classifications (with 1 indicating highly deprived, 2 is fairly or intermediate level deprivation, and 3 indicates less deprived).

5.2.4 Prevalence of elective abortion in Ghana

Elective abortion is the second largest form of adverse pregnancy outcome (7%) after miscarriage (9%) in all pregnancy outcomes over the five year referenced period recorded in the GMHS data. The mean number of abortions among women who ever had an abortion is about 2, but this varies slightly by socioeconomic characteristics. It increases with age and peaks at the middle age bracket, and declines thereafter (Table 5.2.1).

The proportion of abortions to women also increased with household wealth and was highest among women in the wealthiest quintile (5th quintile). Abortions among women also increased with educational attainment but declined among women with education beyond secondary and higher. In terms of locality (urban versus rural) women in urban areas were twice as likely as women in rural areas to have aborted a pregnancy (19.7 and 10.4 per cent urban-rural, respectively). In terms of abortion to pregnancy ratios, the proportions are higher among the younger age cohort but decline steadily with increasing age. With marital status, abortion is low among the married cohort but high among the divorced/separated and the never married.

The proportion of abortion to live births is high among women who are not married (51%); for every two live births, such a woman would have wasted at least one pregnancy. Other cohort of women who have high abortion incidence to live births include women who have secondary or higher level education (SSS and higher), women who are well exposed to the media, and women

in urban areas. Women who have ever used or are still using contraceptives also have higher abortions to live birth proportions (more than 4 times) compared to women who have never used a contraceptive. The proportion of abortion to live births is four times higher in urban areas as compared to rural areas and nearly two times higher among the rich than the poorest.

Table 5.2.1: Proportion of abortions to women, pregnancies and live births (%)

Individual/household characteristics	Women who ever had an abortion	Abortions/Pregnancies	Abortions/Livebirths
Maternal age group			
15-19	2.9	17.9	24.4
20-24	11.1	12.9	17.2
25-29	16.2	10.4	13.0
30-34	17.1	7.4	8.7
35-39	18.9	6.5	7.6
40-44	21.7	6.2	7.1
45-49	18.7	4.7	5.4
Marital status			
Married	15.9	5.8	6.7
Loose union	15.8	7.6	8.8
Widowed	19.3	6.2	7.0
Divorce/separated	27.3	11.3	14.0
Not married	7.1	30.0	51.1
Educational attainment			
None attained	5.9	1.9	2.0
Primary	14.2	6.5	7.6
MLSCE/JSS	19.2	11.6	14.5
SSCE/GCE	16.2	19.7	28.4
Higher certificate	14.5	17.3	26.0
Level of exposure to media			
Less exposed	11.0	4.6	5.2
Relative exposure	18.7	11.4	14.5
Well exposed	14.9	15.7	21.3
Contraceptive use			
Always use contraceptive	22.1	10.5	12.6
Stopped using contraceptive	23.9	10.5	13.0
Never used contraceptive	4.6	2.6	3.0
Religious background			
Catholic	10.8	5.7	6.6
Protestant	17.2	9.3	11.3
Methodist	15.5	9.6	11.6
Presbyterian	20.4	11.4	14.6
Pentecost/Charismatic	19.0	9.9	12.2
Moslem	4.3	2.0	2.2
Traditionalist/Spiritualist	4.0	1.5	1.6
No stated religion	6.0	2.4	2.6
Wealth status of household			
Poorest	10.4	4.5	5.2
Poorer	11.8	6.1	7.1
Middle	12.4	6.5	7.6
Richer	15.8	8.1	9.8
Richest	17.8	9.9	12.1
Locality			
Urban	19.7	12.5	16.1
Rural	10.4	4.1	4.6

A tenth (11%) of the women who had an abortion did more than one attempt before succeeding to eliminate a pregnancy and the majority of these women are those from the wealthiest households (71%). About 28% of those who attempted more than one time are from poorer households. The common place or source of assistance for the first attempt to abort a pregnancy is a relative (sometimes friends) (Appendix F: Figure 2). This was common with both the wealthy and less wealthy, educated and uneducated and the young and the old. In most cases the cost of the first attempt is borne by the woman perhaps at the blind side of the partner.

5.2.5 Determinants of elective abortion

Models 1-5 are considered the primary models whilst 6-9 are expanded models as they included interaction terms. The model diagnostics are therefore produced for only models 1-5. The diagnostics shows that model 5 is well fitted and more preferable to the others with the lowest AIC and BIC. It is also noted that the variance component for the random intercepts in the various models remained relatively larger than the standard errors suggesting that there are community-level variance still unaccounted for. Models 1- 3 considered only individual- and household-level factors as determinants of elective abortion (Table 5.2.2a). Models 4 – 9 introduce the locality dummy and the deprivation variable at various levels whilst controlling for the individual and household factors (Table 5.2.2b). In models 8 and 9 cross-level interactive terms are introduced to understand the contextual effects of the neighbourhood on the likelihood of seeking abortion.

Individual and household-level determinants of elective abortion

The regression analysis presents results that are generally consistent with expectations and similar to previous studies showing the role of individual and household-level factors that are strong in predicting a woman's likelihood of resorting to abortion to end a pregnancy. These results are reported in Models 1 and 2 (Table 5.2.2b). At the individual level very important factors that predict the likelihood of a woman having an abortion are the woman's age, number of pregnancies, level of education, level of media awareness, and marital status. Religion and ethnic origin are also very important factors that predict the likelihood of a woman obtaining an abortion for a perceived "uncomfortable pregnancy".

One variable that was most strongly and consistently associated with induced abortion was maternal education. Women with secondary or higher level of education show significantly high odds of consciously terminating a pregnancy as compared to women with no education (odds ratio; 4.9: $p<0.001$). Similarly, women who are well exposed in terms of listening to radio always, reading newspapers and watching television, have significantly increased odds of wasting a pregnancy (odds ratio; 1.8: $p<0.001$) as compared to women who are less exposed (availed of one media source or none at all). Earlier studies that reached similar findings have reckoned that educated and well exposed women are inclined to source an abortion in order to continue with their education (Ahiadeke, 2001), but also due to their "contextual proximity" to information regarding safe procedures, aware of legal channels of obtaining it or ability to circumvent the medicolegal restrictions.

Unmarried (divorced or never married) women were also found to have higher odds of having an abortion compared to married women (odds ratio; 2.1: $p<0.001$), and the odds of abortion was higher among women who have never married (odds ratio; 3.3: $p<0.001$) as compared to married women. Women staying in consensual unions also have higher, albeit, weakly significant chance of reporting an abortion (odds ration; 1.2: $p<0.1$) compared to married women. There is also a higher odds ratio in favour of reporting an abortion for women who had high numbers of pregnancies. For every additional pregnancy after the third pregnancy the odds in favour of abortion increases by nearly five times ($p<0.001$) as compared to women who had experienced three or less pregnancies.

Muslim women had a lower odds of aborting a pregnancy, and women who reported that they were traditionalists equally had lower odds of aborting a pregnancy (odds ratio; 0.56: $p<0.001$ and 0.51: $p<0.001$ respectively) compared to women who are Catholics. Women of Mole-Dagbani, Grusi, and Gruma ethnic extraction have decreased odds of seeking abortion as compared to women of Akan background. Households in the fifth quintile were found to have an elevated likelihood of having an abortion (odds ratios of 1.4; $p<0.05$) compared with households in the first or poorest quintile (Table 5.2.2a; model 3).

The category of women who have a higher likelihood of aborting a pregnancy are younger women (15-19 years), women with high level of education, those who have high number of pregnancies, unmarried/never married women, women who are well exposed to media and women from wealthy households. The evidence also points to a fact that Muslim and women who are traditionalists are less prone to aborting a pregnancy. Women who were currently using

contraceptives and women who have ever used a contraceptive had increased odds of having an abortion.

Table 5.2.2a: Multilevel logistic regression assessing determinants of elective abortion√

Ever had an abortion	Model 1		Model 2		Model 3	
Maternal age	0.956	***	0.956	***	0.955	***
Number of pregnancies	1.452	***	1.454	***	1.458	***
Employed	0.989		1.009		1.008	
Maternal education (No education = base)						
Primary	1.786	***	1.778	***	1.775	***
MLSCE/JSS	2.571	***	2.579	***	2.554	***
SEC/SSS	3.731	***	3.718	***	3.660	***
Tertiary/higher	3.927	***	3.887	***	3.802	***
Marital status (Married==ref)						
Loose union	1.2106	*	1.199		1.205	
Widowed	1.2331		1.239		1.226	
Divorce/separated	2.1170	***	2.102	***	2.097	***
Never married	3.3444	***	3.295	***	3.279	***
Level of exposure to media (Less exposed==ref)						
Relatively exposed	1.523	***	1.507	***	1.476	***
Well exposed	1.786	***	1.773	***	1.733	***
Ever/using contraceptive	2.274	***	2.245	***	2.234	***
Religion (Catholic = base)						
Protestant	1.168		1.125		1.126	
Methodist	1.035		1.023		1.015	
Presby	1.331	*	1.332	*	1.329	*
Pentecost/charismatic	1.247	*	1.243	*	1.229	*
Moslem	0.672	**	0.671	*	0.671	*
Tradition/spiritualist	0.486	**	0.480	**	0.487	**
No religion	0.506	***	0.506	***	0.510	***
Ethnic group (Akan ethnic group = base)						
Ga_damgme	1.086		1.057		1.058	
Ewe	1.224	*	1.225	*	1.210	
Guan	0.710		0.729		0.747	
Mole_dagbani	0.219	***	0.223	***	0.229	***
Grusi	0.325	***	0.325	***	0.336	***
Gruma	0.309	***	0.305	***	0.314	***
Other groups	0.586	***	0.587	***	0.598	**
Household level						
Wealth quintiles (1st quintile = base)						
2nd quintile			1.008		1.004	
3rd quintile			0.832		0.823	
4th quintile			1.221		1.209	
5th quintile (Wealthiest)			1.358	***	1.338	**
Number of literates in the household					1.103	***

*Neighbourhood level N=352; Individual level N=6725
^Significance level: *p< 0:1; ** p< 0:05; ***p<0:001
√Odd ratios reported

Neighbourhood level determinants of elective abortion

A simple classification of the neighbourhood effect using locality of residence (1, urban and 0, rural) in Model 4 showed that, residing in an urban area increased the chances of aborting a pregnancy (odds ratio of 2.4; $p<0.001$). Notwithstanding, the individual-level characteristics remained strong and statistically significant as they were without the inclusion of the locality factor. The household wealth status however lost statistical relevance. It appears plausible to conclude at this stage that elective abortion is more likely to be an urban phenomenon and not really peculiar to wealthy households. Model 5 introduced neighbourhood level of deprivation to understand the contextual effects of the neighbourhood on the chances of seeking abortion to end a pregnancy. The results appear to support a priori expectation that as compared to highly deprived areas, middle and affluent neighbourhoods have a higher likelihood of seeking abortion (odds ratios of 1.5 & 1.7 for middle and affluent neighbourhoods respectively; $p<0.001$). In other words, living in an affluent area strongly influences the chances of a woman aborting a pregnancy. This remained unaltered even after controlling for household wealth in Model 6. It is possible to say that it is not so much the wealth status of the household that matters but there is a neighbourhood effect.

However, in Model 7 the effect of the aggregated neighbourhood variable (level of deprivation) lost its statistical significance when locality was controlled for. This presents a classic example of a 'suppressor effect'. Conceptually, level of deprivation and locality-type are strongly inter-linked (urban areas tend to be less deprived). What this means is that when level of deprivation is included as the only neighbourhood predictor variable, it 'explains' the variance in the outcome variable which is both as a result of locality of residence and level of deprivation. However, when

locality is added to the model, it controls (or 'suppresses') that part of the variance in the outcome variable which is due to the level of deprivation.

In Models 8 and 9 are interactive terms to establish if there are "compositional" effects other than assumed "contextual" effects on women's chances of seeking an abortion. The interactive terms introduced were wealth status (wealth quintiles) and neighbourhood's level of deprivation captured as a dummy (1, affluent and 0, otherwise). The results without the neighbourhood variable (Model 8) showed that women in middle-level and wealthiest household category (3rd and 5th quintiles) had significantly higher odds of having an abortion if they were in an affluent neighbourhood. This is different from what was initially found without the interactive terms where only households' within the fifth quintile category were associated with abortion. A woman in a household that is in the fifth wealth quintile and who lives in a less deprived neighbourhood is two-times likely to abort a pregnancy ($p<0.001$) compared to a woman in a first wealth quintile who lives in an affluent neighbourhood. This adds further meaning to the argument that the chances of a woman seeking abortion is pushed more by the contextual arrangement of the neighbourhood and little due to the individual characteristics of women.

In Model 9 both neighbourhood contextual factor: level of deprivation, and the interactive terms are used together in the regression. The magnitude of the interactive terms generally disappeared in the presence of the aggregated deprivation index, even though a middle level woman in less deprived neighbourhoods remains significantly associated with an increased likelihood of wasting a pregnancy (significant at the $p<0.1$ level). Coterminous with that is the fact that middle-level neighbourhoods appeared significantly associated with increased odds of committing elective

abortion. Contextually, the level of deprivation of a neighbourhood importantly explains a woman's likelihood of seeking abortion. The contextual effect however appears to be strong in the middle-level neighbourhoods as compared to the very deprived neighbourhoods.

Table 5.2.2b: Multilevel logistic regression assessing determinants of elective abortion[√]

Ever had an abortion	Model 4		Model 5		Model 6		Model 7		Model 8		Model 9	
Maternal age	0.950	***	0.954	***	0.953	***	0.950	***	0.954	***	0.953	***
Number of pregnancies	1.480	***	1.465	***	1.466	***	1.481	***	1.461	***	1.466	***
Employed	0.967		0.980		0.999		0.970		0.997		1.001	
Maternal education (No education = base)												
Primary	1.692	***	1.767	***	1.759	***	1.692	***	1.759	***	1.755	***
MLSCE/JSS	2.363	***	2.513	***	2.521	***	2.366	***	2.520	***	2.513	***
SEC/SSS	3.173	***	3.548	***	3.538	***	3.168	***	3.575	***	3.525	***
Tertiary/higher	3.250	***	3.696	***	3.662	***	3.254	***	3.671	***	3.661	***
Marital status (Married==ref)												
Loose union	1.217	*	1.224	*	1.213	*	1.221	*	1.202		1.212	*
Widowed	1.195		1.239		1.244		1.204		1.238		1.249	
Divorce/separated	2.041	***	2.088	***	2.075	***	2.039	***	2.078	***	2.073	***
Never married	3.155	***	3.294	***	3.249	***	3.157	***	3.225	***	3.234	***
Level of exposure to media (Less exposed==ref)												
Relatively exposed	1.327	***	1.443	***	1.430	***	1.323	***	1.454	***	1.434	***
Well exposed	1.575	***	1.684	***	1.675	***	1.568	***	1.718	***	1.687	***
Ever/using contraceptive	2.159	***	2.235	***	2.208	***	2.157	***	2.223	***	2.214	***
Religion (Catholic = base)												
Protestant	1.051		1.169		1.127		1.056		1.128		1.132	
Methodist	1.010		1.034		1.021		1.013		1.017		1.024	
Presby	1.309	*	1.346	*	1.347	*	1.318	*	1.327	*	1.348	*
Pentecost/charismatic	1.180		1.243	*	1.238	*	1.187		1.226	*	1.238	*
Moslem	0.586	***	0.654	**	0.652	**	0.586	**	0.662	*	0.653	**
Tradition/spiritualist	0.511	**	0.499	**	0.493	**	0.511	**	0.492	**	0.495	**
No religion	0.505	***	0.517	***	0.517	***	0.508	***	0.512	***	0.516	**
Ethnic group (Akan ethnic group = base)												
Ga_damgme	1.053		1.063		1.035		1.050		1.037		1.038	
Ewe	1.240	*	1.187		1.190		1.228	*	1.205		1.185	
Guan	0.841		0.707		0.726		0.830		0.735		0.728	
Mole_dagbani	0.234	***	0.226	***	0.230	***	0.234	***	0.230	***	0.231	***
Grusi	0.341	***	0.347	***	0.348	***	0.344	***	0.339	***	0.348	***
Gruma	0.326	***	0.320	***	0.315	***	0.325	***	0.318	***	0.314	***
Other groups	0.597	**	0.592	**	0.592	**	0.590	**	0.602	**	0.589	***
Household level												
Wealth quintiles (1st quintile = base)												
2nd quintile	0.970				1.009		0.973		0.920		0.993	
3rd quintile	0.802				0.831		0.805		0.730	**	0.786	
4th quintile	1.122				1.208		1.124		1.125		1.203	
5th quintile (Wealthiest)	1.197				1.329	**	1.201		1.114		1.194	
Number of literates in the household	1.038		1.081	**	1.079	**	1.035		1.089	**	1.078	**
Locality	2.393	***					2.272	***				
Level of deveprivation (very deprived neighbourhoods = base)												
Middle-level neighbourhoods			1.495	***	1.477	***	1.190				1.480	***
Affluent neighbourhoods			1.653	***	1.623	***	1.142				1.457	
wealth2_affuent neighbourhood									1.261		1.040	
wealth3_affuent neighbourhood									1.400	**	1.152	*
wealth4_affuent neighbourhood									1.218		1.004	
wealth5_affuent neighbourhood									1.573	***	1.293	

*Neighbourhood level N=352; Individual level N=6725

^Significance level: *p< 0:1; ** p< 0:05; ***p<0:001

[√] Odd ratios reported

5.2.6 Discussion

It is always difficult to have an adequate discussion on elective abortion because of the general lack of complete and unrepresentative data arising from the general reluctance to discuss the issue. Regardless of whatever it is, the incidence of abortion of Ghana is a problem for reducing maternal mortality in Ghana. While women with financial ability could resort to legal and safe abortion procedures, less affluent women tend to indulge in dangerous and illegal procedures.

The majority of women who reported having had an abortion were young, unmarried (never married) and had attained at least secondary education or above. This presents a typical pattern found in other studies (Anniteye and Mayhew, 2011; Kumari and Vijay, 2010; Pallikadavath and William, 2006; Ahiadeke, 2001 and 2002). Younger always wants to delay childbearing until they are married or acquire further education (Anniteye and Mayhew, 2011). Leibowitz and others (1986) also explained that younger women are likely to have short time horizons and likely to view the world differently than more mature women hence current factors tend to weigh heavily in their decisions to keep a pregnancy.

Education, all other things being equal, was expected to have a negative effect on the demand for abortions as it is known to increase peoples' knowledge about effective contraceptive techniques so that women may not have to conceive if they do not wish to. On the contrary, other studies have explained that education might indeed increase demand for abortions since it raises the opportunity cost of a household's time (Becker, 1965; Willis, 1973). Where childcare is time-intensive relative to other goods, it raises the relative price of an additional child to a woman whose educational attainment is relevant to securing her source of livelihood. Agrawal (2007)

also suggested that educated women are more likely than uneducated women to have information and access to abortion services and that could explain the high likelihood of obtaining an abortion. Lawrence and others (2005) further noted that even among older women and women who had children, disruption of schooling can be a reason for resorting to abortion to abort a pregnancy.

