A MIXED METHODS STUDY OF SOCIAL NETWORK CHARACTARISTICS AND HEALTH FACILITY DELIVERY AMONG WOMEN IN RURAL GHANA

Leslie E. Cofie

A dissertation submitted to the faculty at the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Health Behavior in the Gillings School of Global Public Health.

Chapel Hill
2016

Approved by:

Clare Barrington

Kavita Singh

Suzanne Maman

Susan Ennett

Sodzi Sodzi-Tettey

ABSTRACT

Leslie E. Cofie: A Mixed Methods Study of Social Network Characteristics and Health Facility Delivery Among Women in Rural Ghana
(Under the direction of Clare Barrington)

Background: Most maternal deaths are preventable with health facility birth, but half of women in sub-Saharan Africa do not deliver in health facilities. Although theoretical and empirical evidence suggest that social networks influence facility delivery, examination of this relationship in Africa is very limited. The aims of this mixed-methods study were to: (1) examine the association between social network structural and functional characteristics and facility delivery in rural Ghana; (2) test whether these network characteristics had an interactive effect on facility delivery; and (3) explore how women's network composition and social support influence facility delivery.

Methods: Both quantitative and qualitative data came from the Maternal and Newborn Health Referral (MNHR) project in Ghana. I used multivariate logistic regression to analyze endline quantitative data from mothers (n=783) enrolled in the MNHR study. Qualitative data included in-depth interviews with mothers (n=40) and husbands (n=20), and 4 focus group interviews with mothers-in-law. I analyzed the data using narrative methods and thematic coding procedures.

Results: Higher levels of instrumental support (OR: 1.60, CI: 1.10-2.34) and informational support (OR: 1.66, CI: 1.08-2.54) were significantly associated with higher

odds of facility delivery. In terms of social norms, knowing more women who had received pregnancy-related care in a facility (OR: 2.20, CI: 1.21-4.00) was significantly associated with higher odds of facility delivery. The number of network members that respondents lived near moderated the positive relationship between informational support and facility delivery. Informational support modified the positive relationship between number of women the respondents know that have utilized a facility for pregnancy-related care and facility delivery. The qualitative findings revealed that the social networks of women who delivered in a facility endorsed facility delivery and mobilized resources to support women's facility delivery. Among women who had homebirths, social networks endorsed homebirth and/or delayed in making arrangements to facilitate facility delivery.

Conclusion: Women's social networks influenced whether they delivered in a health facility. Social networks should be targeted in maternal health interventions to increase facility delivery uptake.

ACKNOWLDGEMENTS

My sincerest appreciation to my parents, older sister and younger sister whose love and support gave me the courage to pursue my doctorate degree. I am forever grateful for the devotion and commitment my parents have to ensuring my success in life. To my older sister, thank you for being my big sister. Finally, my sincerest gratitude to my partner for all her support in the final phase of my dissertation completion.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

In 2015, sub-Saharan African countries accounted for 66% of the world's maternal mortality, which represented 201,000 deaths (WHO et al., 2015). Most maternal deaths could be prevented with health facility births assisted by skilled birth attendants (UNFPA, 2009). However, in sub-Saharan Africa, half of pregnant women do not deliver in health facilities (UNICEF, 2014). In Ghana, 73% of pregnant women overall deliver in health facilities, but the coverage is only 59% for women in rural areas (GSS, GHS, & ICF Macro, 2015). There is ample evidence from the maternal health field identifying determinants of the uptake of facility delivery including: physical and economic access; maternal socio-demographics (e.g. age, parity, education, wealth); and perceived needs/benefits of using the services (Gabrysch & Campbell, 2009; Moyer & Mustafa, 2013). Conversely, social determinants, such as social networks, have received little attention.

Social networks are a form of social capital that can facilitate the provision of social and material resources to promote health (Bourdieu, 1986; Kawachi, 2008). A social network is a web of social relationships among a group of individuals, which has both structural and functional characteristics (Mitchell, 1969; Fischer, 1982; Lauman, 1973). Network structural characteristics include network size and network members' connectedness (density), demographic similarities (homogeneity) and emotional closeness with each other (tie strength) (Seeman & Berkman, 1987; House, Landis & Umberson, 1988). Network functions include resources provided by network members, social support, and the social influence exerted by network members (Berkman & Glass, 2000). Understanding the influence of social networks on

facility delivery can provide insights into ways to increase use of facility birth (Gabrysch & Campbell, 2009; Say & Raine 2007). Yet, research on the relationships between social network structural and functional characteristics and facility delivery is sparse.

Edmonds and colleagues (2012) recently found no association between network structural characteristics (homogeneity, density and strength) and facility birth. These authors also examined the interaction between structural characteristics and network function (descriptive norms regarding place of delivery) and found no significant effect of this interaction effect on facility birth. Edmonds and colleagues acknowledged that additional work is needed to examine other network structures, as previous studies found an association between network structure (larger network size, higher frequency of contact, closer proximity of network members to one another, and higher strength of network ties) and health services utilization including maternal care (Devillanova, 2008; Deri, 2005; Berkavonic & Telesky, 1982).

Previous research has suggested that women's experience of various forms of social support (emotional, instrumental and informational) during pregnancy and delivery influence their place of delivery (Story et al., 2012; Ono et al., 2013). Recently, Ono and colleagues (2013) conducted the only quantitative study in sub-Saharan Africa on the association between social support and use of facility delivery, in Kenya. They found that married women whose husbands helped them with farming, and/or whose neighbors helped them with fetching water, were less likely to deliver at a health facility than those who did not receive these two forms of support. They suggested that a likely explanation was that married women lived in close-knit communities with their husbands' family household, and thus were influenced by the family's normative belief in homebirths. Conversely, the unmarried women were not subject to normative influences from a husband's family to deliver at home, and so were more likely to deliver at a

health facility. Additional research can provide further insights into ways in which network members' provision of different types of social support may influence women's use of facility delivery.

Along with social support, normative influence is another social network functional characteristic that is positively associated with health facility delivery. Evidence from Mali and Tanzania suggest that women whose husbands and mothers-in-law had favorable views of health facility birth were more likely to delivery in a health facility, than those whose husbands and mothers-in-law's views were unfavorable (Danforth et al., 2009; White et al., 2013). Further work can build on these findings, which were based on community level norms, by examining the normative influence of network members in women's pregnancy and delivery experiences.

Presently, no study has examined the relationship between network structure and health facility delivery in sub-Saharan Africa. Only one study has quantitatively examined, and found, an association between social support on facility delivery (Ono et al., 2013). Also, research of the relationship between social norms and facility delivery has mainly focused on community level norms (White et al., 2013; Speizer et al., 2014). Taken together these findings point to the need to further examine which specific network characteristics are associated with women's use of facility delivery. While interactions between the network characteristics may have an effect on facility delivery, more research is needed to examine the nature of the relationships (Edmonds et al., 2012; Story et al., 2012; Ono et al., 2013).

My dissertation study responds to these gaps in maternal health research by using a mixed-methods convergent design to address the overarching question: What is the influence of social network characteristics on pregnant women's use of facility birth in rural Ghana? Specifically, I quantitatively examined the association between structural and functional network

characteristics and use of health facility birth, accounting for well-known determinants of the outcome. Additionally, I conducted an in-depth qualitative assessment of how social network characteristics influenced women's pregnancy, labor and delivery experiences.

My specific aims were to:

Aim 1.1: Determine whether social network structure (size, frequency and proximity), social support (informational, instrumental and emotional) and social norms (injunctive and descriptive norms) are associated with health facility birth among women in rural Ghana.

Aim 1.2: Determine whether network structure (size, frequency and proximity) and network functions (social support and social norms) interact to influence health facility birth.

Aim 2: Qualitatively explore how social network characteristics are related to health facility birth. My goal was to understand how network members influence women's pregnancy, labor and delivery experiences. I aimed to characterize the social network dynamics of women in rural Ghana and to examine how network composition, social support, and norms are related to women's use of health facility births.

Data for my dissertation was collected as part of an endline assessment of a quality improvement intervention in rural Ghana to improve maternal and newborn health. Aim 1 was addressed using household survey data collected from 783 women with births within 3 years prior to the survey data collection. To address Aim 2, I used qualitative data collected through individual interviews with 40 mothers and 20 husbands; and 4 focus group discussions with mothers-in-law.

My dissertation research advances understanding of social network factors that influence health facility delivery. Findings from this study can be used to inform maternal health interventions to promote health services delivery care and use.

Definition of terms

I define terms frequently used in this study in order to enable understanding and quick reference to the meaning of these key terms.

Health facility birth – Use a skilled birth attendant for delivery at a facility. In low- and middle-income countries, skilled birth attendance mostly occurs at health facilities, where skilled health professionals are likely to have access to essential equipment and supplies (Gabrysch & Campbell, 2009; UNICEF, 2014).

Skilled birth attendance – the process whereby a skilled birth attendant (e.g. midwife, midwife, doctor or nurse) provides adequate care for pregnant women during labor, birth and immediately postpartum in an enabling environment (Adegoke & van den Broek, 2009; Sullivan & Hirst, 2011).

Social network – a web of social relationships among a group of individuals, which has both structural and functional characteristics (Mitchell, 1969; Fischer, 1982; Lauman, 1995).

Network structural characteristics – properties of the relationship among members within a network (Hall & Wellman, 1985; House et al., 1988; Seeman & Berkman, 1988; Israel, 1982). These includes:

Composition – refers to the types of individuals in the network (e.g. relatives, neighbors and friends).

Size – number of members in an individual's network.

Frequency – how often an individual comes in contact/ interact with network members.

Proximity – how close an individual lives to their network members.

Functional network characteristics – various roles performed by network members such as provision of social support and social influence (House, 1981).

Social support – different kinds of support provided to an individual by his/her network members (House, 1981; Thoits, 1995; Kahn & Antonucci, 1986; Sarason et al., 1990). These include:

Emotional support – love, care, or understanding provided by network members.

Instrumental support – tangible aid or assistance provided by network members.

Informational support – advice or relevant information offered by network members.

Social influence – refers to shared norms and behaviors that impact one's attitudes and behaviors (Marsden & Friedkin, 1994; Erickson, 1988; Cialdini & Trost, 1998; Lapinski & Rimal, 2005). These include:

Descriptive norms – perceptions of behaviors that are most common among network members. Individuals within a network tend to adopt perceived behaviors of network members.

Injunctive norms – perceptions of behaviors that are acceptable by network members, and individuals are influenced to adhere to those behaviors in order to avoid social sanctioning.

Organization of the study

Chapter 2 of my dissertation introduces background information on maternal mortality, its causes, and use of health facility delivery to reduce maternal deaths globally and specific to Ghana. In this chapter, I review the literature on known determinants of facility delivery. Additionally, I discuss the need to examine additional social determinants such as social

networks, which can improve understanding of how to further increase uptakes in women's use of facility-based deliver care.

In Chapter 3, I present the theoretical rationale for examining women's social networks, and review prior literature on the relationship between social network structure, functions, and maternal health care including birth delivery care.

In Chapter 4, I introduce the convergent mixed methods approach I used to collect and analyze my quantitative and qualitative data.

Chapter 5 details my quantitative study on the relationship between network structure, functions (social support and social norms), and facility delivery. I used logistic regression analysis to examine these relationships. Also, I examined whether the interaction between the network characteristics were associated with health facility birth, following Frazier et al.'s (2004) steps for testing moderations.

In Chapter 6, I present results of my qualitative study of how women's network composition, social support, and norms are related to their use of health facility delivery. I used analytic summaries and a thematic coding process to analyze the data. This chapter helps shed light on the relationship between network characteristics and facility birth that were explored in Chapter 5.

In Chapter 7, I conclude with a discussion of my relevant findings, the strength and limitations of my studies, and future directions for research.

CHAPTER 2: BACKGROUND REVIEW OF LITERATURE

Global Maternal Mortality Trends, Cause, and Solutions

Globally, approximately 303,000 women died from pregnancy and childbirth in 2015 (WHO et al., 2015). Maternal mortality is defined as "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" (WHO, 2004a, p. 98).

The maternal mortality ratio (MMR), defined as the number of maternal deaths per 100,000 live births within a given time period, dropped from 385 to 216 maternal deaths per 100,000 live births between 1990 and 2015 (Mattson, 2010; Lozano et al., 2011; WHO et al., 2015). Despite this substantial reduction, concerns remain about the slow progress toward eliminating maternal deaths, especially in low- and middle-income countries (LMICs).[1] Yearly, LMICs account for 99% of the maternal deaths worldwide and LMICs in certain regions experience higher proportions of maternal deaths than others (Kassebaum et al., 2014). In 2015, for example, 66% of global maternal deaths were in the sub-Saharan African region, and also this region had the highest regional MMR – 546 maternal deaths per 100,000 live births (WHO et al., 2015).

Causes of Maternal Deaths: The WHO (2004a) definition of maternal mortality establishes a distinction between direct and indirect causes of maternal deaths. Direct causes of maternal mortality include hemorrhage, hypertensive disorder, sepsis, complications from

[1] LMICs and high-income countries are differentiated by their gross national income (GNI) per capita, which is under $12,476 for LMICs and above that amount for high-income countries (World Bank, 2014).

delivery, and abortions. These account for almost 73% of all maternal deaths globally (Say et al., 2014). Indirect causes of maternal deaths include malaria, anemia, HIV and heart disease, which account for 27% of all maternal deaths worldwide. According to recent estimates, indirect causes (28.6%), hemorrhage (24.5%), hypertension (16%), and sepsis (10.3%) were the leading causes of maternal mortality in sub-Saharan Africa (Say et al, 2014).

Skilled Birth Attendance and Maternal Mortality Reduction: Maternal deaths can be prevented through the use of skilled birth attendance, the process whereby a skilled birth attendant provides adequate care to pregnant women during labor, birth and immediately postpartum in an enabling environment or health facility (Family Care International, 2000; Adegoke & van den Broek, 2009; Sullivan & Hirst, 2011). A skilled birth attendant is an accredited health professional – e.g. a midwife, doctor or nurse – trained to proficiency in the skills needed to provide care for uncomplicated pregnancy and delivery, and to manage and refer complications in women and newborns (Van Lerberghe & De Brouwere, 2001; WHO, 2004b). Skilled birth attendance is the single most important means of reducing maternal deaths worldwide (UNFPA, 2009; de Bernis, Sherratt, AbouZahr, & Van Lerberghe, 2003; Harvey et al., 2007). An estimated 15% of all women will experience birth related complications that are potentially life threatening, and yet these complications are generally unpredictable (UNFPA, 2009). The complications, along with other causes of maternal deaths, can be prevented or addressed, if women have access to skilled attendance during labor and delivery (Van den Broek & Falconer, 2011; UNFPA, 2009).

In LMICs, skilled birth attendance mostly occurs at health facilities, where skilled health professionals are likely to have access to essential equipment and supplies (Gabrysch & Campbell, 2009; UNICEF, 2014). While approximately 90% of births in regions like East Asia

and Latin America occur in health facilities, less than half of all deliveries in sub-Saharan Africa take place in health facilities (UNICEF, 2014). My dissertation focuses on health facility births because having skilled birth attendants in health facilities with referral capacities is the most efficient and cost-effective way to reduce pregnancy related complications in LMICs (Campbell & Graham, 2006; Prata et al., 2011). Moreover, my research is part of a larger national project to promote health facility delivery among pregnant women in Ghana. Henceforth, I differentiate between skilled birth attendance, per my initial definition, and health facility birth, which is described as the use a skilled birth attendant for delivery at a facility.

Determinants of Health Facility Delivery Globally

Numerous studies across LMICs have examined determinants of health facility delivery. Perhaps most notable is Thaddeus and Maine's (1994) review of determinants associated with health facility use for delivery care in the early part of the 1990s, which resulted in the conceptualization of the three-delay model. The authors' conceptual model served as a framework for identifying determinants related to delays in 1) deciding to seek care, 2) getting to a health facility and 3) receiving appropriate care. Thaddeus and Maine's model focused on women seeking obstetric care after experiencing birth related complications. More recent reviews have expanded such focus to include uncomplicated pregnancies (Say & Raine, 2007; Gabrysch & Campbell, 2009; Moyer & Mustafa, 2013). For example, Gabrysch and Campbell (2009) included research on preventive care seeking for uncomplicated births, in their review of determinants of the use health facility for delivery.

Building on Thaddeus and Maine's (1994) conceptual model Gabrysch and Campbell (2009) developed a different framework which presented three categories of determinants that were positively associated with health facility delivery: physical and economic accessibility;

sociocultural; and perceived needs and benefits. Physical accessibility determinants included shorter distance to health a facility, higher availability of transportation and residing in urban (as opposed to rural) areas. Economic accessibility determinants were lower costs of health services, and higher status of husband's occupation. Gabrysch and Campbell broadly conceptualized sociocultural determinants as influences on decision-making to seek care, and included decision-making of both mothers and their family. Hence, they included women's autonomy (higher control over resources and decision-making power) and higher levels of maternal and husband education as sociocultural determinants, although these may be considered as maternal or socio-demographic determinants. Perceived needs/benefits determinants included regular attendance of antenatal care (ANC), previous delivery in health facility, perception of high quality of care, and lower birth order and experience of complications. Subsequent reviews focusing on the south Asia and sub-Saharan African regions also demonstrated that these determinants were associated with health facility births (Moyer & Mustafa, 2103; Tey & Lai, 2013; Brighton, D'Arcy, Kirtley, & Kennedy, 2013).

Sub-Saharan Africa: In the sub-Saharan African region, a large body of work previously examined determinants of health facility births (Tey & Lai, 2013; Stephenson, Baschieri, Clements, Hennink, & Madise, 2006; Moyer & Mustafa, 2013; Brighton et al., 2013). Most recently, a systematic review of determinants associated with facility delivery in the region showed that maternal characteristics, ANC attendance, social, facility and macro-level determinants were positively associated with facility delivery (Moyer & Mustafa 2013). Maternal characteristics included higher maternal age, lower parity, higher maternal education, higher levels of household wealth, positive perceptions and experiences from using health facility delivery care, and urban as opposed to rural residence. ANC determinants included

regular ANC attendance, earlier time of first ANC visit, high quality of ANC, and being advised to delivery in health facility during ANC visit. Social determinants were the least examined. They included higher perceptions of positive community attitudes towards facility birth, higher percentage of women in a village who attended ANC, higher community endorsement of skilled health professionals, and higher community perceptions about having access to the nearest facility. Facility determinants included shorter distance to health facility, lower cost associated with facility birth, higher perception about quality of delivery care, and higher perception of positive staff attitudes and behaviors. Macro level determinants included higher total health expenditure per capita, higher proportion of female literacy nationally, and greater percentage of government spending on health care.

The majority of studies on determinants of facility delivery in LMICs including African countries have focused on maternal and socio-demographic characteristics (Say & Raine, 2007; Gabrysch & Campbell, 2009; Moyer, Dako-Gyeke, & Adanu, 2013; Moyer & Mustafa, 2013). Moyer & Mustafa (2013) noted that a critical gap in the literature is studies that move beyond such characteristics to examine social determinants influencing delivery location. They, along with other researchers, argued that previous studies on the determinants of facility delivery were limited, since researchers did not examine additional determinants such as social networks, which are likely to advance understanding of health facility delivery (Gabrysch & Campbell, 2009; Say & Raine 2007). To address this critical gap in the literature, my dissertation research focused on women's social network characteristics in relation to their use of health services for delivery.

In the next section I focus on Ghana, the country where I conducted my dissertation research, and describe relevant trends in maternal mortality and health facility delivery in the

country. I then review the literature on determinants associated with use of health facility delivery in Ghana.

Maternal Mortality and Skilled Birth Attendance in Ghana

Ghana is a LMIC with a population of 24.7 million people and a Gross National Income per capita of $1,760 (GSS et al., 2015; World Bank, 2014). Like many LMICs Ghana has a high number of maternal deaths, ranking 32st among all countries worldwide (CIA, 2015). In 2015 the estimated number of maternal deaths in Ghana was 2,800 representing the second highest cause of female mortalities in the country (GSS et al., 20015; WHO et al., 2015). Ghana's MMR dropped from 634 to 319 maternal deaths per 100,000 live births, between 1990 and 2015 (Who et al., 2015). This improvement was due to improved access and utilization of maternal health services such as health facility delivery across the country (Crissman et al., 2011).

In Ghana direct causes of maternal mortality including hemorrhage, hypertension, sepsis, obstructed labor, miscarriage and abortion make up 70% of all maternal deaths in the country (GSS et al., 2015). Other leading causes of maternal deaths are indirect causes including malaria, HIV, anemia, hepatitis, and respiratory infections; and miscellaneous causes, such as obstetric deaths of unspecified cause, rapture of the uterus, embolism, obstetric surgery complications and complication related to anesthesia (GSS et al., 2015; Asamoah, Moussa, Stafstrom & Musinguzi, 2011).

According to the 2014 Ghana Demographic Health Survey (GDHS) 73% of pregnant women nationally delivered in health facilities, an increase from 41% in 1988 (ICF Macro, 2010; GSS et al., 2015). The 2014 GDHS also indicated that traditional birth attendants (TBAs) and relatives/friends assisted in a much higher proportion of births among pregnant women living in rural areas (35%) than in urban areas (9%) (GSS et al., 2015). The proportion of health facility

delivery in rural areas has always been much lower than in urban areas, despite increases in recent decades. In 2014 health facility birth in rural and urban areas were 59% and 90%, respectively (GSS et al., 2015). The lowest coverage of health facility delivery was in regions of Ghana with largely rural populations, for example the Northern (35%) and Upper West (63%) regions. Despite progress towards reducing maternal deaths in Ghana by increasing uptake in health facility deliveries, there is a need for improvement, especially in rural settings (Dzakpasu et al., 2012).

The increase in the use of health facility birth in Ghana has been due to the availability of free birth delivery for pregnant women across the country since 2005, and most recently the enactment of the National Health Insurance Scheme, which provides free health insurance for all pregnant women (Ministry of Health, 2008; National Health Insurance Authority, 2008; Witter, Arhinful, Kusi, & Zakaria-Akoto, 2007). Starting in 2000, the implementation of the Community-Based Health Planning and Services (CHPS) Program led to the training of community health officers as midwives, to assist pregnant women at delivery in rural health facilities known as CHPS compounds (Nyonator, Awoonor-Williams, Phillips, Jones, & Miller, 2005). Despite scale-up of this initiative to rural areas across the country, inequities in access and use of skilled birth attendants at delivery remain.

Determinants of Health Facility Delivery in Ghana

Research on determinants influencing health facility delivery in Ghana has been based on quantitative cross-sectional data from household surveillance data like the GDHS and regional surveillance data (Addai, 2000; Akazili et al., 20011; Adanu, 2010; Gyimah, Takyi, & Addai, 2006; Mills et al., 2008). Qualitative studies have also examined the perspectives and experiences of women, their family members (e.g. mothers, mothers-in-laws, household and

family heads), health providers (e.g. midwives, TBAs and nurses) and community leaders (Crissman et al., 2011, 2013; Mills & Bertrand, 2005; D'Ambruoso, Abbey, & Hussein, 2005; Jansen, 2006; Bazzano, Kirkwood, Tawiah-Agyemang, Owusu-Agyei & Adungo, 2008). In this section I draw from both quantitative and qualitative studies to describe determinants associated with facility birth in Ghana. I also adopt relevant categories of determinants from previous reviews to help frame the following comprehensive assessment of literature from Ghana (Say & Raine, 2007; Moyer and Mustafa, 2013). These are maternal socio-demographic, economic, physical accessibility, facility, and sociocultural determinants.

Maternal Socio-Demographic Determinants: Research on determinants associated with use of health facility birth in Ghana has largely examined the role of maternal determinants. Higher maternal age is generally associated with use of facility delivery, with one exception (Doku, Neupane & Doku, 2012; Mills et al., 2008; Addai, 2000; The Prevention Maternal Mortality network, 1992). Adanu's (2010) examination of the 2003 GDHS revealed that age was not significantly associated with use of obstetric health services. Parity was influential such that women with a higher number of children were less likely to use health facility delivery, even after controlling for other socio-demographic determinants like age, maternal and partner/husband education, and wealth (Mills et al., 2008; Doku et al., 2012).

Both maternal and husband/male partner education were positively associated with health facility delivery (Johnson, Padmadas, & Brown, 2009; Mills et al., 2008; Doku et al., 2012; Sakeah, et al., 2014a; Gyimah et al., 2006). Compared with those from poor or lower income households, women from wealthier households or those who have higher income were more likely to use health facility delivery (Doku et al., 2012; Johnson et al., 2009; Mills et al., 2008). One study noted that women whose occupation was related to agriculture were less likely use

health facility birth (Addai, 2000). Qualitative evidence also suggests that women who were economically dependent on their husbands were less likely to deliver in a health facility (The Prevention Maternal Mortality network, 1992; Bazzano et al., 2008).

Religion has also been associated with health facility delivery and compared with women who practiced Ghana's traditional religions, Christian and Moslem women were more likely to use health facility delivery (Doku et al., 2012; Sakeah et al., 2014a; Addai, 2000). In a study of the effect of religion on maternal health services use including health facility delivery, being Christian was found to be a significant determinant, even after controlling for education, household wealth, and residence (Gyimah et al., 2006). Residence was another important determinant of facility delivery in Ghana, as urban residence was generally associated with higher levels of health facility delivery than rural residence (Doku et al., 2012; Addai, 200; Johnson et al., 2009; Penfold, Harrison, Bell & Fitzmaurice, 2007).

Antenatal Care Determinants: Some studies in Ghana have shown that pregnant women who initiated ANC in their first trimester, and those who frequently used ANC during pregnancy, were more likely deliver at a health facility (D'Ambruoso et al., 2005; Johnson et al., 2009; Mills et al., 2008). Notably, pregnant women who attended more than four ANC visits were more likely to use health facility delivery than those who had fewer visits (Mills et al., 2008). In their study on the influence of ANC on place of delivery in Northern Ghana, Akazili and colleagues (2011) found that being seen by a doctor or a clinic nurse decreased the likelihood of homebirths among pregnant women. Not receiving ANC during pregnancy, and especially receiving care from TBAs, was significantly associated with use of homebirth. They also noted that women who initiated ANC in their third trimester were 46% less likely to use homebirth, whereas those who initiated care in their second trimester were 17% less likely than those who initiated ANC in

their first trimester to use homebirth. A suggested explanation was that women presenting in the third trimester likely experienced complications.

Economic Determinants: Studies from other LMICs have long established cost as a major barrier to the use of skilled delivery service. In Ghana financial costs in terms of health facility fees, drugs and medical supplies, and transportation have been identified as a big hindrance to deliveries in health facilities (Bazzano et al., 2008; The Prevention Maternal Mortality network, 1992; Mills & Bertrand, 2005; D'Ambruoso et al., 2005; Akazili et al., 2011). Those living in rural areas of the country consider these costs burdensome and inconvenient, unlike homebirths that enable them to deliver in the comfort of their own home with fewer expenses (Bazzano et al., 2008; Akazili et al., 2011). Concerns about cost burden is supported by recent evidence, which showed that despite birth delivery fee waivers and free health services offered to pregnant women in Ghana, costs related to getting to the health facilities, having to buy medical supplies, and loss of work hours (e.g. farm work) remains a main deterrent from using health facility delivery (Mills et al., 2008; Crissman et al., 2013).