In the literature, locality of residence (urban), media exposure and religion are important factors associated with a woman's likelihood of aborting a pregnancy. For example, Ahiadeke (2001) using a multivariate logistic regression analysis noticed an increased likelihood of abortion among urban women in Ghana. Pallikadavath and William (2006) also noticed in India, for instance, that women who lived in rural areas were less likely than their counterparts in urban areas to have had an abortion. The consistency of the locality factor in similar studies may not just be a reflection of a lack of abortion services in rural areas but also a lower demand for abortion in rural areas due to limited exposure to the media (Pallikadavath and William, 2006). Besides, women in rural areas also endure a strict adherence to traditional, norms and values compared to women living in urban areas.

Studies suggest that the Muslim religion in particular have beliefs that specifically preclude the use of abortion (Pallikadavath and Stones, 2006; Bose and Trent, 2006). For instance, Islam does not permit a woman to abort a pregnancy simply to avoid shame or hide a sin (Islam Learning Material, 2012). The only conditions that permit abortion under Islam are if a child has serious deformities, cases of rape or incest, and victimized women (Islam Learning Material, 2012; Queensland Health and Islamic Council, 2010). Under these conditions, if it must be done, it

should be before the foetus survives up to 120 days. The only time a woman can abort a pregnancy even after four months is when it is found that giving birth will endanger the mother's life.

Abortions are also found to be strongly associated with socioeconomic status of the household. Abortion was also found to be associated with wealthy households. This is consistent with other studies such as Bose and Trent (2006) who found that higher standards of living or higher income is associated with the likelihood of a woman undergoing induced abortion. The reason for this may be that women belonging to households with a higher standard of living have better access to health services in general and abortion services in particular especially from private medical care providers. Therefore, women with higher wealth status are likely to have greater access to both public and private abortion service providers. On purely economic arguments, we may also attribute this to the fact that abortion is a normal good with an income elastic demand (Medoff, 1988).

Beyond the individual and the household level factors that are associated with a woman's decision to abort a pregnancy, the results further showed that women living in less deprived neighbourhoods were many times more likely to have had an abortion compared to women living in very deprived neighbourhoods, even after controlling for socioeconomic status of families. This supports the thesis that the neighbourhood has an influence on the decision to have an abortion. This effect was examined further by creating an interaction term between household wealth and neighbourhood deprivation status. The results showed that not only is less deprived (affluent) neighbourhoods having a positive and strongly significant effect on the likelihood of

aborting a pregnancy, but women in middle level households living in affluent neighbourhoods have a significantly higher likelihood of having abortion (in the full model; 9) compared to women other women in affluent areas. Indeed a middle level household's chance of undergoing an abortion increases nearly six times if they live in affluent neighbourhoods compared to living in a middle-level neighbourhood.

Pathways through which neighbourhood characteristics influence elective abortion

Women from higher-income, better-educated families living in less deprived neighbourhoods are more likely than poorer women to abort a pregnancy. Wealthier families are usually the ones able to afford medical abortion services and can elect to abort a pregnancy. Three theoretical pathways are employed to explain the underlying reasons that influence women to undergo abortion. These are the psychosocial aspects of an unwanted (unplanned) pregnancy, the role of private market actors and the economic argument (competitive market effect).

Psychosocial theory

Pregnancy which is supposed to be a desirable outcome of a sexual relationship, when it is not intended or occur to a teenager and/or unmarried person the reception can be mixed and the interpretation embarrassing. In the case of unmarried women or teenagers, society's reception and interpretations is usually negative. It is seen as a reflection of falling moral standards in a family (Mauldon and Delbanco, 1997). One's immediate neighbourhood can exert enormous psychological and social pressure on one's behaviour and that can influence whether or not an unwanted pregnancy is kept to term. The neighbourhood usually present a context where the fortunes or misfortunes of residents are always evident to all. It is at the neighbourhood level that

the stigma of teenage or "unclaimed" pregnancy is most often articulated. Under such circumstances, even though abortion is the most condemned maternal behaviour, it becomes the most accessible option.

Bleek (1972), for instance, found that even though mothers try to keep their daughters away from abortion, when two mothers were faced with an unwanted pregnancy, they incited their daughters to have an abortion. This is to avoid bringing shame and condemnation or blame on oneself and one's family. In this analysis nearly 20% of those who did abortion did so due to feeling of shame, for the avoidance of stigma and due to parental pressure because they were either not married or boyfriends absconded and denied pregnancy or rejected them.

The role of private market actors

The role of private market actors also influences women's decision to abort a pregnancy. Private market actors are essentially persons who control institutional resources located in a neighbourhood, and serve as points of interface between neighbourhood residents and vital services. The prevalence of private market actors in encouraging or discouraging certain behaviours by residents in a neighbourhood is studied in other jurisdictions (Horowitz et al. 2004; Zenk et al., 2005). Even though discussions about the effect of private market actors on residents' behaviour is lacking in Ghana, there is substantial evidence from developed countries' context (e.g. U.S.) regarding large spatial variations in distribution of market actors and how their proximity affects health-related behaviours of neighbourhood residents (Horowitz, 2004; Zenk et al., 2005).

Even though this study does not have data on the distribution of health facilities or health service providers, anecdotally, affluent neighbourhoods, especially high-class urban areas are known to be fertile places for private clinics, pharmacies, and other mobile medical service providers (including quack doctors). The spatial concentration of these private market actors may actually provide the stimuli that influence the behaviours of neighbourhood residents, including seeking abortion services (whether legal or illegal). The data shows that nearly eight out of ten women who had an abortion did it with a private medical provider (this includes private hospital, clinics and pharmacies) either in the woman's home or in provider's facility (Appendix F; Table 2).

One other explanation for the predominance of the use of private providers may be due to the use of the NHIS. Technically, the Ghana NHIS does not cover elective abortion. However, Regulation 19(1) of the law requires the scheme to cater for victims of medical emergencies which include Medical, and Obstetric and Gynaecological emergencies (NHIS Regulations, 2004 (LI 1809)). Healthcare providers revealed during in-depth interviews that most women after having attempted an abortion outside the formal health system are sent to health facilities with severe obstetric complications. The treatment of cases of attempted abortion under the NHIS can only be seen as an opportunity for health facilities (including public facilities) to navigate the legal barriers to provide abortion services and a more convenient way to escape other ethical proscriptions associated with it and to make money.

Economic argument

The economic argument relies on the fertility control behaviour model which posits that a household's fertility control decision is based on a comparison of the costs and benefits associated with an additional child over time (Michael, 1973). The net cost of an additional child represents a household's effective excess demand for children, given prices, income level, level of production of complements and substitutes, among others. If the net cost is positive, a woman will engage in fertility control by purchasing and using goods and time inputs to reduce the probability of conception. According to Medoff (1988) abortion is a "good" that reduces that probability to zero. The opportunity cost of an abortion is then directly related to the cost of not aborting, which is the direct and indirect cost of childbirth and childrearing (King et al. 1992).

The other reality is that in an economy where employment opportunities are limited (high unemployment and under-employment) and local economic space is narrow, the contest for economic opportunities is usually intense. Women in both formal and informal sector are concerned about losing their employment to pregnancy and childrearing. Given these economic realities especially in urban areas, women in labour force, regardless of marital status, have a greater opportunity cost of an additional child than housewives and by extension would have a greater demand for abortions. The data shows that the predominant reason for having an abortion is to delay childbearing (28%) and the other is the woman's inability to cater for a child (20.7%) (See Appendix F Figure 1).

5.2.7 Concluding this section

For every person, the pathway from sexual initiation to motherhood involves a sequence of choices: whether actively or passively, all reproductive women make choices about their fertility. The focus on abortions in the media and policy discussions has primarily been on this choice, pinning it down to moral and ethical issues. Antagonists of abortion perceive women and medical doctors obtaining and giving abortion services respectively as tainted or discredited (Kumar et al. 2009). Whatever the case may be, besides the implications of abortion for maternal mortality, abortion could lead to depletion of the reproductive basket and can affect later chances of pregnancy or safe delivery.

Beyond the individual and household characteristics, we started out that the neighbourhood within which an individual lives has an impact on the behaviour of elective abortion. We conclude from this study that elective abortion is not a problem in highly deprived neighbourhoods neither is it overly concentrated in affluent or advantaged neighbourhoods. It is essentially a middle-level neighbourhood problem. These neighbourhoods can be seen as mimicking a growing economy where there is high level of social and ethnic diversity due to immigration. Even though we originally found that affluent neighbourhoods were significantly associated with higher likelihood of abortions, the cross-level models show that it is women who are in middle-level households (3rd quintile) living in affluent neighbourhoods that are significantly likely to undergo abortion.

In Ghana, human rights activists and reproductive rights advocates have argued for an inclusion of abortion services under the national health insurance scheme (Lithur, 2008). The argument among others is that poor women wanting to undertake abortion are unable to do so because of

cost outlays and more often resort to unsafe means. The position being contemplated in this section is that a full scale provision of abortion services under the scheme will only serve to deepen inequities in the health system since the majority of women who reported having committed an abortion are not the poor, and not many people did it because they thought they were economically incapable of taking care of an additional child. Only about two out of ten cited inability to cater for a child as a reason for an abortion. Making it free will therefore mean cross-subsidising the affluent and not the poor and it will further put pressure on the teething national health insurance scheme.

Unsafe abortion is the most easily preventable cause of maternal death. Policies trying to curb unsafe abortion and its related causes will not address existing social problems that undermine these efforts if neighbourhood institutions do not function well. Public education is crucial to make women sufficiently aware of the adverse consequences of self-induced abortion (especially repeated abortions) on their reproductive lives. In terms of the effects of legalization, the evidence suggests that legal status makes little difference to overall abortion levels across the world. Besides it is fundamentally difficult to prosecute abortion cases (Ahiadeke, 2002).

These findings further demonstrate one methodological point, that an analysis of a socio-psychological outcome such as terminating a pregnancy must sufficiently contextualise the conditions in which this is done. The issue of abortion is not just a problem of the young and unmarried, but a "disease of urbanisation", precipitated by the burden of stigma and social chastisement associated with unplanned pregnancies, and perpetuated by the activities of private market actors, and also the need to continue to be part of the growing competitive market. There

is a strong need to study the level of deprivation as evident in varying degrees in different neighbourhoods to specifically understand how that impact on women's demand for abortion. It is important to however acknowledge that because a cross-sectional data is being used here, the selective processes by which members move within and between areas is not easily understood, nor is the impact of that movement on the study theorised.

5.3 Socioeconomic determinants of maternal mortality: a look beyond individual responsibilities

5.3.1 Introduction

The WHO (2012) defined maternal mortality as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. Among human development indicators, maternal mortality is known to show the most pertinent inequalities between resource-rich and resource-poor countries (McClure, Goldenberg and Bann, 2007). In 2010 the global estimates of maternal mortality indicated that maternal mortality ratio (MMR) had declined by 48 per cent from 400 in 1990 to 210 maternal deaths per 100,000 live births in 2010 (WHO, 2012). In developing regions it was (higher at 240) about 15 times higher than in developed regions (WHO, 2012).

The relative risk of death was 1 in 150 in comparison to 1 in 3800 for women in the developing and developed countries respectively (WHO, 2012). Sub-Saharan Africa had the highest MMR at 500 maternal deaths per 100,000 live births, with riskier life-time chances of death at 1 in 39 births. This latest estimates shows that whilst developed countries are making progress towards achieving the MDG 5 target of a 75 per cent reduction of the 1990 ratio by 2015, for developing countries, giving birth remains a dreaded threat to life. The uneven progress and disparity in maternal mortality between developed and developing countries and particularly for sub-Saharan Africa is a matter of considerable global interest.

Ghana is among a few countries in the sub-region that are said to be making progress towards achieving the MDG 5 target (WHO, 2012). Between 1990 and 2010 Ghana's average annual reduction rate was 2.6% which is about half of the expected annual reduction rate of 5.5%. Statistics on trends of maternal mortality produced by the WHO (2012) indicates that Ghana's MMR declined from 580 deaths per 100,000 live births to 350 deaths per 100,000 live births between 1990 and 2010. Adult lifetime risk of maternal death measured in 2010 slightly improved from 1 in 66 to 1 in 68, better than compared to 1 in 39 for the sub-Region. Notwithstanding this, there are concerns over increasing disparities in the rate of maternal mortality in Ghana which appear to display similar patterns as the case between developed and developing countries. In particular, there are considerable differences across regions, with the northern regions showing MMR of over 800 maternal deaths per 100,000 live births (Ghana MDG Report, 2006).

Studies have suggested that maternal mortality, the most sensitive outcome of poor maternal health, could be associated with critical conditions of the areas within which women live (de Graaf, et al. 2012; Agyemang, et al. 2009; CEMACH, 2008; Lewis, 2007). This section examines the relationship between socioeconomic inequalities at both the individual and the neighbourhood level and the risk of maternal mortality in Ghana. The intention is focus on "underlying" factors at the neighbourhood level that are associated with maternal mortality outcome.

5.3.2 A review of literature on determinants of maternal mortality

Using McCarthy and Maine's conceptual framework (1992) as the guiding framework, maternal mortality is seen as the culmination of a series of events in a woman's life where pregnancy is the most proximate one. McCarthy and Maine noted that the underlying issues have to do with the onset of pregnancy complications, poor awareness of these complications (lack of education), as well as poor access to health care. There are also issues of poor nutrition and poverty as well as cultural factors, such as low status, early marriages, cultural dietary practices during pregnancy, and ambivalent standards regarding sexual practices and unplanned pregnancies, resulting sometimes in clandestine abortion or prepubertal and unhappy marriages which tend to increase the risk of maternal deaths.

McCarthy and Maine's (1992) framework is organized around three general stages or components of the process of maternal mortality. The closest is the sequence of events or outcomes that culminates in either disability or death (proximate factors). These outcomes are pregnancy and pregnancy-related complications. Second are the set of intermediate determinants: women health status; their reproductive status; their access to health services; and their health care behaviour (including her use of health services, health lifestyles) which influence these outcomes. The third is the set of socioeconomic factors which are at the greatest distance from the risk of maternal death.

Pregnancy is the starting point in the process because it is the necessary precondition for a death to be classified as maternal death. Pregnancy is the biological state through which all other factors influence maternal death, but which varies from woman to woman. The most obviously

known proximate cause of maternal mortality is the onset of obstetric complications. Obstetric complications can either be direct or indirect. A direct obstetric death is one due to complications of the pregnancy itself, delivery, or the postpartum period, including abortion-related complications. Indirect obstetric deaths are those due to existing medical conditions that are amplified by the pregnancy, or from conditions unrelated to the pregnancy (McCarthy and Maine, 1992).

Maternal deaths due to direct obstetric causes are recorded in developing countries where approximately three-quarters of such causes are reported as compared to one-quarter attributable to indirect causes (Khan, et al. 2006). Common complications that are responsible for deaths due to direct obstetric causes include haemorrhage, abnormalities resulting from unsafe abortion, pregnancy-induced hypertension, and obstructed labour (Maine et al., 1987). These issues have not changed considerably over the years in spite of the implementation of safe motherhood initiatives and medical interventions in developing countries (Khan, et al. 2006). In Africa, the percentage contribution of postpartum haemorrhage (PPH) to total maternal deaths is between 13.3 percent and 43.6 percent (Khan et al. 2006).

At the intermediate level are factors that impact on both the risk of pregnancy and pregnancy complications that may eventually lead to death. McCarthy and Maine's four set of factors that predispose women to the risk of death are the health status of the woman, reproductive status, access to health services and health care behaviour (including utilisation). The health status of the woman depends on the nutritional status (anaemia, height, and weight), infections including parasitic diseases (malaria, hepatitis, and tuberculosis), other chronic conditions (diabetes,

hypertension), and prior history of pregnancy complications. A woman's personal health status prior to and during a pregnancy has an important influence on her chances of suffering and surviving a complication. The leading pre-existing health conditions that are exacerbated by pregnancy and delivery and account for approximately one-quarter of maternal deaths in developing countries are malaria, tuberculosis, hepatitis, anaemia, and malnutrition (Maine et al., 1987; Royston and Armstrong, 1989).

Among the factors that predispose women to the risk of maternal mortality are age, birth parity and birth spacing (Geubbels, 2006; Tahzib, 1989). Although every pregnant woman runs the risk of developing a complication during pregnancy, delivery or the period after delivery, complications are more common among teenagers and older women, women in their first pregnancy and women in their fourth or higher pregnancy, women with short birth intervals, and women who had a complication during a prior pregnancy (Geubbels, 2006). Empirically, age has been shown to have a concave relationship with the maternal mortality ratio, with risks higher for very young women and older women (Tahzib, 1989). Younger women are more likely than others to experience prolonged labour as a result of immature pelvics (Tahzib, 1989). Younger women are also more likely to experience unwanted pregnancies and more likely than others to seek an abortion, even if the only procedures available are unsafe, increasing the risk of death. Higher rates of maternal mortality is also among older women aged 40 and over (Lewis, 2007).

Another factor that determines whether risks of maternal health can result in mortality is access to maternal health services. There is evidence that physical distance, financial barriers, shortages of trained personnel, especially in rural areas, and poor performances of trained personnel

contribute to high levels of maternal mortality in developing countries. Geographical location of services has a direct impact on attendance for antenatal care and service at delivery. Thaddeus and Maine (1994) noted that there is a disincentive to attend antenatal care at facilities far away due to the distance involved to be travelled, availability of affordable transport and the condition of the roads. Geubbels (2006) discussed the "distance decay" factor; implying that the further a patient lives from a health facility, the less likely they are to utilise its services. Narayan and others (2000) suggest distance and travel as the single biggest obstacle to the reduction of maternal mortality, more so even than cost of care at the facility.

The use of healthcare services is perhaps the most critical determinant of the risk of maternal mortality. The use of ANC and the use of care during and after labour and delivery are important in detecting and managing pregnancies and the immediate complications associated with pregnancy. Graham and others (2001) estimated that around 13% to 33% of all maternal deaths may be avoided by skilled attendance at delivery through prevention of four main complications (obstructed labour, eclampsia, puerperal sepsis and obstetric haemorrhage). In a study using cross-country-level data from sub-Saharan Africa, Prata et al. (2009) found that family planning and safe-abortion services saved a higher number of lives followed by antenatal care. Utilisation of maternal healthcare services in developing countries is however poor in relation to adequacy and timing of use. Many women who attend ANC come only once or twice and often late in pregnancy. For supervised delivery, many women only agree to attend when they encounter complications in attempted deliveries at home. This unsatisfactory use of maternal healthcare (MHC) in developing countries is attributed to factors such as poverty, illiteracy, cultural (traditional) and religious practices (GSS et al.2009a & 2009b).

There are also health behaviours that are known to have deleterious impact on the outcome of pregnancy and safe motherhood. These include the use of illicit abortion practices, indulging in harmful traditional practices during pregnancy and childbirth, smoking and alcohol consumption. The most documented reproductive health behaviour that is detrimental to life is engaging in illicit abortion or self-induced abortion practices (Haddad and Nour, 2009; Reardon et al. 2004). Studies have shown that pregnancy-associated deaths are two to four times higher for aborting women compared to delivering women (Reardon et al. 2004), and globally, unsafe abortion claims about 13 per cent of maternal deaths (Haddad and Nour, 2009). Determinants of unsafe abortion apart from health reasons include a desire to continue work, schooling or apprenticeship, avoid social stigma, deal away with unwanted pregnancy, etc. This leads us to the set of factors called distant factors that are equally important in explaining the risk of maternal mortality.