Physical Accessibility Determinants: As in other LMICs, in Ghana longer distances to health facilities and inaccessible public transportation have been shown to be negatively associated with use of facility delivery (Sakeah et al., 2014b; Gething et al., 2012; Galaa & Daare, 2008). A study using geospatial modeling to examine women's geographic access to maternity care at birth sought to identify distance from women' home to the nearest delivery care facilities (Gething et al., 2012). The results revealed that a third of all women in Ghana lived over two hours from health facilities that offer partial emergency obstetric and neonatal care, and half of women in the country lived over two hours from comprehensive emergency obstetric and neonatal care facilities. Qualitative studies based in Ghana also suggest that poor road

conditions, and limited transportation – e.g. lack of public transportation or inappropriate forms transportation like motorcycles or bicycles – make it less likely for pregnant women to deliver at a health facility compared with those who have access to better roads and transportation (Sakeah et al., 2014b; Mills & Bertrand, 2005; The Prevention Maternal Mortality network, 1992).

Facility Determinants: Health provider attitude towards pregnant women and their families was commonly identified by different studies in Ghana as a determinant of utilization of health facility birth. Ghanaian midwives, nurses, and doctors were at times hostile and mistreated patients by physically and verbally abusing them, and as a result pregnant women were less likely to use health facility delivery (Akazili et al., 2011; Mills & Bertrand, 2005). In some cases community members mentioned that health providers demanded the purchase of expensive supplies and medicines, which made pregnant women less likely to use facility delivery (Bazzano et al., 2008). Other determinants identified as deterrents of using skilled birth attendants for delivery in Ghana included health facilities having poor infrastructure and logistics, and also inadequate medicines (Sakeah et al., 2014b). Pregnant women were also unlikely to use health facility delivery if they had concerns about confidentiality, privacy, or previous negative experiences – e.g. still births (D'Ambruoso et al., 2005; Galaa & Daare, 2008). Conversely, women with a strong desire for successful labor and delivery experience were more likely to use health facility delivery.

Sociocultural Determinants: Sociocultural determinants include social norms, customs, cultural influences and practices that affect the attitudes and behaviors of individuals. In Ghana research on social issues and cultural determinants of women's use of health facility delivery is limited, and mostly based on qualitative assessments. For instance, in certain rural areas of the country home deliveries have been traditionally considered a marker of women's status, and thus

women who delivered at home were accorded high social status (The Prevention Maternal Mortality network, 1992; Bazzano et al., 2008; Dako-Gyeke, Aikins, Aryeetey, McCough, & Adongo, 2013). In some cases health facility delivery had a high social cost, as women lost privacy, secrecy and control of their delivery process and were considered vulnerable to evil spirits (Mills & Bertrand, 2005). Additionally, in most instances health decisions regarding pregnant women's care were made by influential family members like husbands, mothers-in-law, other heads of a household, and sometimes TBAs that are well respected in the community; and these individuals generally adhered to the traditional norm of homebirths (Bazzano et al., 2008; Jansen, 2006; Mills & Bertrand, 2005).

There is some evidence of shifting perceptions toward use of health facility delivery in rural areas (Mills & Bertrand, 2005; Crissman et al., 2011, 2013). Crissman and colleagues (2013) recently explored the views of pregnant women seeking ANC at health facilities in rural Ghana. They found that women perceived a changing community norm, from support of the traditional model of homebirths towards health facility delivery. Their findings corroborated previous qualitative studies that also identified an increase in community support for health facility delivery (Jansen, 2006; Mills & Bertrand, 2005). Crissman and colleagues further argued that their findings support quantitative evidence from the 2008 GDHS, which for the first time showed a higher rate of health facility births than homebirths in rural Ghana.

Exploring Social Networks as Determinants of Health Facility Delivery: Sociocultural determinants discussed in the literature, such as community perceptions and social norms regarding birth delivery practices, were mainly identified through qualitative studies and contribute to advancing understanding of socially and culturally relevant issues that likely impact pregnant women's use of facility birth. My dissertation builds on this research by examining

other sociocultural determinants that may influence facility delivery. Specifically, I examine how the social networks of rural Ghanaian women influence their pregnancy experiences, particularly, their use of facility delivery.

In the next section, I present a more extensive literature review on social networks and maternal health in order to provide support for the need to understand the influence of women's social networks on their use of facility delivery. The influential role of women's social ties in decision making about their pregnancy related care is well established in research (Brighton et al., 2013; Jansen, 2006; Crissman et al., 2013). Women's use of health facility delivery is partly dependent of the kinds of support they receive from members of their social networks such as husbands, mothers-in-law, and other elderly women in their family (Edmonds et al., 2012; Ono et al., 2013). Yet, research on the association between social network characteristics like social support and use of facility birth in LMICs is very limited. To date, no research has examined the relationship between social network characteristics and use of facility delivery in Ghana. Therefore, my dissertation addresses this gap in the maternal health literature. In the next chapter, I explain the theoretical and conceptual justification for my study and explore available empirical evidence linking social networks with health facility delivery.

CHAPTER 3: THEORETICAL ORIENTATION

In this section I describe social networks as relevant for examining ways in which social relations influence health. First, I briefly explain how social networks can serve as a form of social capital, which can influence health. Second, I focus on the structural and functional characteristics of social networks and their associations with health behaviors and outcomes. In particular, I review the small maternal health literature linking network characteristics with maternal healthcare utilization, especially, health facility birth. Third, I develop a conceptual model to address my research questions.

Social Capital

Sociological definitions of social capital refer to the idea that an individual's social relationships bestow value in the form of resources or actions taken to benefit that individual (Bourdieu, 1986; Coleman, 1990; Putnam, 1993). People's participation in their network of social relations and their perceptions about the importance of these relations can provide them access to valuable resources, which can influence their health behaviors and outcomes (Kawachi, 2000). I describe social networks as a form of social capital that can impact health. The importance of social networks has been highlighted by other social scientists that posited that the nature of social ties among network members plays an influential role in the health and wellbeing of the members (Hall & Wellman, 1985; Berkman & Glass, 2000). In the following section I present social network concepts that may help to further explain how social networks operate to influence health.

Social Network Concepts

A social network is a web of social relationships among a group of individuals, which has both structural and functional characteristics (Mitchell, 1969; Fischer, 1982; Lauman, 1973). In his definition of social network Mitchel (1969) explained that the characteristics of this web of social relationships may be used to interpret the social behaviors of individuals within a network group. To that end an interest of public health research is to determine how the structural and functional characteristics of social network promote and influence health behaviors and ultimately health outcomes (Luke & Harris, 2007).

Research on the influence of social networks on health has its origins in the theory of social integration. The earliest work on this perspective can be traced back to Durkheim's (1897) study of social patterning of suicide, which significantly contributed to understanding of how social integration impacts mortality. In Durkheim's view, level of social integration (e.g. family, religious, and employment affiliations) determined the strength of people's social ties. Having many ties was valuable for generating more social resources and mitigating social constraints. Durkheim's study (1897) supported his perspective by empirically demonstrating a higher prevalence of suicide among people with fewer social ties compared to those with more ties.

Building on the early work of Durkheim, network theorists were interested in further understanding how network structural characteristics act to influence members within a network (Berkman & Glass, 2000). Network structure is described as the properties of the relationship among members within a network (Hall & Wellman, 1985; House et al., 1988). This includes network composition, which refers to the types of individuals in the network (e.g. relatives, neighbors and friends). Other structural network characteristics include number of network members (*size*), how well network members are connected with each other (*density*),

demographic similarities among members (*homogeneity*), how close members live to a focal individual (*geographic dispersion*), how often an individual comes in contact with network members (*frequency*), the extent to which resource exchange occurs among members (*reciprocity*), and extent to which social ties provide emotional closeness (tie strength) (Israel, 1982; Mitchel & Trickett, 1980; Seeman & Berkman, 1988).

In the 1970s American sociologists examined the composition and structure of networks and the resources available through these networks (Lauman, 1973; Wellman & Leighton, 1979; Granovetter, 1973; Fischer et al., 1977). Several of the researchers in this period developed an egocentric approach to social network analysis, whereby network structure and functions are examined from a focal individual's (ego) perspective (Fischer et al., 1977; Granovetter, 1973; Wellman & Leighton, 1979; Lauman, 1973).

Functional network characteristics refer to the various roles performed by network members such as provision of social support and social influence (House, 1981). Work in health psychology focused on the provision of social support as a functional characteristic of social networks. Social support is described as the different kinds of support provided by network members through their social ties (House, 1981; Thoits, 1995; Kahn & Antonucci, 1986). For instance, emotional support refers to love, care, or understanding provided to an individual by his/her network members (House, 1981; Sarason et al., 1990). Instrumental support is tangible aid or assistance provided. Informational support is advice or relevant information offered when needed (House, 1981; Sarason et al., 1990). These kinds of support are considered forms of resources that can be beneficial for promoting the wellbeing of network members, and function as an important means by which networks members influence the ego's mental and physical health (Berkman & Glass, 2000).

Social influence refers to shared norms and behaviors that impact one's attitudes and behaviors (Marsden & Friedkin, 1994; Erickson, 1988). Individuals within a network tend to adopt the behaviors and perceptions of network members (Leenders, 1997). Norms are conceptualized as descriptive and injunctive (Cialdini & Trost, 1998; Lapinski & Rimal, 2005). Descriptive norms refer to perceptions of behaviors that are most common among network members. Individuals within a network tend to adopt the perceived behaviors of network members, which conveys the notion of what is normal, and thus motivate the individuals act the same (Lapinski & Rimal, 2005). Injunctive norms are perceptions of behaviors that are acceptable by network members, and individuals are influenced to adhere to those behaviors in order to avoid social sanctioning (Lapinski & Rimal, 2005).

Social ties among network members are considered the structural basis on which social support and social influence impact health behavior (Berkman & Glass, 2000; Hall & Wellman, 1985). Not only do each of these network characteristics have a direct effect on health, but they can also operate by interacting or forming pathways that influence proximate health including negative health or health promoting behaviors (e.g. smoking, alcohol abuse, sexual risk behaviors, exercises, and primary care use) and physiological stress response (Hall & Wellman, 1985). In addition to examining the influence of network structure on facility delivery, the interest of my study is to also focus on social support and social norms in order to gain a comprehensive understanding of how the different network characteristics operate to influence health care utilization for birth delivery.

In the following sections I review maternal health studies linking social network structural and functional characteristics with health services use. I then examine the influence of the social network concepts on maternal health utilization.

Social Network Characteristics and Maternal Health

Within the field of maternal health, research on network characteristics has mostly focused on family planning, including fertility decision and contraceptive use, and child survival. Network structural characteristics such as size, density and composition have previously been associated with fertility decision, contraceptive use, parity, and child survival (Bove, Vala-Haynes & Valeggia, 2012; Madhavan, Adam & Simon, 2003; Adam, Madhavan & Simon, 2002; Simon, Adams & Madhavan, 2002). For example, Kohler et al. (2001) found that women in rural Kenya with a higher density of social network members (close kin members, neighbors and friends) that used contraception were more likely to use contraception than women with a lower density of social network members (Kohler, Behrman, Watkin & 2001).

Kohler and colleagues (2001) also examined the underlying mechanism of the relationship between social influence and contraceptive use. They measured social influence as the number of contraceptive users in a woman's social network, which reflects descriptive norm. In addition to finding a positive association between social influence and contraceptive use, Kohler et al. (2001) found that network density moderated this relationship. The positive relationship between social influence and contraceptive use was stronger for women with a higher network density. In another study, Madhavan and colleagues (2003) assessed the size of social support networks as a way to disentangle the relationship between social influence and contraceptive use among women in Mali. Specifically, they measured the size of network members who provided instrumental support, i.e. size of material support network and size of practical support network. They found that larger material and practical support networks were positively associated with contraceptive use. Madhavan et al. maintained that network members' expression of social influence on women's contraceptive use was based on the density of

women's support network. However, they did not directly measure the interaction between network structure (density) and social influence, and thus could not identify the underlying means by which these characteristics operate to influence contraceptive use.

Social support in particular has been shown to be very influential in maternal health. Previous work in South Africa indicated that companionship during labor improved labor progression, perceptions of labor, breastfeeding and postpartum depression (Hofmeyr, Nikodem, Wolman, Chalmers & Kramer, 1991; Wolman, Chalmers, Hoffmeyr & Nikodem, 1993; Nikodem, Nolte, Wolman, Glumezoglu & Hofmeyr, 1998). A proposed explanation of the effect of social support on these outcomes is based on the buffering hypothesis, which suggests that availability of a companion during labor who can offer emotional, informational, appraisal and instrumental support serves as a buffer to minimize the impact of labor- related stress (Cohen & Wills, 1985; Wheaton, 1985; Hodnett, Gates, Hofmeyr & Sakala, 2007). This perspective implies that network members play supportive functions that can in turn moderate stress related experiences of a woman's pregnancy. These studies did not, however, quantitatively examine how support moderates pregnancy related stress.

More recent evidence suggests that network members, particularly kin networks, provided different types of support for women through the continuum of their pregnancy and childbirth (Mbekenga, Christensson, Lugina & Olsson, 2011a; Mbekenga, Pembe, Christensson, Darj & Olsson, 2011b; Parkhurst, Rahman & Ssengooba, 2006). Studies in LMICs including Zambia, El Salvador, Guatemala, Kenya, and India have described husbands as providing instrumental support such as money and transportation for pregnancy related care while mothers and mothers-in-law have been reported to provide emotional and informational support (e.g., pregnancy related advice) during women's pregnancy and labor experiences. Siblings, mothers

and in-laws have been found to provide instrumental support including help with house chores and food preparations (Maimbolwa, Sikazwe, Yamba, Diwan & Ransjö-Arvidson, 2001; Carter, 2002; Carter & Speizer, 2005; Kwambai et al., 2013; Raman et al., 2014). These studies were centered around assessment of women's perspectives on the types of support available to them during pregnancy, and were mostly based on qualitative methods. More research is needed to quantitatively examine which aspects of support provided by women's social networks are influential in their use of facility delivery.