The distant factors are important to the risk of maternal death as they have an extended influence on a woman's health status, access to health care and health behaviour. These are factors encapsulated in the socioeconomic status of women, family and the community. They are reflected in educational attainment, occupation, income or wealth all at the individual or family level and aggregate wealth and community resources at the community level. Several studies have established that the risk of dying is strongly influenced by one's status in the society (Kaplan et al. 1987; Antonovsky, 1987; Feinstein, 1993; Kaplan and Keil, 1993). The poor, less educated and disadvantaged are more likely to die than are the affluent and more informed.

The collective resources and wealth of a community are important dimensions of socioeconomic status that are likely to have a strong influence on the health of a population. Anderson and others (1997) noted that even though family income has a stronger association with mortality than the area in which people live, area socioeconomic status more broadly has an independent and substantial contribution to mortality. Wing and colleagues (1988) and Taylor and others (1993) both showed that changes in the socio-environmental characteristics such as an areas' economic profile and average educational attainment predict declines in mortality attributable to heart disease.

Using various measures of a neighbourhood's level of development, studies also concluded that the risk of maternal mortality is compounded by macrostructural circumstances of the neighbourhood within which a woman resides beside the usual biomedical factors which are similar throughout the world (CEMACH, 2008; Lewis, 2007). As indicated earlier, the common measures of a neighbourhood's level of development are the index of multiple deprivation, concentrated affluence, and concentrated poverty. Using the measure of multiple deprivation, studies in England have shown that there is a strong association between area deprivation and maternal mortality with areas of high deprivation recording higher rates, and women living in the most deprived areas (fifth quintile) are around five times more likely to die from maternal causes than those in the least deprived quintile (Lewis, 2007).

Another important condition of the neighbourhood that could impact on maternal survival is the level of ethnic diversity. In cross-country studies, it is suggested that ethnic diversity is negatively associated with the provision of public goods including health services, meaning that

where ethnic diversity is high, public goods are poorly provided (Miguel and Gugerty 2005, Habyarimana et al 2009). All other things being equal, a highly diverse neighbourhood should have higher rate of maternal mortality. But in a similar cross-country analysis, Platas (2010) found that in sub-Saharan Africa ethnic diversity was negatively associated with the risk of maternal mortality. From a sociocultural context, ethnic diversity may be associated with increased opportunities for cross-cultural interaction and sharing of important experiences which can offer positive health opportunities for women.

Concentration of ethnic groups in ethnic enclaves may only serve to concentrate the exposure to culturally bias health practices with adverse health outcomes. Certain ethnic beliefs, norms and traditions regarding fertility-related behaviours and outcomes strongly influence certain reproductive health behaviours. In some Ghanaian societies, for instance, the observance of certain dietary practices during pregnancy and the peculiarly elaborate rituals that accompany the death of a woman in pregnancy or during delivery reflects their traditionally orthodox understanding of women's reproductive issues. Among the Kasena-Nankanis in the Upper East region for instance, pregnant women are restricted to vegetarian diet; they must not eat meat and groundnut lest they give birth to 'spirit children' (see Senah, 2003). Observance of these taboos may exacerbate already deficient nutritional and anaemic status of pregnant women which can increase the risk of mortality.

To deal with the tragedy of maternal mortality in society therefore, there is the need for an integrative approach that contextualises the individual factors in a multisectoral framework. The number of possible combinations of all personal level and technical factors is vast, but not

enough of these combinations get to the underlying determinants of maternal mortality in our communities. The interplay among technical elements, the intermediate factors and the distant factors can facilitate maternal mortality reduction. This study seeks to examine that interplay focusing more attention on the neighbourhood within which women live.

5.3.3 Data and analytical model

The datasets used for this section comes from the women-specific and the verbal autopsy component of the GMHS. The 2000 PHC data is used to construct the neighbourhood level variables. Included in the GMHS is a verbal autopsy model where siblings or a closed surviving relative of a deceased woman was interviewed about the causes of death of the deceased woman if aged 12 – 49 years. The verbal autopsy collected information on signs and symptoms observed prior to the death, plus an open-ended narrative of the circumstances surrounding the death. The verbal autopsy data is useful for this analysis because it has information that can also be used to measure socioeconomic status of deceased women which is not collected in the sibling history questionnaire.

Estimating the determinants of maternal mortality

This analysis is based on a case-control design in which women who died during pregnancy, delivery or in the postpartum period (cases) are compared with a group of women who gave birth and did not die (control). Case-control studies similar to this one have historically been a statistically powerful design to identify risk factors (Gupta et al. 2010; WHO, 1994). The starting point in the data extraction process in this study is that all maternal deaths confirmed in the verbal autopsy data are regarded as cases, while the controls are carefully selected from women

reporting a live birth during the same period (using the last 5 years preceding the survey: 2002 – 2007 as the reference period) and in the same sampling cluster. All female deaths in the reproductive age that are established to be due to maternal causes are included in the study as cases. The controls were selected from 5,023 women who reported a live birth during the same period and about whom the desired information was available. Cases and controls are not matched, which is to be expected as maternal deaths are not common events.

Since the outcome of interest is binary: either a woman dies of pregnancy-related reasons (Y = 1) or survived a pregnancy (Y = 0) the appropriate model formulation for the analysis will be a probit or a logit model. Given the hierarchical or nested nature of the data, a two-level model is used to allow for correlation between mortality due to characteristics of individuals living in the same neighbourhood, and to explore the extent of between-neighbourhood variation in maternal mortality. The approach consists on first defining a model at the individual level, and then estimating the statistical model that results from aggregating the individual-level model over individuals in an area. First the individual-level model is expressed as follows:

$Y_{ik} = 1$ the woman dies from pregnancy - related conditions with a probability of P_{ik}

$Y_{ik} = 0$ the woman survives a pregnancy with a probability of $1 - P_{ik}$

Where

$$P_{ik} = \beta X_{ik} + \alpha_k \qquad \text{Eq.5.3.1}$$

i and k denote the ith woman and the kth neighbourhood respectively. X_{ik} is a vector of regressors and β represent parameters to be estimated. α_k is a constant that captures the effect

of neighbourhood specific characteristics that influence the probability of a woman dying of maternal causes. From here, the expected value of Y_{ik} is expressed as:

$$E(Y_{ik}) = 1 \times \Pr(Y_{ik} = 1) + 0 \times \Pr(Y_{ik} = 0) \qquad \text{Eq.5.3.2}$$

Therefore, the full model can be defined as:

$$Y_{ik} = \beta X_{ik} + \alpha_k + \varepsilon_{ik} \qquad \text{Eq.5.3.3}$$

where ε_{ik} is an error term with zero mean. Note that in this formulation, the probability of dying is assumed to depend linearly on the regressors for estimation purposes. This does not rule out the possibility of non-linearity in the relationship between mortality and variables such as age and wealth as suggested in previous studies (Leon-Gonzalez and Tseng, 2010; Gravelle et al. 2002).

Based on the conceptual framework presented in Figure 3.1, explanatory variables are included from both individual level and neighbourhood level. Individual level variables included are age, education, and marital status, the only individual level variables available in the data that allows a comparison between maternal mortality cases and women who had safe deliveries. The key neighbourhood variable is the measure of deprivation (IMD). The other factors that are included to reflect socioeconomic nature of the neighbourhood is aggregate literacy, aggregate education, aggregate employment level and ethnic and religious diversity. Aggregate literacy, education and employment are measured as the proportion of the population 15-60 years who are educated up to secondary school level or above, and can read in the English language and or any other Ghanaian language, and who are employed. These are disaggregated for males and females.

5.3.4 Univariate and Bivariate analysis of data

The mean age of women who died from pregnancy-related causes was 29 years. The number of reported maternal deaths declined with age but increased after the age group of 25-29 years (Table 5.3.1). More maternal deaths are recorded in the lower age group of 15 - 19 among which 78 per cent of pregnancies recorded led to deaths. There are more maternal deaths among women with no education. More deaths were recorded among women with secondary education than those with JHS/MSLC or primary school education. Many of the deaths in this category could be associated with abortion practices.

There are also higher maternal deaths among widowed women (76.5 %) than divorced and women in consensual union. Maternal deaths recorded among women who have never married is about 7% points higher than women who are married. There are many maternal deaths recorded in small cities and towns than in rural areas and large cities. Maternal deaths reported in the rural areas (39.7%) are only about 6% higher than deaths recorded in large cities.

The bivariate analysis with level of significance reported in the last column of Table 5.3.1 indicates that there are significant variations in reported maternal mortality by the selected individual and community factors. The differences observed across age, education and marital status on the individual level and locality type are all significant at 1%. The relationship between the probability of dying a maternal death and age is not linear with higher risk among women aged 15-19 years. The relationship between locality and the probability of dying from pregnancy-related conditions is linear, showing increasing incidence as you move out from the large cities to small cities and towns. However, the incidence appears lower in the rural areas.

Table 5.3.1: Characteristics of GMHS data used in the analysis

Characteristics		Total	Controls		Cases		P - value
			n = 769	Percent	n = 670	Percent	
Age	15-19	88	19	21.6	69	78.4	
	20-24	314	188	59.9	126	40.1	
	25-29	378	226	59.8	152	40.2	
	30-34	289	161	55.7	128	44.3	
	35-39	230	114	49.6	116	50.4	
	40-44	102	41	40.2	61	59.8	
	45-49	38	20	52.6	18	47.4	0.000
Education	No education	396	172	43.4	224	56.6	
	Primary	332	193	58.1	139	41.9	
	JHS/MSLC	555	323	58.2	232	41.8	
	SHS/Voc.	120	62	51.7	58	48.3	
	College/higher	30	19	63.3	11	36.7	0.000
Marital status	Married	1084	525	48.4	559	51.6	
	Loose/consensual union	131	117	89.3	14	10.7	
	Widowed	17	4	23.5	13	76.5	
	Divorce/separated	67	64	95.5	3	4.5	
	Never married	143	59	41.3	84	58.7	0.000
Locality of residence	Large city	258	171	66.3	87	33.7	
	Small city	119	22	18.5	97	81.5	
	Town	415	184	44.3	231	55.7	
	Rural	650	392	60.3	258	39.7	0.000

5.3.5 Determinants of maternal mortality

The relationship between the index of deprivation and maternal mortality was first examined by correlation analysis, and then followed with a multilevel logistic regression. The composite index is significantly positively correlated with maternal mortality: r = 0:72 ($p<0.05$). The correlations between maternal mortality and the original indicators used in the construction of the deprivation index are also summarized in Appendix D (Table 2).

The logistic regression analysis started by considering an unconditional model (results however not reported), which includes no fixed effects to confirm the need for a multilevel analysis. The variance partition coefficient shows that approximately 4.2% of the total variance in the log odds of maternal mortality can be attributed to neighbourhood effect. This is statistically significant suggesting that even though the proportion is small the neighbourhood variations in the risk of maternal mortality cannot be ignored. The subsequent analyses involved a series of models, adding predictors at the individual and neighbourhood levels.

The regression results are presented in Tables 5.3.2. In model 1 individual level factors are added to examine their effect on the risk of maternal mortality. Model 2 added type of locality (large city, small city, town and rural area). In model 3 IMD was added and in model 4 measures of ethnic and religious diversity were included. Model 5 added cross-level interactive factors (IMD interacted with type of locality) to examine the locality where deprivation has the severest impact on the risk of maternal mortality. Models 6-10 introduced level 2 factors thought to have mitigating effect on the risk of maternal mortality and also cross-level interactive variables to examine which combination of factors will have strong reducing effect on the risk of maternal mortality.

Individual level variables: age, education and the marital status of a woman are factors significantly associated with the risk of maternal mortality. These factors reflect general social status. Age has a non-linear relationship with maternal mortality with younger (below 19 years) and older age (above 40 years) women having a higher risk of suffering maternal death. This factor remained consistent throughout the series of models conducted even after including

locality of residence and area deprivation level. Maternal education was also consistent in models 1 and 2 showing a lower risk of maternal mortality among women with increasing level of education. The inclusion of locality of residence (locality type: large city, small city, town and rural) and the area deprivation index (IMD) however changed the impact of mother's education.

Women with Junior High School (JHS) education have a lower risk of maternal mortality which is about half as compared to the risk associated with persons with no education (Odds ratio is 0.46: $p<0.05$). Having college education, even though has a reducing effect on the likelihood of maternal mortality, was weakly significant at 10 per cent in models 2 and 3 with the inclusion of locality type (Odds ratio is 0.22). This means that the place of residence is a crucial factor that is associated with the risk of maternal mortality, but perhaps important for persons with higher level of education. Women in loose or consensual union are on the average less at risk of maternal mortality as compared to married women (Odds ratio is 0.027: $p<0.01$). The risk of maternal mortality is also lower with divorced or separated women than married women (Odds ratio is 0.005: $p<0.01$). This effect remained consistent throughout the analysis at the individual level.

The inclusion of level two factors such as the type of locality of residence, the neighbourhood deprivation index (IMD), ethnic and religious diversity did not change so much of the results in the level one factors, suggesting that these factors on their own are significantly strong in explaining the risk of maternal mortality among individuals. Model 2 show that women resident in small cities and towns face higher risk of maternal mortality (Odd ratios of 87.3 and 5.5; significant at 1% respectively) as compared to those resident in large cities. The neighbourhood

deprivation level (IMD) which is the measure of socioeconomic development of an area is introduced in model 3, and the results showed that living in a deprived neighbourhood increases the risk of maternal mortality by 1.58 times ($p<0.05$). The inclusion of the deprivation index appeared to have an added power and significance to the effect of living in small cities which increase the risk of maternal mortality further by 5 points (Odds ratio 92.3: $p<0.01$) in model 3. This signifies that there may be differential impact of deprivation on the risk of maternal mortality for different localities.

Model 4 included ethnic and religious diversity. The results showed that living in ethnically diverse areas is associated with less risk of maternal mortality (Odds ratio of 0.10: $p<0.01$) as compared to ethnically homogenous neighbourhoods. Religious diversity, however, does not seem to have any significant association with the risk of maternal mortality even though the odd ratios are positive for religiously diverse neighbourhoods. The inclusion of the diversity factors caused a slight change in the results at the individual level. In particular, it suppressed the importance of education (college or higher education). It also decreased by about 23 points the effect size that living in a city or town had on the risk of maternal mortality in model 3. This shows the importance of the contextual conditions that women live in and how it affects the individual socioeconomic status in relation to the risk of maternal mortality.

Table 5.3.2: Multilevel logistic regression showing predictors of maternal mortality

Maternal Mortality		Model 1	Model 2	Model 3	Model 4	Model 5
Intercept		7.420 ***	6.681 ***	6.629 ***	7.705 ***	7.159 ***
Age		0.675 ***	0.684 ***	0.687 ***	0.680 ***	0.684 ***
Age squared		1.006 ***	1.006 ***	1.006 ***	1.006 ***	1.006 ***
Marital status	(Married = Ref.)					
Loose/Consensual union		0.025 ***	0.026 ***	0.028 ***	0.027 ***	0.027 ***
Widowed		6.516	6.840	7.222	5.531	5.877
Divorced/Separated		0.007 ***	0.005 ***	0.005 ***	0.004 ***	0.004 ***
Never married		0.872	0.780	0.806	0.805	0.799
Highest education attained	(None attained = Ref.)					
Primary School		0.587 *	0.522 *	0.569 *	0.621	0.640
MSLC/Junior High School		0.469 **	0.414 ***	0.474 **	0.480 **	0.484 **
Senior High School		0.742	0.611	0.693	0.775	0.789
College / Higher		0.303	0.223 *	0.229 *	0.270	0.265
Locality Type	(Large city = Ref.)					
Small city			87.288 ***	92.252 ***	68.711 ***	98.413 ***
Town			5.450 ***	5.467 ***	2.951 **	5.105 ***
Rural			0.632	0.486	0.227 ***	0.325 **
IMD				1.575 **	1.752 ***	0.743
Ethnic diversity	(Ethnic homogeneity = Ref.)					
Intermediate diversity					0.414 **	0.415 **
Highly diverse					0.101 ***	0.108 ***
Religious diversity	(Religious homogeity = Ref.)					
Intermediate diversity					1.705	1.837
Highly diverse					1.527	1.543
IMD#Locality type	(Large city = Ref.)					
IMD # Small city						1.723
IMD # Town						2.867 *
IMD # Rural						2.606 *

Significance level: *p< 0:1; ** p< 0:05; ***p<0:001

Cross-level effects and the risk of maternal mortality

In model 5 an interactive term for IMD and type of locality is added to assess where the impact of deprivation is severe. The results showed that the impact of deprivation is severe in towns and rural areas. The risk of maternal mortality was approximately 3 times higher in towns and rural areas that have high deprivation indices (Odds ratio of 2.9 and 2.6 significant at 10%

respectively) as compared to large cities. In this model, the neighbourhood IMD variable kept in the model as a single indicator on its own lost its significance. This perhaps implies that the deprivation index has a gradient effect and must be seen in terms of levels or degree of deprivation (this disaggregation is used in the next section). The subsequent model shows that highly deprived neighbourhoods are prone to high risk of maternal mortality.

Neighbourhood characteristics such as the proportion of people employed, proportion of people with secondary education (secondary or higher level education) and adult literacy (able to read English language and or any Ghanaian language) are important factors that are expected to impact positively on the risk of maternal mortality. These are introduced in models 6, 7 and 8. In the first of these models (Model 6) the results showed, rather counterintuitively, that living in a neighbourhood where a higher proportion of the people employed are females is associated with a higher risk of maternal mortality (Odds ratio of 1.4 significant at 10%). A neighbourhood dominated by a higher proportion of males employed does not have any significant association with the risk of maternal mortality. However, when these two related variables are in the model together (Model 7), it shows that it is neighbourhoods that have a higher proportion of males employed as compared to females that are associated with a higher risk of maternal mortality (Odds ratio of 1.85; significant at 5%).

Literacy is generally associated with a lower risk of maternal mortality. This is supported in Model 8 which shows that if a woman lives in a neighbourhood where a high proportion of females are literates, risk of maternal mortality is reduced by approximately 70 per cent (Odds ratio, 0.32; $p<0.0001$). Model 9 includes neighbourhood deprivation index and individual

educational attainment (interaction term) to examine the mitigating power of individual level education. The results reflect a homogeneously increasing effect of IMD on the risk of maternal mortality, even though the level of statistical significance is higher with the first term (IMD and No education) than the second term (IMD and Some education). This suggests that the neighbourhood's socioeconomic status has a suppressive effect on an individual's educational attainment. In other words, an individual's level of education does not appear strong enough to mitigate the toxic effect of neighbourhood deprivation on the risk of maternal mortality. The educational status of the mother is suppressed by the level of deprivation in the neighbourhood, so that whether educated (Odds ratio, 1.75: significant at 1%) or non-educated (Odds ratio, 1.74: significant at 5%), living in a deprived neighbourhood increases the risk of maternal mortality.

In model 10 the effect of aggregate female education level (proportion of educated people in the neighbourhood who are females) and the IMD on the risk of maternal mortality is examined. The result showed that there is a significant mitigating effect of high female education at the aggregate level on the risk of maternal mortality, even in deprived neighbourhoods (Odds ratio of 0.71: $p<0.1$). What this means is that between two communities of equally deprived status the one with a higher proportion of females with secondary education is associated with less risk of maternal mortality. This interactive term further freezes the effect size of the deprivation index on its own in increasing the risk of maternal mortality by 0.2 points.