Social Networks and Health Facility Delivery: Research on the influence of network structure and functions on use of health facility birth in LMICs is limited. Notably, Edmonds et al. (2012) examined what variance in women's use of health facility delivery in rural Bangladeshi was attributable to the structure (density, homogeneity and strength of ties) and function (advice to deliver in a facility or at home) of the women's network, over and above the variance explained by their personal characteristics. They examined perceived prevalence of descriptive norms regarding place of delivery, as women's perceptions of collective advice about using facility births. Edmond and colleagues only found a significant association between descriptive norms regarding place of delivery and health facility birth. The odds of facility delivery was higher for women who were advised to deliver in a health facility compared with those advised to deliver at home (OR=5.97% 95% CI=3.27-10.92). There was no association between the structural network characteristics and health facility birth, neither was there an interactive effect of network structure and content on health facility birth.

Edmonds et al. (2012) acknowledged that the measures used in their study may have been unrepresentative of structural network characteristics that potentially influence maternal health utilization. Previous studies that examined the relationship between network structure and health

services utilization found an association between higher network size, higher frequency of contact, closer proximity of network members to one another, and higher strength of ties, and health services use (Devillanova, 2008; Deri, 2005; Berkavonic & Telesky, 1982). These studies also suggested that the relationship between network structure and care utilization was due to individuals being embedded within a network in which they are influenced by perceived norms of health utilization among members of the network.

Sparse evidence exists in the maternal health literature on the impact of social support as a social network functional characteristic on health services utilization, particularly health facility birth. Recently, a study in Kenya examined determinants of the effect of social support on women's use of facility delivery (Ono et al., 2013). The authors found that unmarried women who received tangible support such as help with housework from their mothers and/or help fetching water from siblings were more likely to deliver in health facilities than those without support. Married women whose husbands helped them with farming, and/or neighbors helped them with fetching water, were less likely to delivery at a health facility than those who did not receive such support. Ono and colleagues (2013) suggested that a possible explanation for the observed relationship between social support and facility birth was that the married women lived in close-knit communities with their husbands' family household, and thus were influenced by the family's normative belief in homebirths (injunctive norms). Conversely, the unmarried women were not subject normative influence from a husband's family to deliver at home, and so were less likely to experience homebirth.

Another recent study, in rural Bangladesh, qualitatively explored the role of husbands' social support (emotional, instrumental and informational) and social norms on health facility birth (Story et al., 2012). Findings indicated that pregnant women whose husbands believed in

medical interventions and provided them with different types of support experienced health facility birth, whereas those whose husbands were unsupportive did not deliver in health facilities. Due to a dearth in research in this area, quantitative studies are needed to explore the types of social support that may be important determinants of health facility births (Ono et al., 2013; Alexander et al., 2014).

Some research previously examined the relationship between social norms, as functional network characteristics, and health facility birth (Stephenson et al., 2006; Kruk, et al., 2010; Danforth et al., 2009; White et al., 2013; Speizer et al., 2014). For example, Stephenson and colleagues (2006) assessed community-level influences on facility delivery in six countries in sub-Saharan Africa, and found community norms about health facility births to be a potential mechanism that influence women's decision to use facility delivery. Most recently, a study conducted among rural Ghanaian women found that community-level perceptions (including higher proportion of women, men, and mothers-in-law who had favorable views on facility delivery) were associated with greater odds of facility delivery. Research in Mali and Tanzania has also indicated that women whose husbands and mothers-in-law had favorable views on health facility birth (injunctive norms) were more likely to delivery in a health facility, than those whose husbands and mothers-in-law's views were unfavorable (Danforth et al., 2009; White et al., 2013).

As described above, social support and social influence are relevant network functions that are associated with health facility births. In addition to linking social support with facility births, Ono and colleagues' (2013) work explained that this relationship was likely dependent on the women's network normative context (norms favoring facility/ homebirth). Story et al. (2012) suggested a potentially relevant interaction between social norm and social support, by revealing

that supportive husbands also believed in medical intervention, and thus their wives were more likely to use health facility than the wives of unsupportive husbands. Speizer and colleagues (2014) findings showed a significant association between norms about facility births and women's use of facility deliver, as well as a significant interaction between these norms and women's decision-making autonomy. However, their work did not examine norms specifically within social networks.

Taken together the above studies suggest that social network characteristics are important social factors that can provide further insights into determinants of health facility birth. While structural and functional network characteristics have been linked with health facility birth, this work is sparse. To date, no study has examined the relationship between network structure and health facility delivery in sub-Saharan Africa and only one study, in rural Kenya, has quantitatively examined the influence of social support on use of health facility birth (Ono et al., 2013). Examining the association of specific network characteristics, including structure and functions (social support and social influence), with facility birth can contribute to knowledge on ways to improve facility delivery access and use. Moreover, there is a need for research to elucidate the how social networks influence the use of facility delivery by examining the interaction effects of network structure and functions on facility delivery use. This can provide knowledge on how to integrate resources available through social networks into strategies to increase uptake in facility delivery.

My dissertation study addresses the overarching question: What is the influence of social network characteristics on pregnant women's use of facility birth in rural Ghana? To that end, I determined relationships between social network structure, functions (social support and social norms), and health facility birth. Next, I examined how network structure and functions interact

to influence facility birth. Additionally, I qualitatively explored how women's social network characteristics influence their pregnancy, labor and delivery experiences.

Study Aims, Hypotheses and Conceptual Model

The purpose of my dissertation research was to examine the relationship between social network structure, functions (social support and social norms), and health facility births among women living in rural Ghana. I used quantitative and qualitative methods to address this purpose through two main aims. This mixed-methods approach enabled me to quantitatively determine relationships between social network characteristics and health facility birth, while simultaneously exploring in-depth how network characteristics are related to facility birth (Creswell & Clark, 2011; Johnson & Onwuegbuzie, 2004). The conceptual model of my hypothesized relationships between network characteristics and facility birth is depicted in Figure 1.

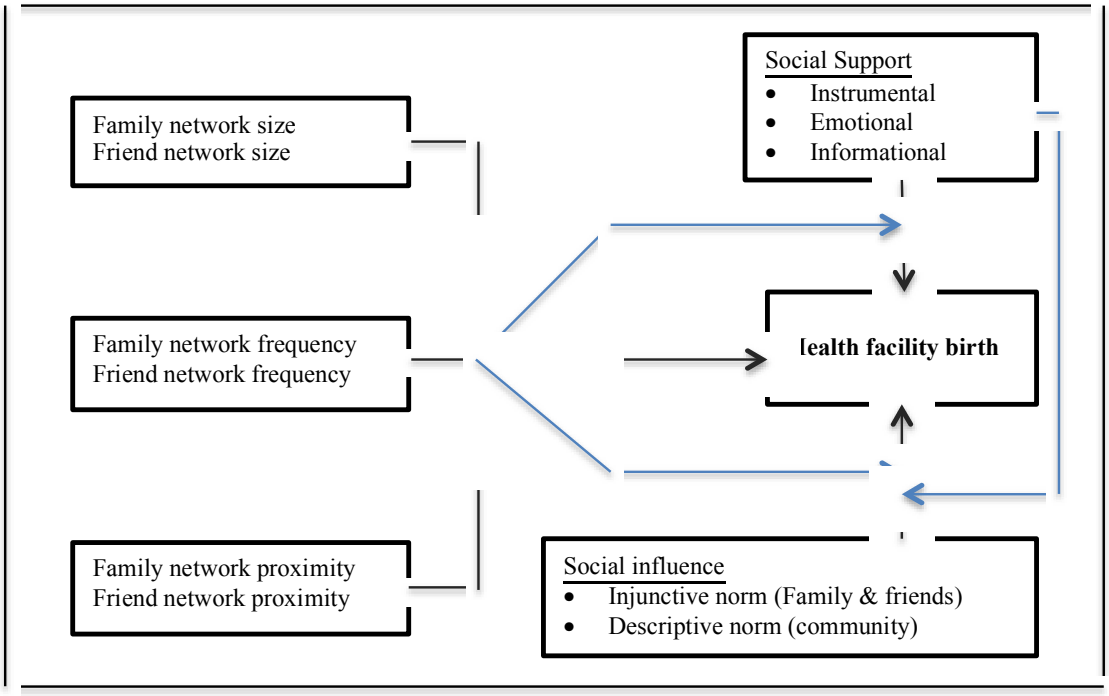

Figure 1: Conceptual model of the relationship between network characteristics and facility birth.

Aims and Hypotheses

Aim 1.1: Determine whether social network structure (size, frequency and proximity), social support (informational, instrumental and emotional) and social norms (injunctive and descriptive norms) are associated with health facility birth among women in rural Ghana.

Hypotheses 1.1:

a) Social network structure (size, frequency and proximity) will be associated with use of health facility birth such that:
    I. Lager network size will be positively associated with use of health facility birth.
    II. Higher frequency of contact with network members will be positively associated with use of health facility birth.
    III. Larger numbers of network members living in close proximity to women will be positively associated with use of health facility birth.
b) Social support will be associated with use of health facility birth such that higher perceptions of informational, instrumental, and emotional support will be positively associated with use of health facility birth.
c) Social norms will be associated with use of health facility birth such that higher perceived prevalence of descriptive and injunctive norms will be positively associated with use of health facility birth.

Aim 1.2: Determine whether network structure (size, frequency and proximity) and network functions (social support and social norms) interact to influence health facility birth.

*Hypotheses 1.2***:**

a) The relationship between perception of social support and health facility birth will vary by network structure:

I. The positive association between higher perception of social support and facility birth will vary by network size, such that the relationship will be stronger for women with larger network size.

II. The positive association between higher perception of social support and facility birth will vary by frequency of contact with network members, such that the relationship will be stronger for women with higher frequency of contact with network members.

III. The positive association between higher perception of social support and facility birth will vary by network proximity, such that the relationship will be stronger for women with a larger number of network members that live in close proximity to them.

b) The relationship between social norms and heath facility birth will vary by network structure:

I. The positive association between higher perceived prevalence of social norms and health facility birth will vary by network size, such that the relationship will be stronger for women with larger network size.

II. The positive association between higher perceived prevalence of social norms and health facility birth will vary by frequency of contact with network members, such that the relationship will be stronger for women with higher frequency of contact with network members.

III. The positive association between higher perceived prevalence of social norms and health facility birth will vary by network proximity, such that the relationship will

be stronger for women with a larger number of network members that live in close proximity to them.

c) The relationship between social norms and heath facility birth will vary by social support:

I. The positive association between higher perceived prevalence of social norms and health facility birth will vary by informational support, such that the relationship will be stronger for women with higher perception of informational support.

II. The positive association between higher perceived prevalence of social norms and health facility birth will vary by instrumental support, such that the relationship will be stronger for women with higher perception of instrumental support.

III. The positive association between higher perceived prevalence of social norms and health facility birth will vary by emotional support, such that the relationship will be stronger for women with higher perception of emotional support.

Aim 2:

I qualitatively explored how social network characteristics are related to health facility birth. My goal was to understand how network members influence women's pregnancy, labor and delivery experiences. I aimed to characterize the social network dynamics of women in rural Ghana and to examine whether and how network composition, social support, and norms are related to women's use of health facility births. The purpose of Aim 2 was to help interpret the relationships examined in the first aim.

CHAPTER 4: METHODS

I used a mixed-methods convergent design whereby both quantitative and qualitative data were collected within the same time period but independently of each other, and analyzed separately (Creswell & Clark, 20011; Teddlie & Tashakkori, 2009). Using the mixed-methods design I was able to quantitatively examine the relationship between structural and functional network characteristics with health facility birth. I was then able to interpret my quantitative findings by qualitatively exploring in-depth how these network characteristics operated to influence women's pregnancy experiences and place of birth.

For both the qualitative and quantitative components, I used an egocentric network approach whereby the characteristics of rural Ghanaian women's social networks were examined through responses from women themselves, rather than interviewing all members of their networks (Fischer et al., 1977; Wellman & Leighton, 1979). Measures of women's perceptions of their social networks are well correlated with the actual attributes of their network members, and thus serve as a reliable measure of the characteristics of the network members (McCarty, 2002). The approach is particularly useful for learning about social networks of women in a large population because it is a cost-effective way, with low respondent burden, to gain a reliable account of the women's network characteristics that may influence their attitudes and behaviors (Carrington, Scott, & Wasserman, 2005). It also enables data collection using conventional quantitative research methods, and allows data analysis with convention analytic methods (Carrington, Scott, & Wasserman, 2005).

Data for my dissertation study was collected as part of a larger evaluation study of a Maternal and Newborn Health referral (MNHR) project. I included items that assessed women's perspectives about their social network characteristics, in a household survey conducted with a random sample of women in two study regions. This allowed me to assess whether social networks are related to facility delivery. Also, I conducted qualitative data collection to examine women's most recent pregnancy and birth experiences. I included interview questions that enabled me to conduct a qualitative egocentric network analysis of women's social networks.

Description of the Study Areas: Northern and Central Regions of Ghana

My dissertation was based in two of Ghana's ten regions: the Central and Northern regions. These regions represent geographically, socio-demographically and culturally distinct areas of Ghana. Ghana's 2010 population and housing census estimated the total populations in these regions at 2,201,863 and 2,479,461 respectively (GSS, 2013). Geographically, the Northern region is the largest of the ten regions, and the Central region is slightly smaller (GSS, 2013). The vegetation in the Northern region is mostly grassland, and has one rainy season annually (GSS, 2013a). Farming is the predominant occupation in the Northern region. The Central region, which is considered very rich in natural resources, has semi-deciduous forest vegetation and is bordered by the coast (GSS, 2013b). This region experiences two rainy seasons annually. In the Central region fishing and farming are the predominant occupation in coastal communities, whereas farming is the main occupation in forested communities. The proportion of the rural population in the Northern region is 70%, and the proportion in the Central region is 53% (GSS, 2013).

Most households in rural communities in both regions are considered poor. The GDHS defines poverty based on measures of inequality in household characteristics, use of health and

other services, and health outcomes (GSS et al., 2009). Both regions have a similarly low employment rate of 9% (GSS, 2013). The literacy rate in the Northern region (28%) is much lower than the rate in the Central region (74%). In both regions more women than men are uneducated (GSS, 2013a; GSS, 2013b). Agricultural households make up 89% of the rural population in the Northern Region, and 73% in the Central region (GSS, 2013). Males are heads of 85% of households in the Northern region and 60% of households in the Central region (GSS, 2013). The average household size is 8 in the Northern region, and 4 in the Central region. However, in both regions households tend to be clustered in close-knit communities in rural areas, with extended family members living nearby. Islam is the predominant religion in the Northern region (60%) whereas Christianity is predominant in the Central region (83%) (GSS, 2013).

Generally, rural communities and villages in both regions are several miles apart. The road conditions are very poor in most areas, and tend to be impassable during the rainy seasons (Levy & Wong, 2010). The most common means of transportation in the Northern region are bicycles, motorcycles or walking (Levy & Wong, 2010). In the Central region there is public transportation in the form of taxi and buses, along with walking. Few rural communities in the Northern and Central regions have access to a local health facility (GSS et al., 2015). Most people have to travel miles to access higher-level health facilities such as health centers and hospitals. In the Northern region, women rely on their family members and sometimes their neighbors to secure transportation to access health facilities (Cofie, Barrington, Singh, Sodzi-Tettey, & Akaliguang, 2015). In the Central region transportation is accessible on main roads, although this can be costly and not necessarily reliable (Cofie et al., 2015; Levy & Wong, 2010).

Women who live in very remote villages have to walk miles to get to a main road to find transportation.

Polygamy is practiced in the Northern region. Traditionally, Northern region women move from their own community to live in their husband's after marriage. Therefore, women often have very little interaction with their blood relatives after marriage. Also, it is customary for husbands and mothers-in-laws to make decisions about women's pregnancy related health needs and to subsequently provide them with resources for pregnancy and delivery care in the Northern region. Conversely, Central region women often do not move away from their community after marriage, and maintain close interactions with their blood-relatives. Husbands, mothers and mothers-in-law in this region make decision about women's pregnancy related care, often with the women's input.

According to the 2014 GDHS the Northern region had the highest total fertility rate (6.6), and the rate in the Central region (4.7) was fifth highest in the country (GSS et al., 2015). The Central region had a MMR of 520 maternal deaths per 100,000 live births and the Northern region had a MMR of 531, both much higher than the national MMR of 485 that year. As mentioned earlier, the proportion of health facility delivery in the Northern region (35%) is lowest among all regions in Ghana, whereas the proportion in the Central region (70%) is lower than the national proportion (73%) (GSS et al., 2015). These data highlight a need to further improve the use of health facility delivery among pregnant women in both regions.

Parent Study Description

Data for my dissertation was collected as part of the follow-up data collection for a supplementary grant under an evaluation research project titled Improving Patient Outcomes, Population Health and System Performance at Scale in Ghana through Faith-based and Partner

Health Systems. The project is known locally as Project Fives Alive. The project was led by the Institute of Health Improvement, in conjunction with the National Catholic Health Service (NCHS), the Ghana Health Service (GHS), a research team from the Institute of Statistical, Social and Economic Research (ISSER) at the University of Legon in Ghana, and an evaluation team from the University of North Carolina (UNC) at Chapel Hill. The objective of Project Fives Alive! (PFA) was to accelerate the achievement of Millennium Development Goals (MDG) four, a 67% reduction in under-five child mortality, and MDG five, a 75% reduction in maternal mortality, by 2015. This was being accomplished through an intervention using quality improvement (QI) methods in health facilities across Ghana to increase coverage of skilled birth delivery and early postnatal care services (Twum-Danso et al., 2012).

Early intervention evaluation showed promising results in reductions of deaths among children under five, but also showed a need to address unreliable referral systems in rural areas that limited access to care at critical times for pregnant women and newborns. Based on observations and anecdotal evidence from frontline health providers the project team learned that in addition to structural barriers, cost and transportation challenges, problems with the referral system were also impacted by sociocultural beliefs in primarily rural areas that led to late care seeking and acceptance of referrals. To address these challenges, a supplementary grant known as the MNHR project was developed to extend QI efforts beyond health facilities to mainly focus on rural communities.

The objective of the MNHR project was to improve access to maternal and newborn health services and health outcomes in rural Ghana by using a QI approach to improve faulty referral processes in rural Ghana. The project sought to contribute to the overall PFA goal of reducing maternal and neonatal mortality by focusing on the referral process for pregnant women

and sick newborns in need of access to comprehensive medical care at a level higher than their current point of facility care access. The MNHR study began with a mixed-methods baseline assessment between May and June 2012 to obtain information about the knowledge, attitudes and practices regarding maternal and newborn health, as well as barriers to service use. The baseline assessment allowed the project to develop an appropriate intervention, and was also used as part of the evaluation of the project's effectiveness overtime. Following the baseline assessment, community-facility Improvement Collaborative Networks ([ICNs] consisting of health providers and key community members) were established in the intervention sites and facility-only ICNs (consisting of health providers) in the comparison sites. These ICNs developed and tested innovative change ideas to improve the MNHR processes at all levels of the health system including community, health post, health center and hospital. This intervention design was used in order to enable evaluation of the effectiveness of community-facility ICN in comparison to the facility-only ICN model used in PFA. A midline quantitative assessment of the MNHR intervention was conducted between October and November 2013 and endline quantitative and qualitative assessments were conducted between January and March 2015.

Dissertation Study

My dissertation research was based on data collected as part of the endline quantitative and qualitative assessments of the MNHR study. To address my specific research questions I included items on social network characteristics in the household survey for the quantitative assessment (Aim 1), and interview questions in the interview guides for the qualitative assessment (Aim 2). The Ghana Health Service Ethical Review Committee approved the study and UNC-Chapel Hill's Internal Review Board exempted it from ethics reviews as it was considered a program evaluation.

Quantitative Study Description

Household Survey: Similar to the baseline and midline assessment, a household survey was designed for the endline assessment, to understand women's experiences in receiving and accepting referral for maternal and newborn care, and challenges that they experienced in using health services. Survey items included questions on knowledge, practices and attitudes about maternal and newborn referral. Specific indicators of focus were knowledge of health risks of home delivery, attitudes toward facility delivery, and barriers to facility-level delivery.

Study Design and Sample Description: The sampling design for the endline assessment was the same as the baseline and midline assessments. Three districts in the Northern region and three districts in the Central region representing the North and South of Ghana respectively were selected. Two of the districts in the Northern region (Nanumba North and Nanumba South) and two of the districts in the Central region (Asikuma Odobea Brakwa and Assin North) were designated as the intervention districts. The third district in the Northern (Gushegu) and Central (Gomoa West) regions were each designated as the comparison districts.

The survey employed a 30 by N cluster sample design, whereby 30 communities were randomly selected in the three designated districts in the Northern region of Ghana (15 intervention communities and 15 comparison communities). The same approach was used in the three designated districts in the Central region. Household survey interviews were conducted among women of reproductive age (15-49 years) regardless of whether or not they had recent pregnancy, women with recent birth in the past 12 months, and pregnant women. Recently pregnant women were randomly sampled from a list of all recently pregnant women in the communities (determined through interviews with community leaders and TBAs.) Two of each pregnant woman's closest neighbors were interviewed because the knowledge, attitudes and

practices of women of all ages regardless of whether or not they had a delivery was considered valuable in informing changes in knowledge, attitudes, and barriers associated with maternal and newborn health services. Also, similar to the baseline and midline assessments, the target sample for the endline household survey was 630 each for the intervention and control communities. A total of 1,260 women were interviewed for the survey. Notably, cross-sectional samples collected for each phase of the project assessment (baseline, midline and endline) were independent of each other.

Quantitative Data Collection Procedures: The UNC-Chapel Hill research evaluation team and the ISSER research team in Ghana designed the survey. Research assistants recruited women participants at the women's homes and provided them with informed consent before administering the survey. The research assistants conducted face-to-face interviews in the native languages of the women (*Twi* and *Fanti* in the Central region, and *Dagbani* and *Lekpepkel* in the Northern region).

Selection Criterion: For the purpose of my dissertation data analysis the selection criterion for my sample was women with delivery in the past three years, which enabled me to capture as many women as possible in my sample, while being mindful of concerns about recall bias.

Power Analysis and Sample Size: I calculated the sample size I needed to obtain adequate statistical power to estimate the parameters for my Aim 1 hypotheses. My analysis was based on detecting a 0.1 or greater magnitude of difference in proportion between the two categories of my dichotomous outcome. I used the estimate of the proportion of health facility births in rural areas of Ghana (52.7%), at the time the endline data collection was designed, as my hypothesized

group 1 proportion (ICF Macro, 2010; GSS, 2011). My sample size (N=783) ensures 80% statistical power using a two-sided statistical test with a p-value = 0.05.

Measures: The endline household survey contained my outcome and control measures, later described in this section. I developed additional questions of social network structure and functions based on existing measures. I subsequently describe the variables I included in my analysis of the relationship between social network characteristics and health facility birth (See Appendices B and C).

Outcome Measure: To address aim 1 of my study, I used the measure of health facility birth, specifically whether or not a woman delivered in a health facility during her most recent pregnancy (Table 4.1). The response categories for this variable were dichotomized into home or health facility.

Table 4.1: Outcome measure

Variable names	Measure	Response category	Item #
Health facility birth	Where was their most recent birth delivery	Recoded as: 1 – health facility (hospital, health center, CHPS, or other facility) 0 – home (home or home of TBA, other)	Q67B

Independent Measures: The main independent variables for Aim 1 were structural characteristics of social networks along with functional characteristics, including social network support and social norms. I adopted social network structural characteristics items from existing measures (Seeman & Berkman, 1988; Berkman & Syme, 1979; Glass, De Leon, & Seeman, 1997; O'Reilly, 1988). In developing these measures I ensured content validity of the measures by receiving feedback from the study's investigators and researchers with expertise in the use of social network and social support measures.

The structural social network items focused on size (number of people in an individual's network), proximity (how far network members live from focal persona) and frequency (the extent to which, or how often, an individual is in contact with network members) (Table 4.2). I combined the responses of the two indicators of network size to create a composite score. Network proximity and frequency also had two indicators each, which were analyzed separately.

Table 4.2: Independent variables – social network structure

Variable names	Measure	Response category
Network size	How many of your relatives with whom you feel close to, and can call on for help, did you have any form of contact with during your last pregnancy experience? By "close" I mean people you feel at ease with, and can talk to about private matters In general, how many friends with whom you feel close to, and can call on for help, did you have any form of contact with during your last pregnancy experience? By "close" I mean people you feel at ease with, and can talk to about private matters.	Relatives_____ Refused_____ DK_____ NA_____ Friends_____ Refused_____ DK_____ NA_____
Network frequency	How many of these relatives did you see or interact with at least a few times a week during your last pregnancy? How many of these friends did you see or interact with at least once a week during your last pregnancy?	Relatives_____ Refused_____ DK_____ NA_____ Friends_____ Refused_____ DK_____ NA_____
Network proximity	How many of these relatives lived in your village (community) during your last pregnancy? How many of these friends lived in your village (community) during your last pregnancy experience?	Relatives_____ Refused_____ DK_____ NA_____ Friends_____ Refused_____ DK_____ NA_____

I adopted social support items from previously established measures (Sarason, Levine, Basham & Sarason, 1983; Sarason, Sarason, Sheratin, & Pierce, 1987; Rock, Green, Wise, & Rock, 1984). Also, I modified my scale to be culturally relevant and ensured that they fit the scope of the study by making the items reflect the local context of women's experiences. For

example, the items included questions about support with household chores and money for transportation, medicine and fees for medical/traditional care. My variables of social support include instrumental, informational, and emotional support. Each variable consists of two items, which were examined separately (Table 4.3). In the social support questionnaire participants were asked about how often different kinds of help was available to them when they needed it during the period of their pregnancy, labor and delivery. Table 4.3 details the different types of support items.

Table 4.3: Independent variables – social support

Variable names	Measure	Response category
Instrumental Social support	Someone to help you with your daily chores (including housework, preparing meals, and childcare) when you needed it.	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____
	Someone to help you seek health care – i.e. take you to get care, or give you money for transportation, medicine, and fees for medical/ traditional care.	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____
Emotional Social support	Someone you could count on to listen to you when you had any problems, concerns, or fears.	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____
	Someone who has gone through pregnancy and could understand what you were going through and be supportive to you through your pregnancy experience.	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____
Informational Social support	Someone who gave you good advice about crisis or situation you were experiencing	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____
	Someone you could turn to when you needed suggestions and advice on how to deal with any concerns or problems.	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____

My measures of social norms including injunctive and descriptive norms (Table 4.4) were developed based on review of the social influence literature (Friedkin, 1998; Cialdini & Trost, 1998; Mason, Conrey, & Smith, 2007). The items examine perceptions about close family and friends' approval of the use of health facilities for pregnancy related care (injunctive norm). Additionally, I included a measure of the perception of the use of health facilities by important referents (descriptive norm).

Table 4.4: Independent variables – social influence

Variable names	Measure	Response category
Injunctive norm_V1	How much do your close relatives you described in the previous section approve or encourage the use of health facilities for care during pregnancy and childbirth?	Strongly approve____ Approve____ Somewhat approve___ Do not approve____
Injunctive norm_V2	How much do your close friends you described in the previous section approve or encourage the use of health facilities for care during pregnancy and childbirth?	Strongly approve____ Approve____ Somewhat approve___ Do not approve____
Descriptive norm	How many of the people you know (e.g. relatives, friends, acquaintances) have gone to the health facility for pregnancy related care?	Most____ Many____ Some_____ Few_____

Control measures: To address Aim 1, I included additional variables known to be associated with use of health facility delivery as controls. These include maternal socio-demographic factors, and women's decision-making autonomy (Table 4.5). Maternal socio-demographic variables included maternal age, education, employment, household wealth, parity, religion, region, ethnicity and marital status.