Table 5.3.2: Continued.

Maternal Mortality	Model 6	Model 7	Model 8	Model 9	Model 10
Intercept	7.848 ***	7.978 ***	8.107 ***	8.104 ***	7.802
Age	0.680 ***	0.688 ***	0.693 ***	0.693 ***	0.691 ***
Age squared	1.006 ***	1.006 ***	1.006 ***	1.006 ***	1.006 ***
Marital status (Married = Ref.)					
Loose/Consensual union	0.027 ***	0.027 ***	0.027 ***	0.027 ***	0.027 ***
Widowed	5.490	6.091	5.700	5.698	5.741
Divorced/Separated	0.004 ***	0.005 ***	0.006 ***	0.006 ***	0.006 ***
Never married	0.814	0.851	0.906	0.906	0.904
Highest education attained (None attained = Ref.)					
Primary School	0.594	0.633	0.699	0.700	0.710
MSLC/Junior High School	0.464 **	0.501 **	0.580	0.580	0.577
Senior High School	0.770	0.853	0.993	0.993	0.985
College / Higher	0.269	0.299	0.338	0.339	0.323
Locality Type (Large city = Ref.)					
Small city	62.065 ***	54.395 ***	35.428 ***	35.436 ***	40.145 ***
Town	2.644 *	2.487 *	1.785	1.786	1.924
Rural	0.190 ***	0.128 ***	0.066 ***	0.066 ***	0.073 ***
IMD	1.918 ***	1.944 ***	1.741 **		1.570 **
Ethnic diversity (Ethnic homogeneity = Ref.)					
Intermediate diversity	0.424 **	0.354 **	0.382 **	0.382 **	0.395 **
Highly diverse	0.109 ***	0.070 ***	0.073 ***	0.073 ***	0.077 ***
Religious diversity (Religious homogeity = Ref.)					
Intermediate diversity	1.608	1.512	1.686	1.687	1.926
Highly diverse	1.465	1.372	1.420	1.421	1.626
Proportion of females who are employed	1.367 *	0.931	1.170	1.358	1.235
Proportion of males who are employed		1.851 **	1.358	1.170	1.363
Proportion of females who are literates			0.315 ***	0.315 ***	0.265 ***
Proportion of males who are literates			1.831	1.834	2.288 **
IMD # No education				1.735 **	
IMD # Some education				1.750 *	
IMD#Prop with Sec educ and above					0.708 *

*Level one variables (individual level) are included in the model but not reported here
^Significance level: *p< 0:1; ** p< 0:05; ***p<0:001

5.3.6 Discussion

The direct causes of maternal death among women are well known as well as the availability of inexpensive methods of prevention and treatment of these direct causes (Khan et al 2006).

However, while the proximate causes of this massive loss of life are well established, the underlying causes of maternal deaths are less well understood. In cross-country analyses, poverty and underdevelopment are often identified as strongly associated with maternal mortality risk differentials. Within country analyses of maternal mortality is however rare, and where they exist, much of the analysis is at the individual level with less understanding brought to bear on the neighbourhoods within which women live and work. This kind of analysis is however important to understand beyond the individual level, macrostructural factors that expose women to the risk of maternal death.

The result of the analysis show that the major risk factor for maternal mortality at the individual level is age (mostly older ages) which seems to have a concave relationship with the risk of maternal mortality. Younger aged mothers (below 19 years) and older age (40 years and above) have an increased risk of maternal mortality. Reasons that could account for this includes the fact that younger women may not be fully prepared psychologically and physiologically to survive 9 months of pregnancy, whilst older women may be getting too exhausted physiologically. The ages of 25-39 are the age bracket with the lowest risk of maternal mortality.

The risk of maternal mortality is significantly lower for a divorced/separated woman and a woman in consensual union than it is for a married woman. There is no statistically significant difference between the risk of maternal mortality for married women and widowed or women who have never married. This is probably because they have reduced likelihood of sexual activities and low fertility. Maternal education shows a decreasing effect on the risk of maternal mortality but the effect is not statistical significant in the last model. This is possibly due to the

inclusion of several variables that also incorporate the educational status of women at the neighbourhood level. It also perhaps shows the suppressive effect of the neighbourhood characteristics on educational attainment of women; conditions that are beyond the ability of individual women.

The major underlying factor that is shown to be associated with high risk of maternal mortality is the level of deprivation of the neighbourhood within which women live. The analysis shows that the deprivation status of a place deteriorates by one more unit, the risk of maternal mortality in the area increases by approximately 2 times. The results further showed that the effect of deprivation on the risk of maternal mortality is severe in rural areas and small towns, contributing approximately 3 times to the risk of maternal mortality as compared to large cities. This result is important for both policy and analytical reasons.

The conditions in a deprived neighbourhood are manifested in poor access to water, sanitation, poor housing, and also characterized by poor road network. This shows that the nature of the area may have an extended influence on several other factors that increases the risk of maternal mortality; e.g. access to health services in general and access to skilled personnel at birth. In deprived rural areas where transport is infrequent as a result of bad roads, walking is the main form of transport, irrespective of the severity of obstetric condition. This can lead to catastrophic outcomes due to loss of timely obstetric attention. High or most deprived rural neighbourhoods can therefore be important areas for programme intervention.

Secondly, the finding that it is the level of deprivation in a rural area that is important and not just rural areas per se is analytically informative. This falls in line with many studies that have argued that using the simple rural-urban dichotomy in analysing health outcomes is inadequate (Weeks et al. 2006; Kausar et al. 1999) and have categorised rural areas for example into rural-high, rural-medium and rural-low depending on the availability and accessibility to critically important social and economic resources (Kausar et al. 1999). Highly deprived rural neighbourhoods fit into Kausar and others' (1999) rural-low categorisation and reflect greater inadequacy of healthcare services, poor road network, and stuck poverty among residents. This study therefore supports the need for a more nuanced analysis of the rural-urban environment instead of the usual discrete and dichotomous categorisation.

The analysis also showed that living in a neighbourhood where a higher proportion of females have higher education (secondary or higher level education) is associated with a lower risk of maternal mortality. An increase in the proportion of females in the population with secondary education (or higher) is associated with a reduction in the risk of maternal mortality by approximately 30 per cent in deprived neighbourhoods. Education has both internal effect on the individual (internal channel) and external effect on other residents in the neighbourhood (externality effect). For the individual, education is crucial in facilitating access to and the understanding of health-related information. Higher maternal education is known to be associated with increased acceptance of modern health practices and higher utilisation of maternal healthcare services (Karlsen et al. 2011; Zhao et al., 2009). An individual's level of education also enhances their understanding of medical treatments, ability to assess risks associated with hazardous behaviour, and aware of the benefits of healthy and nutritious food.

A large body of research in development and health economics has also established that there are externality effects of education on health status of other family and neighbourhood members (Ricci and Zachariadis, 2010; Parashar, 2005). At the aggregate level education improves both health-related behaviours and the quality of health services in the neighbourhood. This is because the average level of education improves a neighbourhood's absorptive capacity for health-related ideas and technologies (Ricci and Zachariadis, 2010). More educated women in a neighbourhood are more likely to trust modern maternal healthcare services more than less educated ones and are typically more receptive of new medical knowledge. There is also the direct externality effect of education. Health-related information is more likely to flow from individuals with higher education in a neighbourhood to the remaining few uneducated women enabling the latter to make better informed health decisions and maintaining a healthier lifestyles.

The results also showed that living in ethnically diverse neighbourhood is associated with a lower likelihood of dying from pregnancy-related conditions as compared to living in ethnically homogeneous areas. This supports earlier results of Platas (2009) suggesting that there are intra-neighbourhood benefits of ethnic diversity which has a reducing effect on the risk of maternal mortality. The cross-cultural interaction that takes place in ethnically diverse neighbourhoods offers greater opportunities to broaden ones variety of experiences; confront stereotypes on social, traditional and ethnic issues that are sometimes inimical to maternal health. These interactions also expose women to different perspectives of health and raise new issues that broaden aspirations.

Ethnic diversity also has a remarkable influence on women's autonomy which has a positive effect on personal reproductive life decisions and healthcare utilisation. Living in an ethnically homogeneous neighbourhood on the other hand can have an injurious effect on women's autonomy. Some ethnic groups are known to be suppressive of women's autonomy. All other things being equal, the effect of ethnically-bias norms are higher in ethnically homogeneous neighbourhoods were the norms and traditions of dominant ethnic groups prevail. Neighbourhoods where there is diversity in ethnic orientation, the traditions and taboos of a single ethnicity are suppressed giving way to more globalised norms and lifestyles that are more favourable to maternal health. In neighbourhoods where there is diversity in ethnic orientation, it is expected that traditions and taboos of these single ethnic groups are suppressed giving way to more globalised norms and lifestyles that are more favourable to maternal health.

5.3.7 Concluding this section

This section investigated the relationship between the neighbourhoods within which women live and the risk of maternal mortality. This was done with the addition of a single composite indicator of Deprivation at the neighbourhood level. This index was constructed using data or indicators that reflect aspects of deprivation that can be experienced by individuals living in deprived areas, relating to: employment, house ownership and room density, access to water, sanitation and source of lighting. Other important factors that manifest socioeconomic development of the neighbourhood within which a woman lives include the level of education and literacy.

The results from the regression analyses provide reason to conclude that women living in deprived areas are associated with a higher risk of maternal mortality as compared to those living in less deprived areas. The impact of deprivation on the risk of maternal mortality is however much higher in rural areas and areas classified as small towns than in large cities. The results further showed that there is a low risk of maternal mortality in neighbourhoods with high proportion of women with secondary education or higher. This mitigating effect remains strong and significant when interacted with the deprivation index. Living in ethnically diverse neighbourhoods is also associated with a lower risk of maternal mortality.

The mechanisms to reduce the risk of maternal mortality can be through education and neighbourhoods' regeneration strategies. Education has a multiplicity of influences at the individual, the family and the neighbourhood level. First of all education empowers women and provides opportunity to adopt new aspirations. Higher education is associated with reduced fertility, increased acceptance of modern health practices and improves utilisation of health services which have a tremendous opportunity to reduce the risk of maternal mortality. The type of education that could lead to a reduction in the risk of maternal mortality from this analysis is when women attain secondary or higher education. This is the level of education that enhances women empowerment, strengthening them to take their own fertility into their hands and also possibly places them in a good position to bargain with men on fertility issues at the household level.

5.4 The effect of healthcare utilisation coverage on the incidence of maternal mortality at the neighbourhood level

5.4.1 Introduction

Regular use of maternal health care service, it is argued, improves maternal health outcomes WHO, 2005; Robinson and Wharrad, 2001). The WHO (2005) for example, attributes the high maternal mortality in developing countries largely to the low proportion of women being attended to by skilled birth attendants. Empirical studies have shown that routine utilisation of maternal healthcare (MHC) has significant benefits for both safe transition of mother through pregnancy and child birth, and the survival and health of both mother and child (Khan 1987). Robinson and Wharrad (2001) found that maternal deaths are substantially reduced when a high proportion of births are attended by health professionals. Campbell and Graham (2006) argued that an important prerequisite to reducing maternal deaths therefore, is universal access to high quality pregnancy and delivery care.

The target of achieving two-thirds reduction in maternal mortality ultimately requires, in part, improved provision of maternal healthcare services including family planning, emergency obstetric care, among others, to enable women to have fewer, better spaced pregnancies (Singh et al. 2009) and also to receive emergency attention in times of complications. It also requires an increase motivation on the part of women and people associated with women in maternity to utilise timely maternal care. This also includes appropriate and effective referral system and emergency obstetric care (Anderson, 2010). A major recommendation in earlier studies therefore is that expanding healthcare services will increase consumption and this will produce the desired impact on maternal health and reduce maternal mortality.

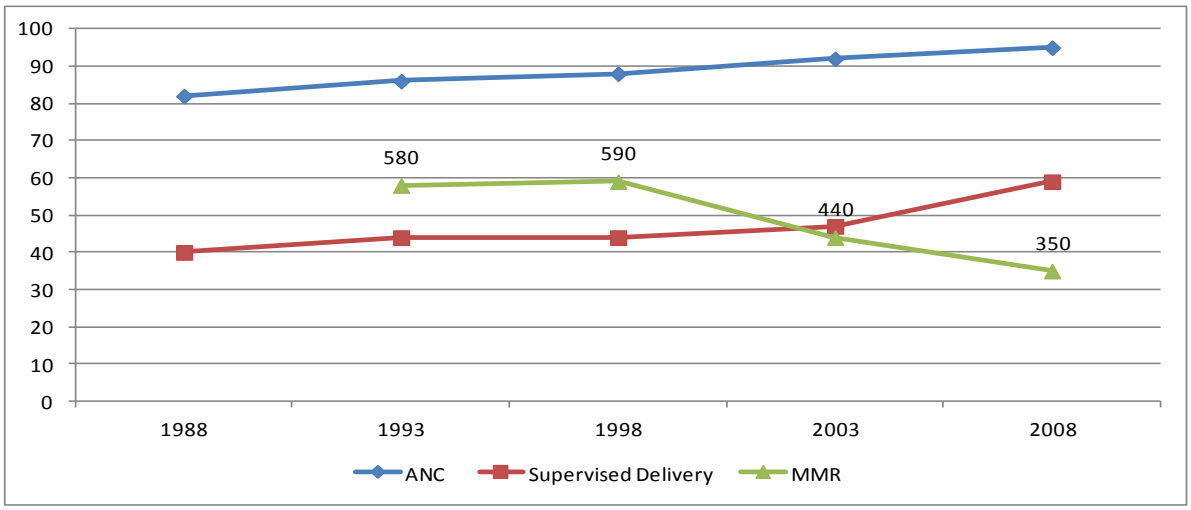
Some studies however, have drawn attention to the fact that there are instances where women who routinely utilise maternal healthcare, yet lose pregnancies and others die while delivering under supervised care (Macfarlane, 2001; Harrison, 1997). This puts doubts on the confirmatory effect of maternal healthcare utilisation on maternal mortality. The case of developing countries, including Ghana for that matter, deserves further analysis in this regard considering that there are disparities in the distribution of maternal healthcare utilisation coverage. The use of courses of maternal healthcare services in Ghana is typically patterned on socioeconomic and neighbourhood configurations. This section examines the relationship between the proportion of maternal healthcare utilisation at the small area level and the incidences of maternal deaths reported in these areas.

5.4.2 Utilisation of maternal healthcare and maternal mortality in Ghana

Regular use of maternal health care service is noted to have improved effect on reducing the risk of maternal death. In Ghana the introduction of a number of maternal health-focus interventions such as the Safe Motherhood programme, the High Impact Rapid Delivery (HIRD) policy, the focused-ANC (FANC) programme, including the Delivery Fee Exemption Policy (DFEP) have all had positive impact on utilisation of maternal healthcare over the last decades. There are measured improvements in Antenatal Care (ANC), Supervised Delivery (SD), Postnatal Care (PNC), Family Planning (FP) acceptor rates and a reduction in fertility rate (Grepin, 2009; GSS et al. 2009a; Witter et al. 2007; Penfold et al. 2007).

Fertility rate declined over the last two decades, reducing on the average by 2 children per a woman between 1988 and 2008 (GSS et al. 2009b). Evaluation of the DFEP and preliminary assessment of the free maternal care component of the NHIS also suggest positive outcomes in terms of increased proportion of births supervised by trained medical personnel and births delivered in facilities (Grepin, 2009; Witter et al. 2007; Penfold et al. 2007). Data from the GDHS show increase in use of antenatal care, supervised delivery and postnatal care (GSS et al. 2009a). It has been suggested that these improvements may have contributed to the marginal but steady decline in maternal mortality (Figure 5.4.1) especially deaths recorded at the institutional level.

Figure 5.4.1: Prop. of women attending ANC and Supervised deliveries and estimated MMR



Source: Calculated with data on ANC & SPD from GSS et al. (2009a) and MMR data from WHO (2012)

However some challenges still remain in terms of achieving most of the intended objectives. Family planning programmes have been slow in acceptance over the years. Contraceptive prevalence rate among married women was only 17 per cent in 2008 (GSS et al. 2009a), while

about 35 per cent of currently married women have an unmet need for family planning (wish to space next birth or to limit childbearing altogether but are currently not using contraception). Underutilisation of family planning interventions and possible contraceptive failures leading to unplanned or mistimed pregnancies with a high propensity for abortion among fecund women are also suggested (Ahiadeke, 2001).

Equity of access to quality maternal healthcare continues to be an important concern with both rural-urban and regional differences (GSS, 2009a & 2009b). Urban areas record higher rates of use compared to rural areas. As discussed earlier, one of the most pertinent factors that account for low utilisation in some areas among several factors are the lack of male involvement in maternal health issues (MoH, 2011). In the case of family planning practices for instance, women usually will require the expressed permission from their husbands. Besides that, most women hold misconceptions about the use of family planning.

There are also concerns about supervised deliveries in Ghana, with a widened gap between the regions with the highest and the lowest performance in terms of coverage. Supervised delivery generally remains low (58.7%) in Ghana (GSS et al. 2009a). The Northern region and the Volta region have the lowest coverage (below 40%) in 2010 which is attributed in part to unequal distribution of health personnel across the regions. The Northern region, for instance, has the second lowest number of midwifes per population. The Volta region, on the other hand, experienced a significant reduction in the number of midwifes in 2010 as compared to previous years. The Western region which has the lowest number of midwifes per population also has only a slightly above 40 per cent coverage of supervised deliveries in 2010 (MoH, 2011).

The referral-response system also remains a problem in many districts across the country. The major barrier to this is the lack of ambulance services in most districts, poor road network, poor transport system, poor communication and general sociocultural barriers peculiar to rural communities. Although regional and district hospitals are well equipped to handle complicated labour cases, the main issue has been how to timely transport women in labour to these facilities. The national ambulance service is said to be expensive (and probably not yet able to ensure district based services). Several districts have however adapted innovative ways for transporting women to the nearest higher level facility. Some districts rely on private transport (taxis or motorbikes) where available and road network motorable, to provide ambulance services for women in labour. Other districts have set up telephone directories of all senior health personal and opinion leaders in the community to aid the referral processes.

Despite the benefits of MHC, some women in Ghana do not antenatal care at all, and the care that is received is often characterised by an insufficient number of visits, and timed late into pregnancy. Furthermore, delivery care utilised is still dominated by home births, either in the TBA's or the marital home. Hence, high risk pregnancies are often not identified, obstetric histories are ignored, opportunities for transmitting family planning messages are missed and important information on nutrition and health care is not disseminated mothers who need this.

Socio-cultural (mis)conceptions of fertility issues and use of modern healthcare practices appear incongruent with sexual relationships. Closely associated with this is the high incidence of unwanted and mistimed pregnancies prevalent in most societies giving rise to the high incidence

of clandestine abortion practices pervasive today. This may also explain the significantly high fertility rates in rural areas and the three Northern regions, and some southern regions such as the Central regions, which continue to be higher than the national average (Agyei-Mensah et al. 2005). This section estimates the effects of utilisation of antenatal care, postnatal care and receiving supervised delivery on the incidence of maternal mortality at the smallest unit level, the neighbourhoods within which women live and work.

5.4.3 Data and analytical model

The data for this section of the thesis is from the verbal autopsy component of the GMHS and also the 2000 PHC. There are three approaches to measuring maternal mortality: the maternal mortality ratio (MMR), the maternal mortality rate (MMRate) and the Proportion of maternal deaths to all woman deaths in the population (Box 1 shows the measurement approaches). The MMR is defined as the number of maternal deaths in a population divided by the number of live births. It depicts the risk of maternal death relative to the number of live births and essentially captures the risk of death in a single pregnancy or a single live birth. The MMRate refers to the number of maternal deaths in a population divided by the number of women aged 15–49 years. The MMRate captures both the risk of maternal death per pregnancy or per birth (live birth or stillbirth) and the level of fertility in the population.

The third which is the proportion of maternal deaths (PM) to all deaths to women of reproductive age 15-49 years is calculated as the number of maternal deaths divided by the total deaths among women aged 15–49 years. It reflects the ratio of maternal deaths to total female deaths. The PM unlike the MMR tends to be relatively unbiased since its numerator and denominator already

tends to bias in the same direction (WHO, 2012). The MMR, even though tends to incorporate information on maternal deaths and live births, it tends to be systematically biased downward due to underreporting of maternal deaths. The PM is preferred for this analysis.

Box 1 : Measurements of maternal mortality

$$MMR = \frac{\text{Maternal Deaths}}{\text{Live biths}}$$

$$MM\,Rate = \frac{\text{Maternal Deaths}}{\text{Females 15 - 49 years}}$$

$$\text{Proportion Maternal Deaths} = \frac{\text{Maternal Deaths}}{\text{All deaths involving females 15 - 49 years}}$$

Analytical model

The lack of substantial decline in the rate of maternal deaths can be attributed to the potential directing of intervention programmes to less at risk areas due to inability to estimate maternal mortality at the smallest unit level that can facilitate easy and proper targeting of interventions. Valid estimates of levels and trends of mortality significantly underpin the ability to make judgements about health and to design appropriate interventions (Campbell and Graham, 1996). In particular, information on levels and trends permits identification of critical areas for action programmes, a basis for planning, monitoring and evaluating programmes.

Generally, two commonly employed methods of estimating maternal mortality rate in the absence of complete registration and good attribution of causes of deaths are the direct estimation methods from large sample size household surveys and indirect estimation method

usually through regression models. The direct estimation approach however has challenges (Ahmed and Hill, 2010). The approach is unable to cater for small areas which may have unique characteristics and a high (low) level of risks than averages at the national level. These areas are sometimes too small to observe maternal deaths. Using such data to estimate maternal mortality for small areas may not provide efficient estimates due to small sample size and large variance even though it may provide unbiased estimates. What happens is that these areas may not be estimated at all when the area is not included or no death is recorded.

WHO/UNICEF/UNDP/World Bank joint team currently uses a multilevel regression method to indirectly estimate MMR for countries where complete maternal mortality data is not available. Recent studies have proposed the use of random-effect Poisson models which are already common in epidemiological studies, especially for cancer-related mortality estimates, to estimate maternal mortality at sub-national level (Ahmed and Hill, 2010). Estimations of maternal mortality this way relies on spatial distribution of such factors as important and unique to an area (country, district, Census ward, neighbourhood, etc.). The use of regression-based models to estimate maternal mortality is beginning to receive attention considering the difficulty in getting complete and reliable data at the country-level for cross-country estimations of maternal mortality. Multilevel models offer a statistical means of representing country data about levels and trends of maternal mortality within a global model that can also be used for predicting out-of-sample values (Gelman and Hill, 2006).

Ahmed and Hill (2010) proposed an empirical Bayes prediction method to estimate maternal mortality at sub-national level relying on spatial distribution of factors which are unique to an

area. These models incorporate the error term in estimations thus taking care of unobserved heterogeneity across areas likely ignored in standard linear estimations. Indirect estimates of maternal mortality from sample survey data also rest on the assumption that areas having similar characteristics will have identical maternal mortality. These methods cannot also yield any estimate at all if a unit area is not included in a survey or no death is observed in it because of its small size.

The first formulation of the aggregate model starts with an individual's probability model:

$$Y_{ik} = \beta X_{ik} + \alpha_k + \varepsilon_{ik} \qquad \text{Eq. 5.4.1}$$

This captures the probability (discrete nature of the variable) of dying from pregnancy-related conditions. The average value of Y_{ik} in neighbourhood k is;

$$Y_{tk} = \frac{1}{w_{tk}} \sum_{i=1}^{w_{tk}} (Y_{itk}) \qquad \text{Eq. 5.4.2}$$

where w_k is the number of women of reproductive age (15-49) in the k^{th} neighbourhood and t period. Note that Y_{tk} is the maternal mortality rate in neighbourhood k in period t. In the random-effects model at the neighbourhood level, equation (5.4.1) is aggregated and expressed as:

$$Y_{tk} = \overline{X}'\beta + u_k + \varepsilon_{tk} \qquad \text{Eq. 5.4.3}$$

where $\overline{X}_k$ is a vector containing the average values of the regressors in X_{itk} and u_k captures the heterogeneity across the areas; $u_k \sim N(0, \sigma^2 u)$ and $\varepsilon_{tk} \sim N(0, \sigma^2 u)$.

A Poisson regression model which combines both the direct and indirect approaches in an optimal way is used to estimate the MM rate.

5.4.4 Distribution of maternal deaths

To analyse the incidence of maternal deaths in a neighbourhood, the number of maternal deaths occurring in the neighbourhood were counted. About 38 per cent of the neighbourhoods have non-zero maternal deaths. The highest number of maternal deaths recorded in a single neighbourhood was 5 (Table 5.4.1).Only about 0.2% of all neighbourhoods recorded the highest number of maternal deaths. About 38.2 per cent of less deprived (Not deprived) neighbourhoods recorded maternal deaths compared to 37.6 per cent of relatively deprived and 37.9 per cent of deprived neighbourhoods.

Table 5.4.1: Number of maternal deaths and the level of deprivation

No. Maternal deaths	Not deprived	Relatively Deprived	Deprived	All
0	61.8	62.4	62.1	62.1
1	29.4	28.2	29.8	29.1
2	6.6	7.8	6.9	7.1
3	1.6	1.1	1.2	1.3
4	0.5	0.2	0.0	0.2
5	0.2	0.2	0.0	0.2

Table 5.4.2: Number of maternal deaths and the type of locality

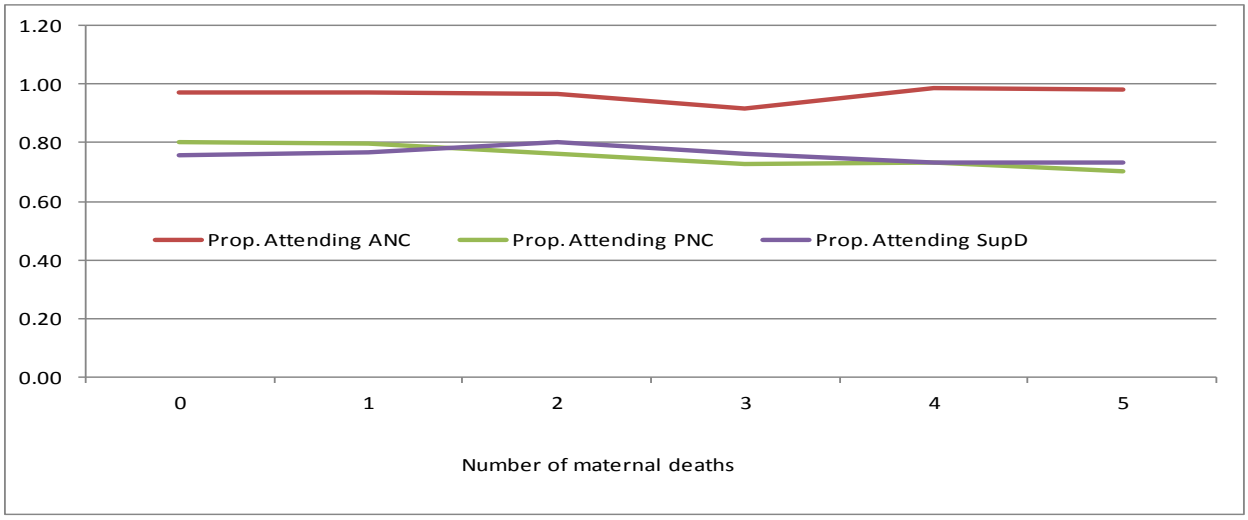
No. Maternal deaths	Large city	Small city/Town	Rural	All
0	59.4	63.5	62.1	62.1
1	31.8	27.3	29.6	29.1
2	6.5	7.3	7.1	7.1
3	1.5	1.3	1.2	1.3
4	0.4	0.4	0.0	0.2
5	0.4	0.2	0.0	0.2

Maternal deaths recorded in large cities were more than deaths recorded in rural areas (Table 5.4.2). The highest number (5) of maternal deaths was recorded in the large cities. The highest

number of maternal deaths recorded in a rural area was 3, and this was recorded in only 1.2% of rural areas. About 48.6 per cent of localities classified as large cities recorded maternal deaths, which is about 12 percentage points higher than the number of rural localities that recorded a maternal death.

Coverage of maternal healthcare is taken as the proportion of women who attended antenatal care (ANC), received supervised delivery (SupD) and attended postnatal care (PNC) all regarding the last pregnancy preceding the survey. Even though the numbers of maternal deaths appear to increase with decreasing proportion of women using supervised deliveries and attending postnatal care, the difference does not appear to be significant (Figure 5.4.2). However, for policy purposes, it is typically not the size of the relationship between two variables that matter, but on how the expected outcome of interest varies with the independent variable being studied. The relationship between the incidence of maternal deaths and ANC appear to be positive, indicating that increasing ANC coverage is associated with increasing incidence of maternal deaths. This is probably because ANC coverage is already high across all localities.

Figure 5.4.2: Maternal healthcare coverage and incidence of maternal deaths



5.4.5 Estimation of maternal mortality rate using a Poisson regression model

The unit of analysis in this section is the community. The frequency distribution shows that about 62 per cent of the communities did not record any maternal death. The standard approach to dealing with the problem of low counts is usually to increase the level of aggregation, for example analysing only large cities or districts. This strategy however could lead to less meaningful measurement of important explanatory variables, such as being forced to assume that a single standard of living measure applies equally well to all neighbourhoods in a city or district. Poisson-based regression models of count of events are preferable because they are built on assumptions about error distributions that are consistent with the nature of event counts (Cameron and Trevedi, 1998; Osgood, 2000).

Poisson-based models do not assume homogeneity of variance. Instead, residual variance is expected to be a function of the predicted number of deaths, which in turn is a function of the size of the population at risk. Furthermore, even though a logarithmic transformation is inherent

in Poisson-based regression, observed rates of zero present no problem. Unlike least square analysis which requires a log transformation of rates, Poisson-based regression analyses do not require taking the logarithm of the dependent variable. Instead, estimation for these models involves computing the probability of the observed count, based on the fitted value for the mean count.

The basic Poisson regression model is:

$$In\left(\lambda_k\right) = \sum_{j=0}^{j} \beta_k x_{kj} \qquad \text{Eq. 5.4.5.1}$$

$$P\left(Y_k = y_k\right) = \frac{e^{-\lambda_k} \lambda_k^{y_k}}{y_k!} \qquad \text{Eq. 5.4.5.2}$$

Equation (5.4.5.1) is a regression equation relating the natural logarithm of the expected number of deaths for unit k, $In(\lambda_k)$ to the sum of the products of each explanatory variable, (x_{kj}) multiplied by a regression coefficient, β_k (where β_0 is a constant multiplied by 1 for each case).

Equation (5.4.5.2) indicates that the probability of y_k, the observed outcome for each unit, follows the Poisson distribution which is reflected in the right-hand side of the equation, for the mean count from Eq. (5.4.5.1), λ_k. Thus, the expected distribution of death counts, and corresponding distribution of regression residuals, depends on the fitted mean count, λ_k. The role of the natural logarithm in Eq. (5.4.5.1) is comparable to the logarithmic transformation of the dependent variable that is common in analysis of aggregate rates data.

A simple elaboration transforms the Poisson model of event counts to a model that captures the rate of occurrence in each unity. If λ_k is the expected number of deaths in a given unit area, then λ_k / w_k would be the corresponding rate of maternal mortality, where w_k is the size of deaths to all women aged 15-49 years recorded for that unit. We can then derive a variation of Eq. (5.4.5.1) to capture the rate of maternal mortality as:

$$In\left(\frac{\lambda_k}{w_k}\right) = \sum_{j=1}^{j} \beta_k x_{kj} \qquad \text{Eq. 5.4.5.3}$$

$$In(\lambda_k) = In(w_k) + \sum_{j=0}^{j} \beta_j x_{kj} \qquad \text{Eq. 5.4.5.4}$$

Thus, by adding the natural logarithm of the size of the population at risk to the regression model, and by giving that variable a fixed coefficient of one, Poisson regression becomes an analysis of rates of events per unit, rather than an analysis of counts of events. It is also an acknowledgement of the greater precision of rates based on larger populations, thus addressing the problem of heterogeneity of error variance discussed above (Osgood, 2000).

Poisson-based models are built on the assumption that the underlying data take the form of nonnegative integer counts of events which is the case for mortality rates, calculated as death counts divided by population at risk. Poisson models are however not error-proof. They are however appropriate because they recognize the limited amount of information in smaller areas. The price the researcher pays in this trade-off is that the smaller the event counts, the larger the sample of aggregate units needed to achieve adequate statistical power (Osgood, 2000).

In this analysis the maternal mortality rate is the number of maternal deaths in women aged 15-49 years divided by the number of deaths to all women aged 15-49 years. The range of the dependent variable is between 0 and 1000 instead of between 0 and 1 as the proportion is further multiplied by 1000. The econometric approach does not take explicitly into account that the dependent variable is bounded; however, this did not pose any problem since none of the fitted values did appear to violate this restriction.

The key independent variable is the coverage of healthcare utilisation. Three variables are being used to measure this: proportion of women who used antenatal care, proportion of women who were assisted during delivery by skilled personnel (supervised delivery) proportion of women who used postnatal care. These are behavioural variables considered to be important determinants of maternal mortality. The use of these measures of coverage has been shown in empirical works as good measures of healthcare coverage. A high utilisation level is an important reflection of greater awareness of the importance of antenatal care, postnatal care and supervised deliveries by women in such a neighbourhood. It may also reflect the inherent positive externalities of high level of coverage on other members in the community. Women who live in close proximity with high using neighbours are likely to receive positive effect and may change health practices.

Other variables on the right-hand side include type of locality of residence (large city, small city, town and rural), the neighbourhood's measure of multiple deprivation (3 dummies; less deprived, intermediate deprivation, and most or high deprivation), ethnic and religious diversity (each has 3 dummies; less diverse, intermediate level, and most or high diversity), education (proportion of

women and men who are educated up to Senior High School or higher), employment (proportion of males and females who are employed). Outcomes of pregnancies apart from live births are also included; log transformed number of miscarriages, stillbirth and abortion. The log of woman exposure years is included as an exposure variable and its coefficient constrained to one.

The fitted Poisson model was:

$$\log(pm)_k = \beta_0 + \beta_1 Locality_k + \beta_2 (i.IMD)_k + \beta_3 Ethnic\,\mathrm{Div}_k + \beta_4\,\mathrm{Re}lig\,\mathrm{Div}_k + \beta_5 Education_k + \beta_6 Employment_{11} + \beta_7 (\ln(miscarriages)_k + \beta_8 (\ln(stillbirth)_k + \beta_9 (\ln(abortions) + \beta_{10} MHC\ Use_k + \beta_{n+1} (Interaction\ terms) + v_k + \log(womyrs)$$

where βs are the model estimated coefficients, and v is the residual error for area k. The woman-person years $\log(womyrs)$ is included as the exposure term – logarithm of exposure. In model estimations, usually a woman contributed 0.5 person–years, otherwise py = 1 for each year of observation (Ahmed and Hill, 2010). This can also be estimated as the sum of the individual probabilities of maternal death in a neighbourhood. In this estimation the risk of maternal death is a predicted estimate from section 3. This is then included in the final model as the offset for the study reference period.

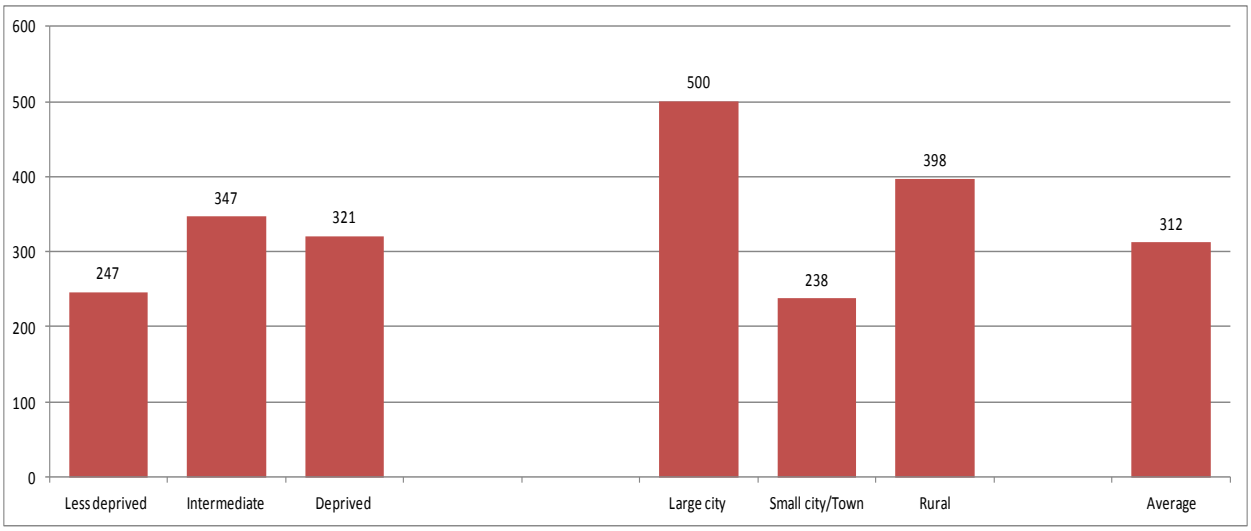
The independent variables are introduced in the model in a list-wise fashion, giving rise to five models The interaction terms have the rate of miscarriage, stillbirth, and abortion interacted with deprived neighbourhood. This is expected to reflect the quality of care for adverse pregnancy outcomes. In a deprived neighbourhood, a high incidence of poor pregnancy outcomes will increase the incidence rate of maternal mortality all other things being equal. The deprivation index is also interacted with locality type (rural#deprived) and also with the proportion of

females' educated (proportion of educated females#deprived). A "high proportion of females educated" in a neighbourhood is expected to mitigate the incidence rate of maternal mortality. This is also expected in deprived neighbourhoods. A robust fixed effect estimation procedure is used which allows for heteroskedasticity and intragroup autocorrelation in the error term.