Table 4.5: Control variables

	Variable names	Measure	Response category	Item #
Maternal socio-demographic Factors	Maternal age	Age of participant	Continuous: number in years	Q1-2
	Education	Mother's highest level of education	1=preschool; 2=primary; 3=middle; 4=secondary; 5=higher; 96=don't know	Q3-4
	Employment	Current work status	1=unpaid family work/housewife/agric worker; 2=unemployed; 3=self-employed; 4=formal work; 5=informal work; 6=other	Q14A-B
	Parity	Number of children the woman has	#_____	Q142-147
	Household wealth	An item list assessing characteristics of household: Household and function assets; Dwelling characteristics and household possessions	See appendix B for details	Q24A-AH
	Religion	Religious affiliation	1=Catholic; 2=Anglican; 3=Methodist; 4=Presbyterian; 5=Pentecost; 6=Other Christian; 7=Moslem; 8=Traditional; 9=None; 10=Other	Q25-39
	Marital status	What is your marital status?	1=married/living together; 2=divorced; 3=widowed; 4=never married/never lived together	Q8
	Ethnicity	To which ethnic group do you belong?	1=Akan; 2=Ga; 3=Ewe; 4=Guan; 5=Mole-Dabgani; 6=Grussi; 7=Gruma; 8=Mande; 9=Other	Q10
	Region	Region	Northern; or Central	Q9
Decision-making autonomy	Autonomy	Who usually makes decision about woman's health care	1=respondent; 2=husband/partner; 3=both; 4=mother; 5=father; 6=mother-in-law; 7=father-in-law; 8=someone else	Q16A

Quantitative Analysis to address Aim 1: The first step of this process was to clean the data, run frequencies of the relevant variables to ensure variation in each variable, and address any issue of missing responses. I removed the cases with missing data in order to conduct complete case analysis (Allison, 2002; He, 2010). I examined the distribution of variables of

interest, and checked for outliers by running univariate statistics. Next, I used bivariate tests of association to assess the association between my control variables and independent variables (the network characteristics) with use of health facility births. The variables that were significant, at an alpha $p \leq .10$, were later used in a logistic regression model to test my hypotheses for Aims 1.1.

To test the hypotheses for Aim 1.1, I used separate logistic regression models to test the association between each network characteristic variable and facility birth, adjusting for the control variables. This regression applies logit transformation to the outcome variable. I used maximum likelihood methods to estimate the parameters (intercepts and regression coefficients). I examined the odds ratios for each model including confidence intervals and p-values. To test my hypotheses under Aim 1.2, I followed Frazier et al.'s (2004) steps for testing moderation. I ran separate logistic regression models to test two-way interactions, specifically, whether social network structural characteristics and/or social support moderated the relationship between social norms and health facility birth. Additionally, I determined whether social support moderated the relationship between social norms and health facility birth. I then conducted a post hoc analysis to probe the nature of interaction, for the significant moderated effects. This entailed calculating simple intercepts and simple slopes, and level of significance at different levels of social influence and social support. Also, I reran reduced models without interaction terms for models with insignificant interactions. All data management and analysis were conducted using SAS version 9.3 (SAS Institute, Cary NC). The analyses were two-tailed ($p< .05$) and adjusted for clustered survey design by including robust standard errors.

Qualitative Study Description

My second Aim explored how social network characteristics are related to health facility delivery by assessing the social network dynamics of women in rural Ghana. I examined how network composition, social support, and norms are related to women's use of health facility births. To accomplish this, I conducted and analyzed qualitative interviews with mothers, fathers, and mothers-in-law. Although the main focus of this aim is on mothers' experiences, fathers and mothers-in-law were interviewed to obtain additional data about women's network dynamics during their pregnancy, labor and delivery experiences.

Participant Recruitment: I worked with the Ghanaian research team to identify research assistants that I trained on the data collection protocols for the study. I worked with the research assistants to purposively sample participants to be interviewed. We worked with local community health workers and community leaders to identify potential participants. The research assistants then directly contacted the participants about being involved in the study.

We recruited a subsample of women who participated in household surveys to participate in individual qualitative interviews (Figure 2). We conducted in-depth interviews with 20 women from across 2 of the designate districts (1 intervention and 1 control district) each in the Northern and Central region (Table 4.6). Also, a subsample of the women's husbands (10 each in the Northern and Central region) was interviewed. I conducted 4 focus group discussions ([FGDs] 8 to 12 per group) with mothers-in-law selected from a community in each of the district where we conducted the individual interviews. I purposively sampled women who gave birth, and mothers-in-law whose daughters-in-law gave birth, in the past 12 months prior to data collection. I focused on women whose newborns were under 12 months old in order to reduce the possibility of recall bias during the in-depth interviews with participants. To enable comparison on use of

facility delivery, I also sampled equal numbers of women who had facility birth and those who had homebirth.

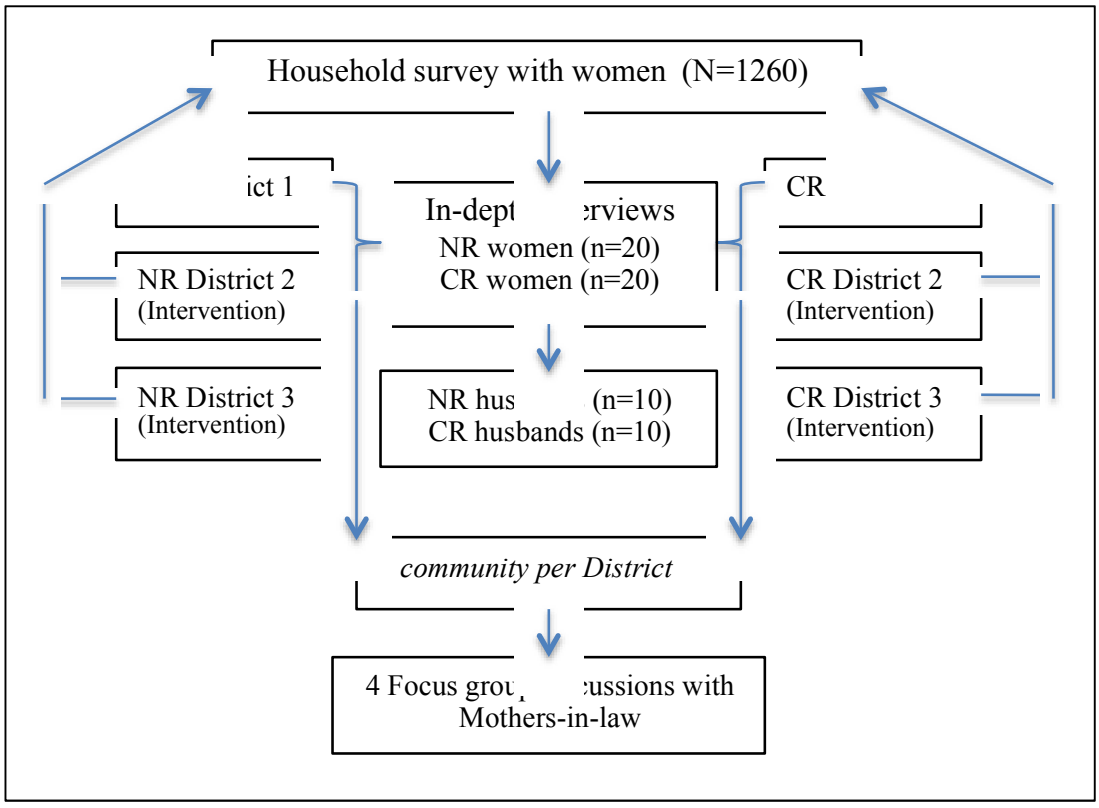

Figure 2: Study design and sample description.

I used saturation as a criterion for determining appropriate samples for my study (Creswell, 1998). Saturation is reached when collecting more data does not yield new information or themes related to the research topic of focus (Glaser & Straus, 1967; Morse 1994). Factors that influenced my decision on the sample I needed to reach saturation include the scope of my study, the range of topics I covered in my interview questions, the depth of the interviews with study participants, and heterogeneity of the participants (Patton, 2002; Creswell, 1998; Morse 1994). Guest et al. (2006) conducted a systematic analysis of their own interview data, to determine the point at which additional interviews failed to produce new information on

their research topic. In analyzing a homogenous sample they discovered 12 interviews were enough to fully develop all but one of their thematic descriptions/ categories. Additional interviews produced very little change to their developed themes and did not provide new information. During fieldwork I met with the research assistants at the end of each day to review summaries of the interviews conducted and to discuss emerging themes. Through this process I determined that we had reached data saturation before completing the interviews with women and their husbands. However, I did not modify the sample size because the interview guide included additional questions that were relevant to the overall endline assessment (Table 4.6). I added two more FGDs with mothers-in-law in order to reach saturation for the FGDs.

Table 4.6: Qualitative data sample

	Northern region		**Central region**		**Total**
	Methods	*Sample*	*Methods*	*Sample*	
Mothers	Individual interviews	20	Individual interviews	20	40
Fathers	Individual interviews	10	Individual interviews	10	20
Mothers-in-law	Focus groups	2	Focus groups	2	4

Data collection procedures: Potential participants were provided with a brief overview of the study and those who met the recruitment criteria and agreed to participate were verbally consented. Individual interviews were conducted in the privacy of participants' homes and FGDs were conducted in local health centers. As the interviews conducted depended on study participants' availability, we were often unable to match the genders of the research assistants with participants'. This meant that in situations where research assistants interviewed participants whose gender was different from theirs there was potential for response bias. Probing questions were used to ensure that participants provided as much relevant and detailed information as possible. All interviews were conducted using a semi-structured interview guide. The interviews were conducted in the local languages of the study participants (*Twi* and *Fanti* in the Central region and *Dagbani* and *Lekpepkel* in the Northern region).

To assess network characteristics women were asked to provide a complete list of all network members involved in their pregnancy experiences. Women then provided information on how they are related, and their frequency of contact and interactions with network members; how long they have known the members; and how far network members lived from them. They also described the type of relationship they have with network members, and also which network members know and interact with each other. To assess network function, women were asked about the role of each network member, and the kinds of support and influence each person provided on women's health service utilization decisions during pregnancy and delivery.

Husbands were asked to describe their wives' pregnancy experiences, identify roles of individuals involved in health decisions about their pregnancy, and describe the kinds of support they and other family members provided their wives. In the FGDs we asked mothers-in-law to identify the roles of individuals involved in health decisions about women's pregnancy, describe community perceptions about place of childbirth, and describe various support they (mothers-in-law) and family members provided the women (See Appendix D for interview guides).

Detailed field notes of each interview were taken during the data collection process (Emerson, Fretz, & Shaw, 1995). A summary of individual interviews and focus groups were written following each interview, using an interview summary form. At the end of each day of data collection, I met with research assistants to discuss emerging themes and relevant topics to address. This helped inform improvements needed in the research questions and our interview approach. Throughout the data collection process I wrote memos on my observations of the interview process, and participants' comments and actions. All interviews were audio recorded and transcribed verbatim by research assistants that were well versed in the local languages. I

conduct quality control of the transcriptions received to ensure that interviews are accurately transcribed into English.

Qualitative Analysis to address Aim 2: I began the analysis by conducting close readings of all individual interviews and FGD transcripts. Next, I wrote analytic summaries of each interview with women and husband on their pregnancy and delivery experiences, and of each FGD with mothers-in-law on their perceptions about childbirth experiences of women in their communities (Sandelowski, 1995). I then generated preliminary descriptive codes and memos on the various roles of network members in women's pregnancy and delivery care experiences using these summaries. Following, another review of transcripts, and discussions with the research team about emergent themes from the analytic summaries and field notes, I developed a core set of inductive codes in order to conduct thematic analysis of women's social network characteristics and pregnancy/delivery care experiences. I applied these codes to the individual interviews and FGDs using Atlas.ti software (version 7.0, Scientific Software Development GmbH, Eden Prairie, MN), and modified and added new codes during the coding process (Morse, 1994; Charmaz, 2006). To ensure coding quality I conducted coding checks by reviewing all transcripts after completing the coding process.

Subsequently, I reviewed the code outputs and developed code summaries and analytic matrices (Miles & Huberman, 1994; Sandelowski, 1995). I used the code summaries, which captured women's interactions with network members during pregnancy, to create a table summarizing women's network composition, and to provide contextual information on the supportive and influential roles of network members. In the matrices, I compared women who had facility versus homebirth and Northern versus Central region women, on themes of how

network members' involvement in women's receipt of pregnancy, labor, and delivery care affected their place of delivery.

CHAPTER 5: STRUCTURAL AND FUNCTIONAL NETWORK CHARACTERISTICS AND FACILITY DELIVERY AMONG WOMEN IN RURAL GHANA

Introduction

In 2015, 66% of the world's maternal deaths occurred in the sub-Saharan African region, which is also the region with the highest maternal mortality ratio (MMR) at 546 maternal deaths per 100 000 live births (WHO et al., 2015). Maternal deaths occur as a result of health risks associated with pregnancy, including hypertensive disorder during pregnancy, postpartum hemorrhaging, sepsis, complications from childbirth or unsafe abortions, malaria and anemia (Say et al., 2014). Most maternal mortality can be prevented through health facility delivery with the assistance of a skilled birth attendant (Van den Broek & Falconer, 2011; UNFPA, 2009). Facility delivery is considered the most efficient and cost-effective means of preventing maternal deaths, but in Africa over half of all births occur outside of health facilities (Gabrysch & Campbell, 2009; UNICEF, 2014). Compared to some sub-Saharan African countries, the MMR in Ghana is lower at 319 per 100 000 live birth. However, this ratio is ranked among the highest (32^{nd}) globally (WHO et al., 2015; CIA, 2015). According to the 2014 Ghana Demographic Health Survey (GDHS), 73% of births in the country occurred in health facilities. Whereas 90% of birth among urban populations occurred in facilities, only 59% of births among rural population were in facilities (GSS et al., 2015). Over half of the populations of most regions in Ghana are in rural settings, which highlight the need to improve use of facility delivery in these regions.