Distribution of the estimated maternal mortality rate

The mean estimated maternal mortality rate is 312 per 100,000 live births (Confidence Interval: 203-481). The rate is 321 in deprived areas and 246 in less deprived areas (Figure 5.4.3). Neighbourhoods classified as intermediate neighbourhoods however have the highest rate of 346 deaths per 100,000 live births. Large cities have the highest estimated maternal mortality rate of 500 deaths whilst rural areas have 397 maternal deaths. The regions which had maternal mortality rates above 1000 are Upper West, Brong Ahafo, Greater Accra and Western regions. Upper West region is estimated to have the highest maternal mortality rate of 1546 deaths. The lowest is in the Central and Volta regions estimated at 61 and 92 respectively per 100,000 live births.

Figure 5.4.3: Estimated maternal mortality rate from Poisson model



5.4.6 Healthcare utilisation and the incidence of maternal mortality

The analysis shows that neighbourhoods with a high coverage of supervised delivery attendance are associated with lower incidence rate of maternal mortality. Areas that have a high proportion of women receiving supervised deliveries are associated with a 0.01% reduction in the incidence rate of maternal mortality compared to areas where coverage of skilled personnel attendance at delivery was lower (Table 5.4.3). High antenatal care (ANC) and postnatal care (PNC) coverage are also associated with lower incidence rate, however the effect is not statistically significant. This implies that a neighbourhood that a high proportion of pregnant women attend ANC the incidence of maternal mortality is not lesser or greater than the neighbourhoods where a lower proportion of women do not attend.

The incidence rate was however expected to be higher in small cities and localities classified as small towns, but lower in rural areas. The rate of maternal mortality in small cities is expected to

be higher by about seven times the rate in large cities (significant at 1%) holding other factors constant, whilst in rural areas the difference in the incidence rate is lower by about 45 per cent in relation to large cities. The low incidence rate of mortality in rural areas compared to large cities is counterintuitive as we would expect rural areas to report higher mortality rate than big cities due to the fact that in rural areas healthcare services are inadequate and road network is poor, all of which are associated with poor maternal outcome. The most plausible explanation is that previously observed low utilisation of maternal healthcare, high fertility rate and poor pregnancy outcomes in rural areas which led to favourable government policies and programmes by non-governmental organisations being directed towards the rural areas may have had positive effect on the health behaviours of these populations. This may have led to a lowering of the incidence rate of maternal mortality compared to large cities.

Maternal mortality incidence is however expected to be higher in deprived neighbourhoods as compared to less deprived neighbourhoods. The result in Model 1 indicates that the incident rate for highly deprived neighbourhoods is 1.2 times the incident rate for the least deprived neighbourhoods. This also means that the maternal mortality incidence rate in deprived neighbourhoods is about 20 per cent higher than it is in the less deprived neighbourhoods (significant at 5%). The difference between the intermediate level and the less deprived neighbourhoods is however not significant.

Further analysis with interaction terms in Model 5 showed that deprived rural neighbourhoods have a higher incidence of maternal mortality than less deprived rural areas. The incidence rate of maternal mortality in deprived rural neighbourhoods is about 42 per cent higher than in the

less deprived rural areas. Clearly, rural areas per se may be associated with lower incidence rate as compared to large cities, but when it comes down to level of deprivation, deprived rural areas have a higher incidence rate of maternal mortality than rural areas that are less deprived.

The relationship between ethnic diversity and the incidence of maternal mortality is negative and linearly increasing in magnitude. Neighbourhoods that have an intermediate level diversity have an incidence rate that is nearly 30 per cent lower than in homogenous neighbourhoods, whilst most ethnically diverse neighbourhoods have almost 66 per cent incidence rate lower than expected in homogenous neighbourhoods (significant at 1%). It is fair to suggest that diversity mitigates a variety of ethnically bias cultures that affect maternal health behaviours and health outcomes. Ethnically diverse neighbourhoods as compared to homogenous societies tend to shed off ethnically-entrenched and unfavourable maternal health practices that are sometimes detrimental to the chances of surviving a pregnancy. Where there is a concentration of ethnicity in an area chances are that ethnic norms and culture even where they are detrimental are enforced and obeyed. Religiously diverse neighbourhoods on the other hand are associated with high incidence rate of maternal mortality. The incidence rate of maternal mortality is 1.4 and 1.3 times the rate in religiously homogenous neighbourhoods.

Table 5.4.3: Poisson regression of incidence of maternal mortality (IRR reported)

MMrate	Model 1	Model 2	Model 3	Model 4	Model 5
Type of locality (Large city = ref.)					
Small city	7.293 ***	15.310 ***	13.345 ***	13.228 ***	12.913 ***
Town	1.668 ***	2.806 ***	2.682 ***	2.556 ***	2.490 ***
Rural	0.546 ***	0.097 ***	0.091 ***	0.085 *	0.083 ***
Level of deprivation (Least Deprived = Ref.)					
Intermediate level	1.064	0.939	0.947		0.935
Highly deprived	1.162 **	1.447 ***	1.408 **		6.091
Level of ethnic diversity (Least diverse = Ref.)					
2nd quintile	0.707 ***	0.371 ***	0.348 ***	0.346 ***	0.346 ***
3rd quintile (Highly diverse)	0.336 ***	0.081 ***	0.082 ***	0.088 ***	0.088 ***
Level of religious diversity (Least diverse = Ref.)					
2nd quintile	1.413 ***	1.831 ***	1.866 ***	1.882 ***	1.871 ***
3rd quintile (Highly diverse)	1.254 **	1.403 **	1.448 **	1.413 **	1.415 **
Prop of educated females	0.729 ***	0.519 ***	0.501 ***	0.527 ***	0.522 ***
Prop of educated males	0.985	0.842 *	0.905 *	0.913	0.914
Prop of employed females	0.910 *	1.082	1.094	1.090	1.093
Prop of employed males	1.205 ***	1.330 ***	1.331 ***	1.359 **	1.356 ***
ln(Miscarriages)		2.821 *	2.683 *		
ln(Stillbirth)		0.112 ***	0.124 ***		
ln(Abortions)		1.046	1.040		
Prop attending ANC			0.993	0.995	0.996
Prop attending PNC			0.997	0.997	0.997
Prop receiving supervised delivery			0.994 *	0.994 *	0.994 *
Rural#Deprived				1.418	1.419 *
Miscarriages#Deprived				0.678	0.179
Stillbirth#Deprived				0.155 **	0.183 **
Abortion#Deprived				1.625 **	1.649 *
Prop of educated females#Deprived				0.877	0.880 *
Constant	4.352 ***	1.869 **	3.411 ***	4.579 ***	4.585 **

The rate of maternal mortality in neighbourhoods that have a high proportion of educated females is lower as compared to neighbourhoods with low proportion of educated females (having educational qualification beyond the secondary level). A unit increase in the proportion of females educated in a neighbourhood is associated with about 27 per cent decrease in the incidence rate of maternal mortality, holding other variables constant. This is expected due to the benefits of education to the individual and its externality effect especially on other family members and neighbours. In deprived neighbourhoods an increase in the proportion of women

with secondary education or higher is also associated with a low incidence rate of maternal mortality. A unit increase in the proportion of educated females in a deprived neighbourhood is also associated with a 12 per cent decrease in the incidence rate of maternal mortality (significant at 10%).

Female education has both internal and external effects in a neighbourhood. Women with higher level of formal education tend to have internal loci of control which has favourable implications for reproductive life and the society at large (Shaibu and Akwa, 2012). Education provides women with a leverage to rise above negative socio-cultural, environmental and economic externalities, and to take appropriate steps towards preventing diseases and enhancing health. There is also empirical evidence that show the non-market externality benefits of women's education (e.g. secondary education) accruing to the wider society (Acemoglu and Johnson, 2007; Cutler et al. 2006) This includes lower fertility, better within-family healthcare and better nutrition. The externality benefits of secondary education from girls have been shown to be larger than those from boys, an argument for improving the gender imbalance in lower secondary education survival and secondary upper enrolment (??).

There is a body of research that seek to emphasise the externality effect of maternal education on health status of family members and the community (Acemoglu and Johnson, 2007; Cutler et al. 2006). Combining individual-level and census data from India, Parashar (2005) showed that there is a significantly positive relationship between the proportion of literate females in a district and a child's complete immunization status within that district, above and beyond the child's own mother's education as well as district-level socioeconomic development and healthcare

amenities. Soares (2007) also states that technologies related to individual-level inputs used in the production of health seem to be subject to the effectiveness with which individuals can use these inputs' so that more educated individuals have higher survival advantage in diseases for which medical progress has been important.

The results also showed that in an area where a high proportion of persons employed are males the incidence of maternal mortality is higher. This remains throughout all the different specifications averaging around 1.3 times (significant at 1%), except in model 4 with the introduction of interaction effects. This implies anytime there is a percentage change in the proportion of males' employed in a neighbourhood over another, the incidence of maternal mortality in the former is going to be about 30 per cent higher than will be recorded in the later which did not experience any change in the proportion of males employed, holding all other factors constant.

A neighbourhood with a high aggregate proportion of miscarriage outcomes and high abortion incidences has a high incidence of maternal mortality. Miscarriages in particular remained statistically significant in model 2 and 3 even though at a relatively weaker level (significance level of 10%). Abortion was however not statistically significant even though has a positive effect. A higher aggregate stillbirth rate on the other hand is negatively associated with the incidence rate of maternal mortality. This finding is dissimilar with findings in other areas such as by Rahman and others (2010) in India.

In model 4 interacting the rate of abortion and the level of deprivation showed that high rates of abortion in deprived neighbourhoods is associated with a higher incidence rate of maternal mortality (significant at 5%). This remained strong in the final model (model 5) where the rate of utilisation of maternal health services was included. The possible explanation is that whereas women in urban areas are more likely to obtain abortion as compared to women living in rural areas (Ahiadeke, 2001), rural women are more likely to obtain unsafe abortion (Hill et al. 2009) using herbs and other substances which are often deleterious to their lives.

5.4.7 Discussion

One of the major challenges of monitoring progress towards achieving the MDG 5 target of reducing maternal mortality ratio is the problem of maternal mortality estimation itself. The estimation of MMR is extremely difficult particularly in developing countries, even at the national level where reliable data is a challenge. Few countries have attempted ever to estimate MMR at sub-national domains even though these estimates are essential for setting priority in targeting the areas with high maternal mortality incidence. Even more difficult in statistical sense is estimating maternal mortality for small areas using large survey data. These estimates are however important to help in targeting high risk areas. This section attempted two things: an estimation of maternal mortality using a neighbourhood framework in a Poisson modelling approach and an examination of the effect of healthcare coverage on the incidence of maternal deaths.

The WHO (2005) attributes high maternal mortality largely to low proportion of women being attended to by skilled birth attendants. The analysis indeed shows that neighbourhoods with a

high coverage of supervised delivery attendance are associated with lower incidence rate of maternal mortality. The presence of skilled personnel during delivery is important to curb possible complications and give quicker advice in terms of the next line of action to safe motherhood. More importantly is the expectation of externality effect of wide coverage of supervised delivery attendance. As more and more women in a community seek skilled assistance during deliveries or as many times as successful that a woman seeks medical assistance for delivery it helps dispel time-held notions about facility deliveries.

The study however revealed that deprived rural neighbourhoods have a higher incidence of maternal mortality than less deprived rural areas. The incidence rate of maternal mortality in deprived rural neighbourhoods is about 42 per cent higher than in the less deprived rural areas. Clearly, rural areas per se may be associated with lower incidence rate as compared to large cities, but deprived rural areas have a higher incidence rate than rural areas that are less deprived. This is also not too unexpected. Using a hierarchical Poisson regression, Fukuda and others (2007) showed that all-cause mortality in the most deprived fifth of neighbourhoods was in excess of 26.4% in men and 11.8% in women as compared to the least deprived fifth.

The incident rate of maternal mortality is however lower in neighbourhoods that have a high proportion of females educated up to or beyond senior secondary school level). This factor remained strong even as interacted with deprived areas. The result seems to coincide with the externality benefits of education noted in earlier studies (Acemoglu and Johnson, 2007; Cutler et al. 2006). Female education has both internal and external effects in a neighbourhood. Education provides women with a leverage to rise above negative socio-cultural, environmental and

economic externalities; and to take appropriate steps towards preventing diseases and enhancing health. There is also evidence that the non-market externality benefits from women's education (e.g. secondary education) accrue to the wider society. This includes lower fertility, better within-family healthcare and better nutrition. The externality benefits of secondary education from girls have been shown to be larger than those from boys, an argument for improving the gender imbalance in lower secondary education survival and secondary upper enrolment.

5.4.8 Concluding this section

A very important recommendation to make based on these findings is an improvement in access to maternal health services. The results suggest that interventions to increase the use of supervised care services should target the uneducated, and those women who live in disadvantaged communities. Improved utilisation of maternal health service however cannot be attained unless women have the necessary awareness of the importance of utilising antenatal and postnatal care or delivery under the supervision of a skilled health professional. An enlightened community will appreciate more about women's reproductive health issues than few educated women in a community concentrated by people who still pride the health, the faithfulness and the strength of a woman on where she delivers (home) and who assisted in the delivery (mother-in-law).

Scaling up management of pregnancy-related complications in poor resource settings has proved enormously challenging as most of the direct causes require highly skilled health workers working with advanced technology and equipment in an environment that is accessible. There is the need to improve the socioeconomic conditions of deprived areas and reduce the associated

disparities in development. Improving education of individuals or incomes of households alone may not lead to a reduction in maternal mortality. Deprivation in neighbourhoods is not primarily about poverty. The prevalence of poverty in deprived areas even though awful. But more awful is the fact that so many people and most particularly women living in deprived neighbourhoods have no access to good water source, poor sanitation, and poor dwelling conditions. Upgrading of deprived neighbourhoods or low rural areas has to be deliberate if the risk of maternal mortality is to be reduced.

CHAPTER SIX

6.0 PERSPECTIVES FOR IMPROVING MATERNAL HEALTH OUTCOMES

6.1 Introduction

Challenges of health, healthcare service and access present arguably the most significant barrier to sustainable in developing countries. Diseases of many kinds (communicable and non-communicable) continue to take a significant toll on their populations and economies. In Ghana, despite broad economic advances of the past decade and increase in investment in the supply of health services (NDPC, 2009), there are still difficult conditions for accessing maternal healthcare. Over the years, many programmes and policies have been implemented to address contributing factors to the issue of poor maternal health outcomes. However, data from national research surveys (GDHS, GLSS, and GMHS) suggest that there are still difficulties in achieving substantial coverage in maternal healthcare utilisation and preventing adverse maternal health outcomes such as stillbirths, miscarriage and maternal deaths.

Even though there is a good amount of earlier research from national and international research institutions and academics that is available about conditions for improving maternal health outcomes, there remains a significant gap between the recommendations, implementation and the reality on the ground. A review of the history of the healthcare system in Ghana showed that healthcare financing in particular moved from free healthcare, immediately after independence,

to the introduction of minimal fees in the mid-1980s, full cost recovery in the late 1980s and early 1990s, and to risk pooling and cross-subsidisation health insurance policy from 2000. These different eras show three different intentions: free health for Ghanaians (period after independence); provide adequate healthcare services (through withdrawal of subsidies that could be used to provide adequate services and drugs), and gradually achieve universal access to healthcare with minimal financial burden.

One of the recent efforts in Ghana to improve maternal health outcomes is the inclusion of maternal healthcare in the NHIS to enable women attending antenatal care, attending for delivery care and for postnatal care to receive medical attention free of out-of-pocket payment. The expectation is that without being hindered by direct medical cost maternal health utilisation will improve and all other things being equal, in the long run maternal health outcomes will improve. The delivery fee exemption policy (DFEP) which had the goal of improving supervised delivery is a similar effort which was implemented in 2003. An evaluation of the DFEP and preliminary assessment of the free maternal care component of the NHIS suggest positive outcomes in terms of increased proportion of births supervised by trained medical personnel and births delivered in facilities (Penfold et al. 2007; Witter et al. 2007; Grepin, 2009).

The impact however do seem to be inequitable across the country and differences and challenges remain in improving maternal health outcomes in Ghana. Apart the fact that Family Planning and contraceptive prevalence rate among married women is still low at 17 per cent in 2008 (GSS et al. 2009a), the proportion of women receiving supervised deliveries is low (58.7%) with the Northern region having the lowest coverage in 2010 (below 40%) (MoH, 2011; GSS et al.

2009a). The aim of this chapter is to identify recommendations from the perspective of maternal healthcare users that could make a meaningful contribution to tackling maternal health problems in Ghana.

The source of information for this chapter is from focus group discussions, birth narratives and in-depth interviews conducted separately to enhance the analysis. This analysis involved a triangulation of the qualitative information with the proceeding quantitative analysis. This enabled the study to provide a synthesis of ideas relevant for improving maternal health in Ghana. The chapter proceeds in the first part with a presentation of issues considered as barriers to improving maternal health outcomes. This is followed with a synthesis of policy-relevant findings made from the quantitative analyses and linked up with recommendations made in the qualitative phase for policy purposes.

6.2 Barriers to improving maternal health outcomes

In the conceptual framework (Figure 3.1), the barriers to improving maternal health outcomes can be situated in the first and second departments (moving top-down). The main hypothesis is that the socioeconomic structure of the neighbourhoods in which people live reflects 1) access to public goods; health facilities, roads, public transport; 2) nature of social interactions, cultural values; and 3) which have an effect on health use behaviours and other psychosocial decisions.

In the context of Ghana and most developing countries women are confronted with a number of healthcare utilisation challenges, especially during pregnancy and delivery. These range from geographical, financial and social (including cultural) challenges which affect women's

ability/capacity to fully utilise healthcare services. By better understanding the barriers that women, health care providers, and communities face in ensuring timely and appropriate access to care, Governments and development partners will be well informed about improvements in maternal healthcare provision and how to target to achieve maximum returns.

The main issues that emerged from the focused group discussions (FGDs), women and men birth narratives and the interviews with health personnel and community leaders can be classified into infrastructural (transport and poor roads), financial, "quality" of health personnel care, cultural factors, and community awareness and support.

Infrastructure

Lack of roads and unavailability of reliable transport services emerged in the birth narratives, FGDs and the interaction with the healthcare personnel as the two most important factors underpinning underutilisation of maternal health services resulting in serious maternal health problems among women. Bad roads and lack of transportation are important factors that lead to delays in reaching a place where care is available hence untimely seeking of medical attention. In the districts, for example, the predominant means of transporting an expectant woman was identified as a motorbike or bicycle in the Northern region and "trotro" (local name for the 12-seater urvan bus used for commercial transport in Ghana) in the Central region.

Lack of transport is equally a very important constraining factor in achieving the appropriate referral-response relationship for dealing with emergency obstetric situations. Higher level health facilities are usually in urban centres too far from low level facilities which are usually in rural

areas and small towns. Lack of readily available transport affects both the decision to refer and also the ability on the part of the woman to accept the referral. Most health facilities do not have vehicles on standby for emergency transportation of gynaecological complications and will most often have to rely on assistance from private sympathetic individuals or leave clients to their faith.

Finance

The challenge of lack of transport ties in with the cost involved in obtaining transportation services which sometimes can be a significant constrain to potential users of reproductive health services. Lack of finance to obtain transport was cited by health personnel as the most important factor, for instance, that results in women refusing to accept referrals to facilities away from their neighbourhoods. In rural areas where livelihood activities are mainly subsistent agriculture, money is not an item that is readily available in the household. To get money it has to be through the sale of an asset or a food product which can only happen on a market day. Coupled with the fact that these activities are seasonal and largely unsustainable, the issue of lack of finance to take care of some of the smallest expenditures required of certain health services can be an impediment to healthcare consumption and ultimately poor health outcomes. The cost of joining a commercial vehicle from remote hinterlands to the nearest urban area in response to a referral can be very high of which nurses indicate that sometimes they have to give money for transport to women on referral before they comply with referrals to the next level for care even under severe and dreadful conditions.

Quality health personnel

The quality of health personnel is used here generically to refer to the availability of qualified personnel in community health facilities, the numbers available, and their attitudes towards healthcare seekers, all of which affects ultimately the quality of attention administered. The quality of health personnel is associated with the ability to recognise health complications, take important decisions including knowing when to refer a client (timeliness of referrals made).

The consequence of all these; coupled with poor roads, lack of transport, lack of finance and poor quality health personnel, is a delay in deciding to seek care, delay in reaching healthcare facility, delay in being attended to; and even a delay in being referred to the next level for immediate and appropriate care. Delays occasioned during critical periods of maternity can be deleterious to both mother and unborn child. The evidence of this is shivery as reflected in many of the birth narratives listened to on the field. One such evidence of the damaging effect of a delay in making referral for emergency obstetric care for example is the story of a husband whose wife suffered a stillbirth:

> *My wife paid regular visits to the hospital as she was supposed to do. So we didn't expect anything to go wrong with this pregnancy. I was shocked when she (the nurse) went to unveil the child's corpse and showed me something: "she asked; do you see any white substance on the body? I responded "yes". She told me that, "if the delivery is delayed for some time and the child is unable to come out, it defecates and vomits causing death." She also said that the baby was strong and there was nothing wrong with it. She also went ahead to say that, if my wife was brought there at the time that she was in labour for her to deliver, she would have had the baby but the delay was what caused all these.*
>
> (Birth narrative by a husband in Assin Fosu District in the Central region).

The source of the delay in this story is not from the couple, but a delay by the midwife in referring the patient to the higher level facility for care. This is further revealed in the conversation that followed with the field interviewer:

Interviewer: *Is there anything that happened about concerning the health of pregnant women that you would want the authorities or leaders to know?*

Respondent*: I do not want to say anything that will bring problems for me later. Moreover, the midwife at the other hospital became angry and said that she was going to send the hospital here, a letter. So I will not go ahead and be saying any other thing again.*

Interviewer: *Did you say that the Doctor at the Fosu hospital became angry?*

Respondent: *Yes, the Doctor who conducted the surgical operation at Fosu Hospital became angry about the fact that, they delayed and that led to the complications and subsequent events. Thus, if they had acted with dispatch and sent her over to them, things would have been different. So, she said that she was going to write a letter to the hospital. So if I should go about saying things, they might get to know and if you happen to come to the hospital, she might get angry at you since no one knows what can happen again.*

(Story of husband in Assin Fosu District in the Central region as above).

In another narrative the perceived poor attitude of a midwife caused this woman to take the extreme decision of wanting to remove her womb. This woman utilises antenatal care and other health services quite regularly and during her recent pregnancy also received regular care. When she thought she was due for delivery, she visited her care provider only to be told that she wasn't

ready and had to go back home and come only when she was sure that she was in labour. This turned out disastrous for the woman as revealed in the narrative below:

I was asked to come anytime I go into labour. When I came home and it was time, I went there and she (midwife) was not around. So they called her and she said that she is coming. When she came, she attended to me for some time and later wrote a note that they should take me to Fosu. When I got there and the doctor came to attend to me, the doctor said that it was very serious. At that time, there was one woman who had been taken to the theatre but they told her that she should permit them to take me to the theatre before her. So they took me to the theatre. By the time they brought my child out, the child was dead. It has been about three months now after the time I delivered. I have only one daughter and I was about to get one more. She (the midwife) caused the death of my child. If the midwife had asked me to go to Fosu at once, I think that I would have gotten my child. Because of what happened, I don't even want to give birth again. I asked the Doctor to remove my womb. But I don't know whether he has removed it.

(Birth Narrative of a 40 year old mother in the Central Region, Breku Sub-District).

The additional conversation reflects further the frustration at the midwife for supposedly being the cause of the death of her child.

Interviewer: *You have said that you asked them to remove your womb but what if it becomes possible for you to get pregnant and you do, what will you do differently?*

Respondent*: If I am pregnant, I will not go to the hospital over here again because of what she did to me. I will only go there if the midwife leaves the hospital. Yes, I will only go there if the midwife leaves that hospital.*

The above narratives are examples of how human errors, negligence and poor attitude of health personnel can cause harm to maternal health.

Cultural and traditional attitudes towards maternal health

Certain perceptions and attitudes of individuals and broad-based community views can have damaging end result for maternal health. For example, it was gathered from one of the FGDs held in the Northern region that whilst the preference among both males and their spouses is to seek modern healthcare to solve maternal health needs, in terms of ensuring early identification of high risk situations there is a high tendency to want to first consult the soothsayer (custodian of the spirit gods) to know the future problems they may encounter during pregnancy and delivery and find preventable or timely interventions. They will always execute the directives of the soothsayer before going to hospital. These practices tend to delay early seeking of healthcare.

Blood supply for emergency anaemia conditions (community support)

Getting blood for extremely haemorrhaging conditions is a problem. Whilst this is partly attributed to the lack of refrigerators to store blood for emergency use, it is also a concern that people generally are unprepared to donate blood partly due to HIV scare and stigma associated with it. The lack of blood for haemorrhaging expectant mothers is one of the speediest causes of

most maternal deaths and other negative outcomes such as stillbirths especially in rural and deprived areas where it is practically impossible to get to the nearest facility for support.

In an interaction with one health personnel she lamented how the health facility staffs sometimes have to donate blood to safe lives:

> *At times, you will see the doctor and the midwife running to the laboratory to get their blood transferred and they themselves will come and set it up on the patient in order to revive a patient. That is what is happening here and I have donated and donated and donated. Everybody even the Reverend Sisters, you call them and they are in a rush to come but how long will you be able to do that? The community can help.*
>
> (Interaction with a female nurse in the Central region).

This can be attributed partly to lack of education on the importance of freely donating blood to support the community health facility, but it also possibly reflects issues of nutrition during pregnancy. Poor nutritional practice during pregnancy is associated with anaemic conditions which can lead to stillbirth, miscarriage or even death.

6.3 Advancing perspectives for improving maternal health outcomes

Women's health affects every area of life because of the multiple roles women play in the family, community and the society as a whole. Advancing this context is also in recognition of the shortcomings in mere improvements in delivery of advanced medical technologies. Indeed, even though attending regular antenatal care is established to be one of the measures important for preventing poor maternal health outcomes, many women have been known to lose their lives and

many lose their pregnancies even whilst attending antenatal care. A number of perspectives emerging from the above discussions can be organised into three categories: government-responsibilities, community responsibilities and personal responsibilities.

Government

Government could make a difference through improvements in the socioeconomic structures of communities. This will include provision of roads, quality water, sanitation, lighting, education services and creating and strengthening a legal system that protect employment.

Provision of roads to link deprived rural areas with towns

As discussed under the barriers to improving maternal health, the issue of bad roads especially in rural and deprived areas is critical for maternal health. Good roads, all other things being equal, will improve maternal health outcomes by improving upon the timeliness of reaching health facilities when families do decide to visit a health facility. The issue of lack of reliable transport is also associated with the issue of bad roads. However, whilst transportation services can be supported by individuals, lack of motorable roads owning to the investments required will remain the responsibility of government. Health facilities in rural communities also need to be supported with transport services to adequately respond to emergency obstetric cases that require swift transport to a specialist or a higher level for care.

Provision of other public goods (water, sanitation, and light)

The empirical models support the need for improvements in the provision of public goods such as quality water, improved sanitation (both liquid and solid waste disposal systems), and education. The empirical analysis on the relationship between level of deprivation and all measures of adverse maternal health outcomes indicate that in neighbourhoods that deteriorated in most of the indicators used in the calculation of the index, the maternal health outcomes worsen. The correlation matrix presented in the appendix (Appendix D Table 2) also confirm that lack of access to improved water source and poor sanitation (liquid and solid waste disposal) significantly correlate with high risk and high incidence of maternal mortality.

Provide reliable emergency transport system at health centres

Government also has a responsibility especially towards deprived areas to provide emergency transport service at health centres. In the rural areas the FGDs revealed that in some instances expectant mothers were transported in tractors to health centres. Provision of a formal transport system purposely for emergency cases and strengthening the transport option for dealing with emergency complication is therefore an imperative for improving maternal health outcomes.

Create opportunity for females to obtain higher education

The empirical model showed quite strongly that a neighbourhood with a high proportion of females educated is associated with a lower risk of maternal mortality. Education is known to have both internal and external effect on others in society. Women with higher level formal education tend to have internal locus of control with favourable implications for their

reproductive lives and the society at large. The empirical model further showed that it is women with senior high school education or higher that makes the difference. Government needs to invest in increasing opportunities for women to achieve at least secondary education which has been found to be associated with a reduction in maternal mortality. This is the level of education that enhances women empowerment, strengthening women to take their own fertility into their hands and also places them in a position to bargain with men on fertility issues at the household level.

Create, support and protect livelihood activities

Poverty is a known determinant of a number of adverse maternal health outcomes. The only maternal health outcome that poverty does not seem to be significant and positively associated is abortion. Abortion has been found to be associated with the middle income class, the urban populations and much more prevalent in middle affluent neighbourhoods. This is presumed to be caused by a number of factors including the struggle to maintain employment and to continue with education. Whilst it is not within the scope of this thesis to discuss the legal philosophy of the current abortion law in Ghana, this study recommends that one way by which the demand for abortions can be reduced is by ensuring the protection of employment in the formal employment framework and extending policies to protect jobs also in the private sectors. Governments have the lead role to scale up efforts to improve maternity protection and health through the workplace. As noted earlier, one of the obstacles to achieving greater empowerment is the difficulty of combining reproductive responsibilities with income-earning employment. Governments, trade unions and employers can ensure that work does not threaten the health of

pregnant and nursing mothers and at the same time ensuring that maternity and women's reproductive roles do not jeopardize their employment security.

Community support

Communities' responsibility to support in stocking blood banks

Communities can be mobilised and orientated to provide relevant support in their capacity to make maternal lives better in their areas. Communities can do this in two very important areas: making available private cars and motor bikes for transporting women to health centres on emergencies and donating blood to stock up the communities' health facility blood banks. One thing according to the health personnel that may discourage people from freely donating blood to their community's health facility is the scar and stigma associated with being diagnosed of HIV. People however have to be encouraged and sensitised first of all on the importance of donating blood to the community's blood bank for the benefit of needy haemorrhaging women and also for the reciprocal effect of being served with someone else's blood when one is in need.

Provide transport support

The other important recommendation in terms of community responsibility is to encourage communities to assist in emergency situations by being ready to support in terms of giving out vehicles; cars and motorbikes (including bicycles) to transport women to health facilities for speedy attention. Private transport operators in communities can also be approached to provide emergency transport services at predetermined arrangements or conditions. This is an innovative module being used in the Central region to get around the barriers associated with transport in

the localities. The Central regional health directorate has a memorandum of understanding with the Ghana Private Road Transport Union (GPRTU) spanning all the districts in the region. If a taxi driver belongs to GPRTU and there is a pregnant woman who needs to be transported, the person will transport the pregnant woman to the nearest health facility regardless of where the person lives. This is an innovative arrangement which can be adopted in other communities in other regions across the country.

The local traditional birth attendant (TBA)

The role of TBA's in the provision of maternal health care must be properly integrated in the conventional health care delivery system since they contribute to pregnancy care and home assisted deliveries. There are certain communities that the services of the TBA cannot just be substituted. In an interview with a recently birth women, she averred that "in this community the TBA knows the pregnancy histories of all the women much more than we ourselves." Clearly, any direct attempt to attract women away from seeking the services of this TBA will not yield good returns. But as things exist today, the relationship between the TBAs and the formal health delivery system appears to be a mere network. The integration of TBAs should not only mean creating networks but it should incorporate important training skills on early detection of pregnancy-delivery related complications. Trained TBAs need to be supported with the provision of essential supplies such as clean delivery packs. This will create enabling environment during home assisted delivery in rural deprived settings where women have adopted a preference for home deliveries assisted by TBAs.

6.4 Concluding this chapter

Using largely qualitative information gathered through FGDs, in-depth interviews and birth narratives, this chapter has presented information that could help cave interventions to deal with barriers for accessing timely antenatal, postnatal and supervised delivery services and complying with referrals. These are important services for improving maternal health outcomes. To improve maternal health outcomes, attention must necessarily be given to improving socioeconomic opportunities in neighbourhoods or communities in which people live and work including advances in health technologies. In other words, efforts must focus on the neighbourhoods if interventions will produce the desired impact since this can only be observed if people have the capacity to utilise them.

CHAPTER SEVEN

7.0 CONCLUSIONS AND POLICY IMPLICATIONS

7.1 Introduction

In developing countries, the rate at which women die in pregnancy, in labour and sometimes after delivery makes pregnancy appear more dreadful than a disease. It has been estimated that more than one woman dies every minute from complications of pregnancy and childbirth somewhere in the world. Whilst less than 1% of maternal deaths occur in developed countries, nearly 99 per cent occur in developing countries, demonstrating that they could be avoided if resources and services were available. This makes maternal mortality the health indicator with the widest disparity between developed and developing countries and also deprived and less deprived areas within countries.

In much of the literature and policy discussions, there appears to be an overemphasis on declining fertility as a sine quo non to maternal mortality reduction. However, in Ghana where neither sexual activity, the predominant cause of pregnancy, is anywhere constrained, nor the use of contraceptives protective enough against incidental pregnancies, the focus on fertility as a means to reduce maternal mortality and other adverse maternal health outcomes may not be a lasting endeavour. The hazards of childbirth cannot be avoided simply by preventing pregnancy. Safe motherhood must be viewed much more comprehensively as a vulnerability issue and investigated in a multidisciplinary fashion.

Many social scientists subscribe to this view of the social-production-of-vulnerability, but few acknowledge the contribution of inequalities to the occurrence of conditions that deepen vulnerability. Yet such risk factors continue to shape not only the distribution of vulnerability, but also the factors that reinforce it. Severe shocks to the household such as death create and deepen vulnerability. Maternal death affects household productivity, affects quality of children and future human capital and lowers household's wellbeing. These outcomes in turn create and fertilize the ground where poor maternal health persists. This phenomenon has flourished amidst unprecedented increase in medical research, public health, health economics, geography, sociology and many other disciplines. The problem however remains that most of the hypothesis and policy recommendations have often been individually-based, making it difficult for policy implementation for reasons of lack of resources and also difficulties in targeting.

The consequence of this is the inability to substantially influence safe abortion practices, reduce the rate of stillbirth and miscarriage and the incidence of maternal mortality. The problem is that the social and economic circumstances that women live with are themselves associated with the production of poor health outcomes. For instance, it is how the society responds to a teenage pregnancy that will significantly determine whether a young girl will keep or hide and abort the pregnancy. It is the cultural orientation of an area that will influence a woman's acceptance of a facility delivery or to be supervised by somebody else besides the local TBA. These conditions cannot be addressed by readjusting individually-based mechanisms that appear to link them to disease in a given context. Individually-based interventions more or less target behaviours that sometimes are resistant to change. In other to change the impact of these conditions there is the need to intervene in ways that change the social conditions directly. That requires a research

paradigm that is multidisciplinary to expand the understanding of the social and economic factors that expose women to the risks associated with maternal health. That is the focus of this study.

With the benefit of the Ghana Maternal Health Survey which is a large scale nationally representative survey that collected comprehensive information on all facets of maternal health - pregnancy histories of main respondents and deceased siblings, healthcare utilisation, abortion experiences, and also a verbal autopsy to understand much more closely the causes of reported deaths, this study sought to explore the underlying factors that expose women to adverse maternal health outcomes. The main objective of the study was to examine how socioeconomic inequalities at both individual and neighbourhood or community levels are fundamental to the occurrence of adverse pregnancy outcomes such as stillbirth, miscarriage, abortion practices and maternal mortality. This suggests the use of analytical models that are systemic, yet incorporating local variations in order to contextualise social and economic dynamics that expose women to pregnancy-related risk factors.

The study thus adopted an integrated conceptual framework that embraced both individual-level personal, biological and behavioural factors and community or neighbourhood-level characteristics to reflect factors such as the working environment of women, the cultural setting (in terms of ethnic and religious orientation), coverage of healthcare and more importantly the economic structure of the neighbourhood in terms of whether deprived or less deprived. By doing this the study explored ideas from economics, geography, sociology and public health for the analysis.

Apart from using quantitative models to test the significance of theoretically considered variables or factors that the study started with, the study was further enriched with interviews conducted with healthcare providers, community leaders, transport operators, and more importantly birth narratives from women who had a recent experience of a pregnancy and husbands where exist. These provided additional insights into what are considered barriers to having improved maternal healthcare and suggestions as to how to deal with adverse outcomes.

7.2 Summary of findings

Stillbirth and miscarriage

The results showed that even though miscarriage and stillbirth share many things in common, the difference lies in the direction and the magnitude of effect. The results showed that whilst living in less deprived neighbourhoods is associated with a lower odds ratio of suffering stillbirth, it has a higher effect on the probability of suffering miscarriage. Wealthy households (5th quintile) appear however protected even if they live in a deprived neighbourhood. In terms of stillbirth, even though living in less deprived neighbourhoods is protective, it is women of wealthy background that are associated with a lower risk of stillbirth. It is also women from poorer households living in less deprived neighbourhoods who are more likely to have miscarriages as compared to their wealthy counterparts who live in the less deprived neighbourhoods. For stillbirth, it appears the problem may not be the neighbourhood but the individual's resource endowment and the ability to consume healthcare. Muslim women have a significantly higher odds ratio of reporting a miscarriage. In terms of ethnicity, women who are Ewe also have a higher chance of suffering miscarriages.

Elective abortion

The rate of abortion was found to be higher among the middle and affluent class households and also high among the educated. In terms of locality, abortion is a middle-level neighbourhood problem. These are neighbourhoods that mimic growing economy status where there is high level of social and ethnic diversity due to immigration and upsurge of business activities. Even though affluent neighbourhoods are significantly associated with higher likelihood of abortions, it is women in middle-level households (3rd quintile) living in these affluent neighbourhoods that are significantly likely to commit an abortion. It is also that abortion as we found is not singularly a problem of the young and unmarried, but a "disease of urbanisation", perpetuated by the activities of private market actors. Abortion is neither a poor neighbourhood problem nor a problem of the poor. It is thus difficult for this study to subscribe to the call for the unchecked inclusion of abortion services in the NHIS as it is now.

Maternal mortality

The results showed that women living in deprived areas are associated with a higher risk of maternal mortality as compared to those living in less deprived areas. The impact of deprivation on the risk of maternal mortality is higher in rural areas and areas classified as small towns than in large cities. The results further showed that there is a lowered risk of maternal mortality in neighbourhoods with high proportion of women with secondary school education or higher and therefore serve as a mitigating factor. Living in ethnically diverse neighbourhoods is also associated with a lower risk of maternal mortality.