Determinants of health facility delivery in sub-Saharan African countries like Ghana include shorter distance to a facility, available transportation, affordable cost of facility care, maternal socio-demographics (e.g. older age, lower parity, higher education level, higher wealth, higher health decision making autonomy), perceived needs/benefits of facility birth, and facility factors (e.g. positive health provider attitude, privacy, and good quality of care) (Gabrysch & Campbell, 2009; Moyer & Mustafa, 2013; Moyer et al., 2013; Akazili et al., 20011; Crissman et al., 2011, 2013). Researchers have argued, however, that studies on determinants of facility delivery are limited in part because the majority do not examine key social determinants, including social networks (Gabrysch & Campbell, 2009; Say & Raine 2007; Moyer & Mustafa, 2013). These researchers maintain that understanding determinants like social networks will improve our knowledge on the functions of network members in women's pregnancy experiences, and how members can contribute to women's uptake in facility delivery care. To address this gap in the literature, I examine the role of social networks in women's use of health facility delivery.

Networks Roles in Facility Delivery

A social network is a web of social relationships among a group of individuals, which has both structural and functional characteristics (Mitchell, 1969; Fischer, 1982; Lauman, 1995). The interest of public health research is to determine how the structural and functional characteristics of social networks promote and influence health behaviors and ultimately health outcomes (Luke & Harris, 2007). Network structural characteristics include network size, network members' connectedness (density), demographic similarities (homogeneity) and emotional closeness of network members to each other (tie strength) (Seeman & Berkman, 1988; House, Umberson & Landis, 1988).

Functional characteristics are the resources exchanged among individuals in a network such as social support and social influence in the form of social norms. Social support can include: informational support such as advice/suggestions received from network members; instrumental support, or aid/assistance provided by members; and emotional support, or members' expression of empathy, care and trust (Berkman & Glass, 2000). Social norms potentially impact one's attitudes and behaviors (Erickson, 1988; Berkman & Glass, 2000). Norms are conceptualized as both descriptive and injunctive (Cialdini & Trost, 1998; Lapinski & Rimal, 2005). Descriptive norms refer to perceptions of behaviors that are most common among network members. Individuals within a network tend to adopt the behaviors they believe to be normative among their network members. Injunctive norms are perceptions of behaviors that are considered acceptable by network members, and individuals are influenced to adhere to those behaviors in order to avoid social sanction.

Conceptually, social ties among network members are considered the structural basis on which social support and social norms impact health behavior (Berkman & Glass, 2000; Hall & Wellman, 1985). Not only do each of these network characteristics have a direct effect on health, but also they can potentially operate by interacting to form underlying mechanisms that influence proximate health, including negative health or health promoting behaviors. In this study, I examine the association between network structural and functional characteristics and health facility delivery.

There is evidence of a positive association between network structure (e.g. network size, density, homogeneity, proximity of network members to one another, frequency of contact, and strength of ties among network members) and health services use, including maternal care (Devillanova, 2008; Deri, 2005; St Clair, Smeriglio, Vincent, Alexander, & Celentano, 1989;

Kohler et al., 2001; Adam et al., 2002; Berkanovic & Telesky 1982). Research focusing on the relationship between network structure and facility delivery is limited. Particularly, Edmond et al. (2012) found that network density, homogeneity and strength of ties among women in rural Bangladesh were not significantly related to facility birth. As a result, they suggested a need to examine other structural network measures that may be associated with facility delivery.

In terms of functional network characteristics first, a limited number of studies on the association between social support and facility delivery suggest that women who received informational support (advice to utilize facility-based deliver) and instrumental support (help with house chores and farming) during pregnancy were more likely to utilize facility delivery compared with women who did not receive these kinds on support (Gayen & Raeside, 2007; Edmonds et al., 2012; Ono et al., 2013). Previous research has not examined the relationship between emotional support and facility delivery. Second, community level social norms about the importance of facility birth have been positively related to women's facility delivery (White et al., 2013). Speizer and colleagues (2014) recently found that Ghanaian women's perceptions of a higher proportion of husbands or mothers-in-law who supported facility delivery, and their perception of a higher number of women in their community who delivered in health facilities, were significantly related to facility delivery (Speizer, Story, & Singh, 2014). Studies on network functions have not focused specifically on how the social norms within women's networks impact their use of facility delivery.

Social network theories suggest that network characteristics may interact to influence facility delivery (Seeman, 1996; Berkman & Glass, 2000; Smith & Christakis, 2008). In a qualitative study of husbands' perceptions of social norms regarding facility delivery and their provision of emotional, instrumental and informational support for women's childbirth in rural

Bangladesh, researchers found that husbands of women who had facility births believed health facility delivery was necessary and also provided women with different types of support during delivery, whereas husbands of women who had homebirth believed that childbirth should be at home and were unsupportive of women's facility delivery (Story et al., 2012). The one study that examined the interaction effect of network structure (density, homogeneity and strength of ties) and network function, measured as perceived advice to deliver at a facility or home, on facility delivery found no significant effect (Edmonds et al., 2012). The authors acknowledged that the measures used in their study were likely unrepresentative of structural network characteristics that potentially influence facility delivery.

Presently, no study has examined the relationship between network structure and health facility delivery in sub-Saharan Africa and only one study, in rural Kenya, has quantitatively examined the influence of social support on health facility birth use (Ono et al., 2013). Studies on social norms and facility delivery have mainly focused on community level norms (White et al., 2013; Speizer et al., 2014). Knowledge of which properties of women's network structure, forms of social norms, and kinds of support provided by network members are associated with women's place of delivery, can inform future intervention strategies to further improve facility delivery access and use. Additionally, research on the interactive effects of network structure and functions on facility delivery are needed to further elucidate the process by which network influence the use of facility delivery. To that end, the aim of my study is to determine whether characteristics of network structure and functions (social support and social norms) are associated with facility birth among rural Ghanaian women. Additionally, I determine whether characteristics of network structure and functions interact to influence facility birth.

Methods

Study Setting

I used cross-sectional data from the endline evaluation of a Maternal and Newborn Health referral (MNHR) study, under Project Fives Alive (PFA) in Ghana (Singh et al., 2013). The study sought to contribute to the overall PFA goal of reducing maternal and neonatal mortality by focusing on improving the referral process for pregnant women and newborns in need of comprehensive medical care, from a lower level of facility care such as a health center, to a higher level of facility care such as a hospital. The evaluation of the MNHR was led by an evaluation team from the University of North Carolina (UNC) at Chapel Hill in conjunction with a research team from the Institute of Statistical, Social and Economic Research at the University of Ghana.

A household survey instrument was administered to women between January and March 2015 with the goal of assessing knowledge, practices and attitudes about maternal and newborn referrals. For the purpose of this study additional items were included to assess women's perspectives on their social network characteristics during their most recent pregnancy. This study was approved by the Ghana Health Service Ethical Review Committee and exempted from ethics review by UNC-Chapel Hill's Internal Review Board, as it was considered a program evaluation.

Conceptual Framework

Social network theories suggest that network structure and functions (social support and social norms) will have a direct effect on health behaviors such as facility delivery (House, 1988; Seeman, 1996; Berkman & Glass 2000). The structural properties of network relationships (e.g. network size, frequency and proximity) can enhance women's ability to engage in health

promoting behaviors because of the various network functions of network members (Berkman & Glass 2000; House et al., 1988). Whereas network members can influence health behavior through the provision of (instrumental, emotional and informational) support, network structural characteristics can potentially modify the relationship between social support and facility delivery. Social norms (injunctive and descriptive) within networks can serve as a powerful influence on the behaviors of network members, and the effect of social norms may be moderated by network structural characteristics (Granovetter, 1973: Lapinski & Rimal, 2005; Smith & Christakis, 2008; Gayen & Raeside, 2007). Additionally, social support can operate through its interaction with social norms to influence health behavior. As indicated in previous studies, constructs of social network theories are valuable tools for examining the relationship between network characteristics and health facility delivery use. Figure 1 summarizes the relationships between social network structure, social support, social norms, and facility delivery.

I hypothesize that larger network size, higher frequency of contact with and closer proximity to network members will be positively associated with facility delivery (Figure 1). Perception of a higher frequency of (informational, emotional and instrumental) support from network members during last pregnancy and social norms (injunctive and descriptive norms) favoring facility delivery will be positively associated with use of health facility birth. I suggest that the positive relationship between perception of higher frequency of social support and facility delivery will be moderated by network structural characteristics, such that the relationship will be stronger for women with larger network size, higher frequency of contact with and closer proximity to network members. The positive relationship between higher perceived prevalence of social norms and facility delivery will be moderated by network

structural characteristics, such that the relationship will be stronger for women with larger network size, higher frequency of contact with and closer proximity to network members. Additionally, I hypothesize that the positive relationship between perception of higher perceived prevalence of social norms and facility delivery will be moderated by social support, such that the relationship will be stronger for women with higher frequency of (informational, emotional and instrumental) support.

Study Design and Sample

This study was conducted in three districts each in the Northern and Central regions of Ghana. Two of the districts in the Northern region and two of the districts in the Central region were designated as the intervention districts. The third district in the Northern and Central regions were each designated as the comparison districts. The survey employed a 30 by N cluster sample design whereby 30 clusters of communities were randomly selected in the three designated districts in the Northern region (15 intervention communities and 15 comparison communities), and similarly 30 communities were selected in the Central region. The cluster sampling design is an efficient method of obtaining a representative sample in communities where collecting household census would be difficult (Henderson & Sundaresan, 1982). The clusters were selected from a list of all communities in the districts of interest. Seven women with recent birth in the past 12 months were randomly selected in each cluster to be interviewed, from a comprehensive list of recently pregnant women in each community. This list was compiled through interviews with community health workers, traditional birth attendants and community leaders. Also, two of each pregnant woman's closest neighbors were interviewed (age 15–49 years) because the knowledge, attitudes and practices of women of all ages regardless of whether or not they had a delivery was considered valuable in informing

improvement in health services use. The target sample in each region was 630 women (210 women with a recent birth and 420 additional women), and a total of 1260 women were interviewed.

In this study I specifically focused on women who had given birth in the past 3 years at the time of the survey. I excluded women who had missing information on all key variables of interest resulting in an analytic sample of 783.

Variables

I defined my outcome variable, health facility birth, as having delivered at a health facility during participant's most recent pregnancy in the last three years.

Key independent variables included social network structural and functional characteristics. Network structure variables included network size, frequency of interaction and proximity of network members to women during their last pregnancy. I created a continuous variable for network size by adding the responses of two items: "how many of your (1) relatives, and (2) friends, with whom you feel close to and can call on for help did you have any form of contact with during your last pregnancy experience?" I created a continuous variable for frequency of interaction with network members by summing two items: "How many of these (1) relatives, and (2) friends, did you see or interact with at least a few times a week during your last pregnancy?" Also, I created a continuous variable for proximity by summing two items: "How many of these (1) relatives, and (2) friends, lived in your village (community) during your last pregnancy?"

Network functional characteristics included social support and social norms. For social norms, I assessed injunctive norms using two variables: "how much do your (1) close relatives, and (2) friends, you described in the previous section approve of or encourage the use of health

facilities for care during pregnancy and childbirth?" The response options were: strongly approve, approve, somewhat approve, do not approve, and not applicable. I recoded the response options into a higher approval (strongly approve or approve) and lower approval (somewhat approve, do not approve, or not applicable). For the descriptive norm variable participants were asked: "How many of the women you know of (e.g. relatives, friends, and acquaintances) have gone to the health facility for their pregnancy related care?" The response categories included: most, many, some, few and none. I recoded the categories as greater number (most or many), some and fewer number (few or none).

Using two questions each I created variables of the frequency of instrumental, emotional and informational support. These questions asked women during their last pregnancy how often there was someone to provide them with a particular support. Instrumental support questions included: "someone to help you with your daily chores" and 2) "someone to help you seek health care." Emotional support items included: 1) "someone you could count on to listen to you when you had any problems, concerns, or fears and 2) "someone who had gone through pregnancy and could understand what you were going through and be supportive of your experience." Informational support included: 1) "someone who gave you good advice about crisis or situation you were experiencing" and 2) "someone you could turn to when you needed suggestions and advice on how to deal with problems." The response categories were: all of the time, most of the time, some of the time, a little of the time and none of the time. I recoded each of the categories as more of the time (all or most of the time) and less of the time (some, a little, or none of the time).

I included control variables known to be associated with use of health facility delivery including: maternal age, education, employment, household wealth, religion, marital status,

ethnicity, parity, region, and decision-making autonomy (Moyer & Mustafa, 2013). I created the wealth variable based on a similar approach used in previous studies that examined baseline and midline data from the MNHR project (Singh et al., 2013; Speizer et al., 2014). I selected three household characteristics: type of toilet, location of kitchen and type of fuel used. I coded as poorest households that (1) use wood for fuel, (2) have non-improved toilet (definition from GDHS) and (3) a kitchen outside the house. I coded household with two out of three of these options as medium, and households with one or none of these options as richest. I derived the autonomy variable from the item: "who usually makes decisions about health care for you?" Response options were: respondent alone, husband/partner alone, respondent and husband/partner jointly, other network members. I recoded the options into high decision-making autonomy (respondent alone or respondent and husband/partner jointly), low decision-making autonomy (husband/partner alone), and others (other network members). Table 5.1 provides a description of these variables.