The rate of maternal mortality in neighbourhoods that have a high proportion of educated females is also lower as compared to neighbourhoods with low proportion of educated females (having educational qualification beyond the secondary level). This is expected due to the benefits of education to the individual and its externality effect especially on other family members and neighbours. More important for policy discussion is the fact that in deprived neighbourhoods an increase in the proportion of women with secondary education or high is also associated with a lower incidence rate of maternal mortality. A unit increase in the proportion of high educated females in a deprived neighbourhood decreases the incidence rate of maternal mortality by 12 per cent (significant at 10%). This is usually attributed to the externality factor of high education.

The analysis further showed that a neighbourhood associated with high prevalence of miscarriages and abortion is also associated with high incidence rate of maternal mortality. Neighbourhoods with high incidence of stillbirths, on the other hand, have a lower rate of maternal mortality. Neighbourhoods with a high level of use of supervised delivery were associated with lower incidence rate of maternal mortality. A high proportion of women seeking assistance or having supervised deliveries have a 0.01% lower incidence rate of maternal mortality than areas where women have a lower coverage of skilled personnel assisted deliveries.

7.3 Policy Implications

The lack of an appreciable decline in maternal mortality despite increases in the amount of interventions in maternal healthcare service delivery reflects partly the approaches employed to study the subject of maternal health outcomes which more often leads to the implementation of interventions in areas perhaps less at risk. Data on levels and trends of mortality significantly underpin the ability to make judgements about maternal health and to design appropriate interventions. In particular, information on incidence of pregnancy failures, family planning services (including safe abortion practices) and maternal mortality are critical areas for action. As a result of the lack of data and a dearth of comprehensive and integrated research, intervention programmes most often are designed with half-informed targets and targeted groups of people or communities for attention.

The outcome of this study suggest that it is important to look beyond the individual when analysing maternal health issues because women's reproductive health is essentially affected by their social environment just as their personal biological constitution. Analysis that take communities as rural and urban does not also bring out the significant differences that exist among areas classified demographically as rural and urban. An urban area with slums, overcrowded dwelling conditions is riskier than a rural neighbourhood that has space for people to walk and play about.

The risk factors to maternal health relates to the key indicators of deprivation which influences both the demand and supply side of healthcare and also critical to an individual's stock of health. The demand and supply side factors are poor or inadequate infrastructure (roads transport, etc.),

finance, and poor quality health personnel. Risk factors that affect the stock of health are lack of access to improved water, poor sanitation and improper dwelling arrangements (overcrowding). Health facilities in rural communities that do not have reliable transport to send women under emergency conditions to nearby towns for attention risk recording mortalities or pregnancy loses. From the qualitative discussion we have also seen that the performance of health personnel can jeopardise the fortunes of pregnant women. Clearly, policy must tackle quality improvement issues in a comprehensive manner and include the efficiency of health personnel in attending to maternity cases.

Women having formal education at least up to the secondary school level, as found in this study, was associated with lower incidence of maternal mortality in a neighbourhood. Expanding access to secondary school education for girls is therefore a very important policy option to reduce maternal mortality in Ghana. Secondly, community-focus mass education that sensitises people on the need to support women to attend ANC, PNC and also to be taken care of by medically trained health personnel during delivery is important. Rather than district level, communities need to have community-based maternal health committees where chiefs, opinion leaders, TBAs, worker-based organisations such as the GPRTU, nurses and teachers are part with the aim of tackling maternal health issues at the community level. This will be an expansion of the model being experimented in the Central Region where district health directorates have an understanding with transport operators (GPRTU) to transport emergency cases to health facilities and receive payment later.

Further, development planning must give some attention to areas perceived as less deprived in Ghana, because living among the affluent are poor people who are not often noticed for attention. These are people even though live among the affluent, lack adequate access to improved water, quality dwelling, sanitation, and worse of all, benefit far less from subsidised healthcare. The predicament of these people reflects the prevailing inadequacies and deficiency of our social security arrangements systems. The detrimental externalities of inaction in these areas will continue to be severe if not targeted.

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APPENDICES

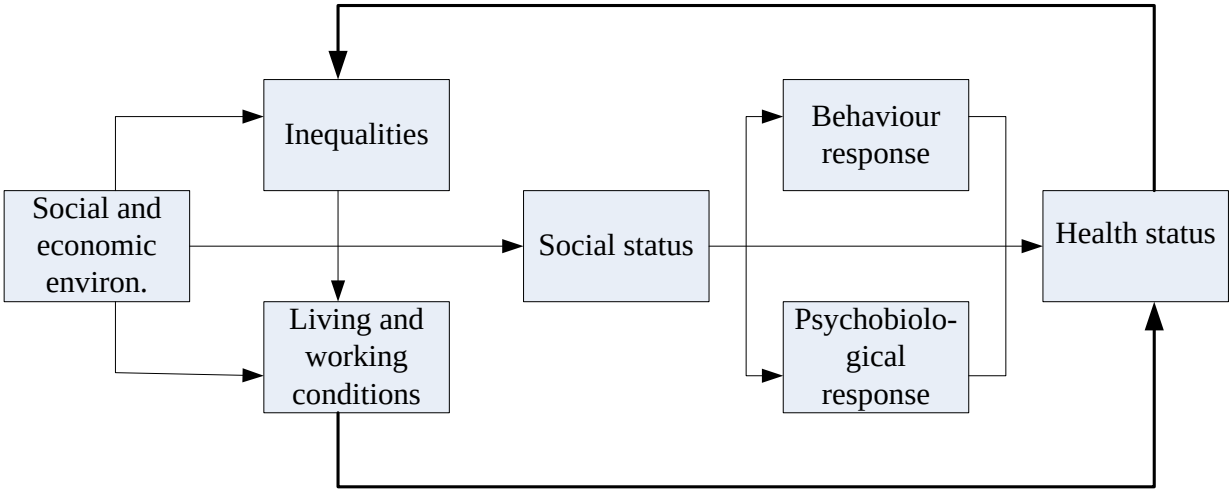
Appendix A

Table 1: Definition of some maternal health concepts used in the work

CONDITION	DEFINITION	SOURCE
Maternity	Period of pregnancy counted from the moment of conception and until 42 days after the termination of gestation, irrespective of outcome.	Riffe (2010)
Maternal Morbidity	Complications that arise during the pregnancy, delivery or post-partum period.	
Live Birth	The complete expulsion or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy, which, after such expulsion or extraction, breathes, or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached. Heartbeats are to be distinguished from transient cardiac contractions; respirations are to be distinguished from fleeting respiratory efforts or gasps.	Kowaleski (1997)
Fetal death	Complete expulsion or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy and which is not an induced termination of pregnancy. The death is indicated by the fact that after such expulsion or extraction, the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles.	Kowaleski (1997)
Miscarriage	Loss of a pregnancy before the foetus is developed enough to survive on its own usually occurring within the first 20 weeks of gestation and weighs 500g or less.	Kowaleski (1997)
Stillbirth,	Death of a foetus in the uterus or during labour or delivery exits a woman. The gestation period for a stillbirth is normally 22 weeks, but it can also happen in full term pregnancies.	Kowaleski (1997)
Abortion/Induced termination of pregnancy	Purposeful interruption of an intrauterine pregnancy with the intention other than to produce a live-born infant and which does not result in a live birth.	Kowaleski (1997)
Maternal death	Death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes	(WHO, 2007; ICD 10th Revision).
Pregnancy-Associated Death	Death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death	(WHO, 2007; ICD 10th Revision).
Lifetime risk of maternal death	The chance of dying from pregnancy for an adult of reproductive age	WHO (2012)
Maternal Mortality Ratio (MMR),	MMR tries to approximate the mortality hazard due to or associated with childbearing.	WHO (2012)
Maternal Mortality Rate (MM Rate)	The MM Rate informs about the maximum absolute mortality improvements that could be realized by reductions in maternal mortality.	WHO (2012)
Proportion maternal among deaths (PM)	This tells the weight of maternal mortality over all deaths to women of reproductive ages.	WHO (2012)
Unsafe Abortion	Abortion performed either by persons lacking the necessary skills or in an environment lacking the minimal medical standards, or both, often in countries where abortion is illegal.	Haddad and Nour (2009)

Appendices B:

Figure 1: Conceptualising the causal pathways of the materialist/neo-materialist model



Source: Meng (2010)

Appendix C:

Table 1: Characteristics of the GMHS 2007

Characteristics	Sample #1	Sample #2
Sample	Nationally representative 1600 clusters 226209 Households w/ completed interviews 4203 female deaths w/ completed VAQ	Nationally representative 400 clusters (sub-sample of Sample #1) 10858 Households w/ completed interview 10370 Women age 15-49 w/ completed interview
Questionnaires	1) Phase 1 Household Questionnaire 2) Verbal Autopsy Questionnaire (VAQ)	1) Phase 2 Household Questionnaire 2) Women's Questionnaire
Sample weights	By region and urban-rural	By region and urban/rural

Source: GSS, GHS and Macro Int., (2009)

Table 2: Distribution of respondents in the qualitative interviews

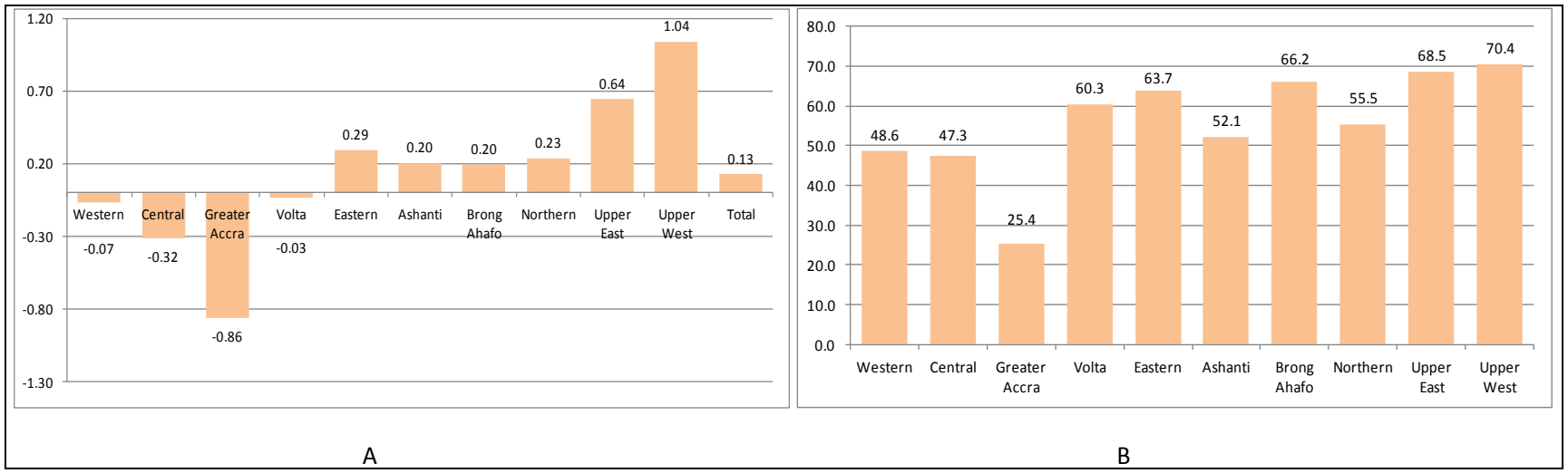
Type of interview	Northern Region Nanumba North Municipal	Central Region Assin North
Focus Group Discussions		
Male Groups	2	2
Female Groups	2	2
Individual level		
Mother Birth Narratives (MBNs)	7	10
Father Birth Narratives (FBNs)	6	8
Facility interview	3	2
Total	**20**	**24**

Appendix D:

Table 1: Indicators use in measuring the IMD by various authors and in this study

Domain	Description	Towsend	Jarman	Carstairs	IMD/SIMD/NIIMD	SEIFA	NZdep	USA	CNI	Spain	Indicators in this study
Unemployment	Percentage of adults who are unemployed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Household Overcrowding	Room density	✓	✓	✓	✓	✓	✓		✓	✓	✓
Low Social Class and Poverty	Rate of households on public assistance			✓	✓	✓		✓	✓	✓	
Education	Percentage of persons with the highest education				✓	✓	✓	✓		✓	✓
Home Ownership	Percentage of owned houses	✓	✓		✓		✓	✓			✓
Income	Per capita income				✓	✓	✓	✓			
Vulnerable	Percentage of aged single households		✓			✓	✓		✓		
Car Ownership		✓		✓				✓			
Barriers to Services and Transport					✓		✓				
Communication						✓	✓				
Health					✓						
Crime					✓						
Improved water source	Prop. of households without access to good water										✓
Improved lighting	Prop. of households without access to good lighting										✓
Poor liquid waste disposal	Prop. of households without good solid waste disposal system										✓
Poor solid waste disposal	Prop. of households without good liquid waste disposal system										✓
Deprived of a dwelling place	Proportion of people with no dwelling place										✓
Deprived of toilet facility	Proportion of households with no good place for toilet										✓

Figure 1: Index of Multiple Deprivation in Ghana (A) and Proportion of deprived areas in each region



Source: Author's construction from the 2000 PHC.

Appendix F

Table 1: Model fit diagnostics for the determinants of stillbirth and miscarriage

Random effects		Model 1	Model 2	Model 3	Model 4	Model 5
Intercept		0.484	0.461	0.328	0.295	0.277
Std. err.		0.081	0.078	0.062	0.060	0.058
Model fit statistics		Model 1	Model 2	Model 3	Model 4	Model 5
AIC		5674.4	5428.8	5426.5	5354.6	5349.1
BIC		6328.6	5660.5	5658.2	5627.1	5531.6

Figure 1: Reasons for seeking an abortion

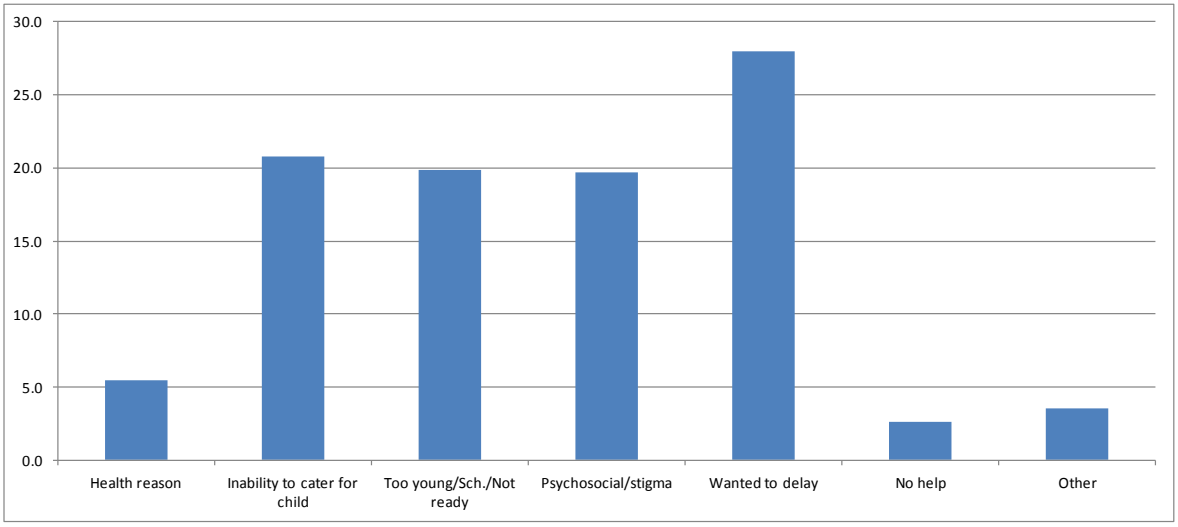


Figure 2: Person who assisted in the first step to have the last abortion

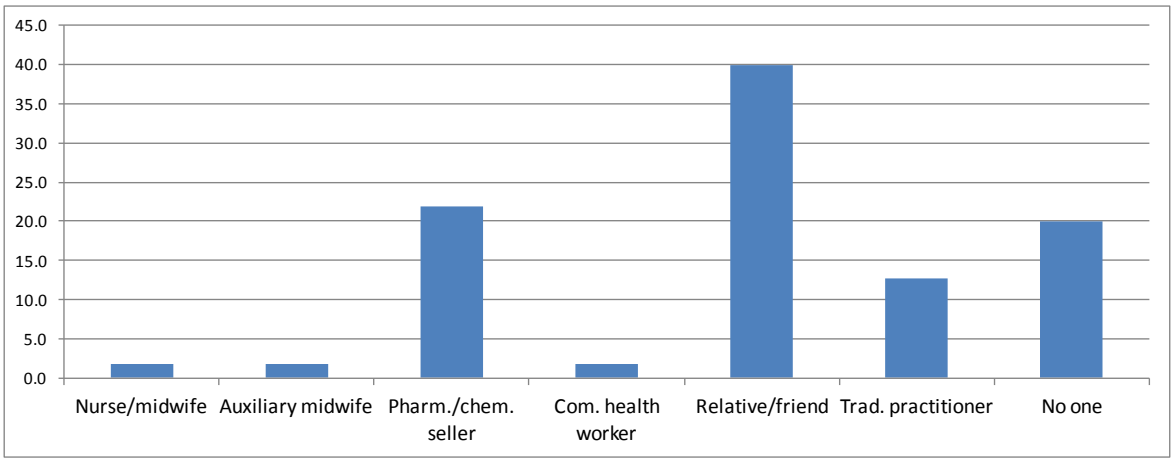


Table 2: Source for the last step to have the last abortion

Source for last step to end pregnancy	Poorest	Poorer	Middle	Richer	Richest	Total
Gov. hospital	6	15	21	20	25	87
Gov. health centre/post	3	6	5	8	12	34
Private hosp/clinic	23	27	40	63	76	229
Pharmacy	1	6	3	12	10	32
Respondent's home	25	18	26	38	48	155
Other home	1	1	2	8	5	18
Other/missing	2	0	2	0	2	9
Total	61	73	99	153	178	564

Appendix G: Table 1: Matrix of correlation coefficients between maternal mortality and domains used for deprivation index

MM/Deprivation indicators	1	2	3	4	5	6	7	8	9	10	11	12	13
(1) No house													
(2) Overcrowded	-0.167												
(3) Unemployed	0.005	0.032											
(4) Light deprived	-0.459	0.677	-0.051										
(5) Water deprived	-0.382	0.648	-0.027	0.796									
(6) Toilet deprived	-0.053	-0.010	-0.062	0.135	0.102								
(7) Fuel deprived	0.420	-0.270	0.129	-0.619	-0.595	-0.227							
(8) No cooking space	-0.102	0.426	0.063	0.257	0.210	-0.132	0.111						
(9) No proper bathing space	0.086	0.390	0.091	0.207	0.197	0.021	-0.025	0.315					
(10) Poor sanitation (liquid)	-0.375	0.525	0.031	0.593	0.513	0.022	-0.297	0.387	0.100				
(11) Poor sanitation (solid)	-0.254	0.901	0.034	0.702	0.696	0.001	-0.312	0.455	0.381	0.540			
(12) No proper dwelling place	0.036	0.039	-0.001	0.021	-0.005	-0.005	0.012	0.077	-0.035	-0.002	0.027		
(13) Maternal mortality	-0.006	0.033	-0.012	0.040	0.038	0.014	-0.046	0.023	0.017	0.040	0.028	0.015	