Analysis

I conducted bivariate analyses of the association between each control variable and health facility birth, and also each network characteristic variables and facility birth, adjusting for the clustered survey design. Using separate logistic regression models I tested the association between each network characteristic and facility birth, adjusting for the control variables. I then ran separate logistic regression models to test two-way interactions, specifically whether network structure moderated the relationship between social support and/or social norms and health facility birth. I also tested whether the interaction between social support and social norms was associated with facility birth. I re-ran reduced models without interaction terms for models with insignificant interaction terms, and conducted post hoc analysis to probe the nature of interaction

of models with significant moderated effect (Frazier, Baron, & Tix, 2004). All logistic regression analyses were two-tailed ($p < .05$) and adjusted for clustered survey design by including robust standard errors in SAS version 9.3 (SAS Institute, Cary NC).

Results

Table 5.1 shows descriptive characteristics of all women respondents, and by whether women had homebirth or facility birth. Half of all respondents (50%) were between 25 and 34 years, and about 5% were younger than 19 years. Just under half (47%) of all women had no formal education. The proportion of women with no formal education was significantly greater among respondent who had homebirth than those who had facility birth (69% vs. 32%, $p < 0.01$). Approximately, two-thirds of all women had unpaid work or were unemployed, 31% were self-employed, and 5% had paid employment. Half of all women were in the poorest category of household wealth. A significantly greater proportion of women who had homebirth than those who had facility birth had unpaid work or were unemployed (81% vs. 53%, $p < 0.01$), and were in the poorest household wealth category (66% vs. 41%, $p < 0.01$). The majority of all women were married (87%), Christian (59%), and the largest ethnicity was Akan (43%). Twenty-nine percent of all respondents had five of more births. A significantly greater proportion of women who had homebirth than those who had facility birth were married or living with a partner (94% vs. 82%, $p < 0.01$), and had six or more children (27% vs. 13%, $p < 0.01$). A significantly greater proportion of women who had homebirth, than those who had facility birth, indicated that their husband alone made decisions about their health care (67% vs. 59%, $p < 0.01$).

Women's network characteristics are also included in Table 5.1. In terms of network structure, the mean pregnancy network size of all women was 3.66 (C1: 3.36-3.96), mean number of network members they interacted with was 2.81 (CI: 3.36-3.96), and mean number of

network members they lived near was 1.59 (CI: 1.43-1.76). Women who had homebirth had a higher mean network size (3.87 vs. 3.51), mean number of network members they interacted with (3.13 vs. 2.59), and mean number of network members they lived near (1.69 vs. 1.52), than the proportion of women who delivered in a facility.

In terms of social norms, 80% of women perceived that their close relatives and 63% perceived that their close friends had higher approval of facility-based pregnancy and delivery care. A significantly greater proportion of respondents who had facility birth than the proportion that had homebirth perceived that their close relatives (86% vs. 72%, $p< 0.01$) had higher approval of facility-based pregnancy and delivery care. Additionally, 64% of all respondents perceived that a greater number of women they know have gone to a facility for pregnancy-related care. More women who had facility birth compared to those who had homebirth perceived that a greater number of women they know have gone to a facility for pregnancy related care (73% vs. 51%, $p< 0.01$).

With regard to instrumental support, 59% of women perceived that more of the time there was someone to help them with their daily chores, and 66% perceived that more of the time there was someone to help them seek health care. Compared to women who delivered at home, a significantly greater proportion of women who had facility birth perceived that more of the time there was someone to help them with daily chores (62% vs. 55%, $p= 0.02$); and to help them seek health care (71% vs. 59%, $p< 0.01$). In terms of emotional support, 62% of women perceived that more of the time there was someone to listen if they had any problems, and 62% perceived that more of the time there was someone who could understand and support them through pregnancy. And with regard to informational support, 65% of women perceived that more of the time there was someone to give them advice, and 62% perceived that more of the

time there was someone they could turn to for suggestions on dealing with concerns. There was no difference in significance for emotional and instrumental supports by place of delivery.

Table 5.2 presents odds ratios and 95% confidence intervals of the association between each network variable and health facility birth, controlling for women's age, education, employment, household wealth, parity, marital status, religion, ethnicity, region, and decision-making autonomy. Overall, I found several significant associations between social norms and social support, and facility delivery. Women who perceived that their close relatives had a higher approval of facility-based pregnancy and delivery care were significantly more likely to have health facility birth (OR: 2.16, CI: 1.27-3.68) than those who perceived that their close relatives had a lower approval. Respondents who perceived that a greater number of women they know have gone to a facility for pregnancy-related care were significantly more likely to have facility birth (OR: 2.20, CI: 1.21-4.00) than those who perceived that a fewer number of women they know have gone to a facility. Women who perceived that more of the time there was someone to help them seek health care were significantly more likely to have facility birth (OR: 1.60, CI: 1.10-2.34), compared with those who perceived that less of the time there was someone to help. Women who perceived that more of the time there was someone to give them advice were significantly more likely to have facility birth (OR: 1.66, CI: 1.08-2.54), compared with those who perceived that less of the time there was someone. The association between respondent's perception that there was someone they could turn to for suggestions and facility birth was marginally significant at a p-value of 0.05 (OR: 1.51, CI: 0.99-2.28). Network structure and emotional support variables were not significantly associated with facility birth.

Nearly all modeled interactions between each network structure and social support variable, and each network structure and social norm variable, were not significantly associated

with facility delivery, adjusting for control variables. Also, most of the modeled interactions between each social norm and social support variable were not significantly associated with facility delivery. Table 5.3 presents two models including an interaction between a network structure and social support variable, and a social norm and social support variable. In Interaction model 1 the interaction between the variables "there was someone to give respondent advice" and "number of network members that respondent lived near" had a marginally significant association with facility birth at a p-value of 0.05 (OR: 1.37, CI: 1.00-1.87). The nature of this interaction was enhancing (Figure 3). That is, the positive relationship between women's perception that more of the time there was someone to give them advice and health facility birth was strongest for respondents who lived near large numbers of network members, whereas as the negative relationship between women's perception that less of the time there was someone to give them advice and health facility birth was strongest for respondents who lived near small numbers of network members.

In the Interaction model 2 (Table 5.3) the interaction between the informational support variable "perception that there was someone to give respondent advice" and descriptive norm variable "number of women respondent know that have gone to a facility for pregnancy-related care" was significantly associated with facility birth. That is, respondents' perception that there was someone to give them advice modified the positive relationship between their perception that some women they know have gone to a facility birth and their own use of facility birth (OR: 5.58, CR: 1.64-19.02, p value<0.01). The nature of this interaction as depicted in Figure 4 shows that among respondents who perceived that some women they know have gone to a facility for pregnancy-related care, those who perceived that more of the time there was someone to give

them advice were more likely to have facility delivery, whereas those who perceived that less of the time there was someone to give them advice were less likely to have facility delivery.

Discussion

I assessed the association between network structural and functional characteristics and facility delivery, as framed by my conceptual model. I found that social norms, instrumental support and informational support were positively associated with women's use of health facility birth. Also, social network structure (proximity) moderated the relationship between social support and facility delivery.

Similar to my examination of the interactive effect of network structure and function, Edmonds and colleagues (2012) previously assessed the interaction between women's network structure and women's perceptions of advice from network members to either deliver at home or at a health facility. Drawing from the Network Episode Model, which posits that health decisions are made in the context of interpersonal interactions within one's social network, Edmonds et al. (2012) suggested that the interaction between network structure and perceptions of advice would help explain pregnant women's decision to utilize health facility birth. These authors, however, did not find evidence of this interaction, which they interpreted as being due to their network structural variable failing to capture distinct structural features of women in rural Bangladesh. In my analyses, I found that women who perceived that more of the time there was someone to give them advice and lived near large numbers of network members had a higher odds of facility birth, whereas women who perceived that less of the time there was someone to give them advice and lived near small numbers of network members had lower odds of facility birth.

This finding of an interaction effect of informational support and network proximity suggests that network structure operates by modifying the relationship between social support

and health-related behavior. Similar examples are found in the maternal health literature, which suggests that network structure interacts with network functions to influence maternal health (Madhavan, Adam & Simon, 2003; Kohler, Behrman, Watkin & 2001). For example, in their study of women in rural Kenya, Kohler et al. (2001) found that network density moderated the relationship between social influence in the form of descriptive norm (number of contraceptive users in a woman's social network) and contraceptive use. The positive relationship between number of contraceptive users in a woman's social network and women's contraceptive use was stronger for women with a higher network density.

I found that network structure was not significantly associated with facility birth. Moreover, contrary to my hypothesis women who had homebirth had higher mean network size, frequency and proximity than those who had facility-birth. It is possible that women who gave birth at home interacted with a slighter higher number of women during their pregnancy and delivery experiences, and yet network members of women who had facility birth were more influential in the decision-making process and support provision to get women to a health facility.

Few studies have explored the interaction between social support and social norms, as an explanation of how network functions are associated with facility delivery use (Story et al., 2012; Ono et al., 2013). Ono and colleagues (2013) qualitatively examined the determinants of the effect of social support on both married and unmarried women's use of facility delivery in Kenya. They argued that married women lived in close-knit communities with their husbands' family household and were likely influenced by the family's normative belief in homebirths, whereas unmarried women were not subject to normative influences from a husband's family to deliver at home, and so were less likely to experience homebirth. My study builds on Ono and

colleagues (2013) work by specifically examining the interactive effect of social support and social norms on facility birth. I found that among respondents who perceived that some of the women they know have gone to a facility for pregnancy-related care, those who perceived that more of the time there was someone to give them advice had a high probability of facility birth, whereas those who perceived that less of the time there was someone to give them advice had a low probability of facility birth. This suggests that whereas women who perceived social norms favoring facility delivery were more likely to have facility birth, receiving advice from network members during pregnancy further strengthened their likelihood of having facility births.

Consistent with previous research (Edmonds et al., 2012; Ono et al., 2013), the measures of social support in my study revealed that women's perception that there was someone to help them seek health care, and to give them advice, during pregnancy was positively associated with facility delivery. My finding is supported by previous work that examined the network functions of specific network members (Carter, 2002; Parkhurst, Rahman & Ssengooba, 2006; Raman et al., 2014). For instance, Moyer et al. (2014) qualitatively examined how social factors influence facility delivery in Ghana (Moyer et al., 2014). They found that women were dependent on their social networks including husband, mother-in-law and head of household for instrumental (economic or logistics) support to get them to a health facility for childbirth. Contrary to my hypothesis, I did not find a significant association between emotional support and facility delivery. Quantitative research on the relationship between emotional support and facility delivery is nonexistent. Previous qualitative research in Bangladesh has found that women who received emotional support from their husbands during labor were more likely to have facility delivery. Possibly, my measure of emotional support did not reflect the type of emotional support experienced by rural Ghanaian women.

In terms of the social norms, I found that respondents' perception that their close relatives approved of facility-based pregnancy and delivery care, and that women they know have gone to a facility for pregnancy-related care, were positively associated with facility birth. This finding suggests that in addition to the growing evidence of a shift in social norms toward use of facility birth in Ghana (Mills & Bertrand, 2005; Jansen, 2006; Crissman et al., 2011, 2013; Moyer et al., 2014), the normative influence of women's network members regarding facility delivery is directly associated with women's use of health facility birth.

Limitations in my study are worth noting. My analysis was based on cross-sectional data, which makes it impossible to infer causality between my key independent variables and outcome. Future longitudinal studies are needed to establish causality. Although my use of a cluster sampling design results in less precision than, for example, a simple random sampling, this was the best approach to collect data from women in rural areas who were clustered in communities/ villages. I sampled women who had given birth three years prior to the survey administration, and this may have introduced an element of recall bias. I used an egocentric approach to collect data on women's network members. As such I did not acquire information on the perspective of women's own network members, which may have provided different insight into the network members' role in facilitating women's facility delivery.

Conclusion

Women's perceptions that network members played various functional roles in their pregnancy and birth delivery experiences were associated with facility delivery. This demonstrates the importance of accounting for the roles of network members in supporting women's pregnancy when designing maternal and child health interventions to promote use of facility-based pregnancy and delivery care. Maternal health interventions should be tailored to

directly incorporate network members in strategies to increase uptake in women's use of pregnancy related health services. Also, future research should examine which types of network members provide specific kinds of social support and are influential in facilitating women's use of facility birth. In countries like Ghana, such work may have immediate impact by informing on-going national level interventions to improve health services delivery for pregnant women.

Table 5.1: Descriptive and network characteristics of women with most recent childbirth, and by place of birth

	Total sample (783)	**Homebirth**	**Facility birth**
Descriptive	Percent (N)	Percent	Percent
Age			
< 19 years	4.73 (37)	2.78 (9)	6.10 (28)
19 – 24 years	27.59 (216)	21.60 (70)	31.81 (146)
25 – 34 years	49.94 (391)	55.86 (181)	45.75 (210)
35 – 49 years	17.75 (139)	19.75 (64)	16.34 (75)***
Education			
None	47.13 (369)	68.83 (223)	31.81 (146)
Primary	26.56 (208)	20.99 (68)	30.50 (17.88)
Secondary	26.31 (206)	10.19 (33)	37.69 (22.09)****
Employment			
Paid	4.60 (36)	2.16 (7)	6.32 (29)
Self employed	30.65 (240)	16.98 (55)	40.31 (185)
Unpaid/ unemployed/other	64.75 (507)	80.86 (262)	53.38 (245)****
Household wealth			
Richest	16.99 (133)	6.48 (21)	24.40 (112)
Medium	31.55 (247)	27.16 (88)	34.64 (159)
Poorest	51.47 (403)	66.36 (215)	40.96 (188)****
Religion			
Christian	58.88 (461)	46.61 (151)	67.54 (310)
Moslem	27.46 (215)	29.32 (95)	26.14 (120)
None/traditional/Other	13.67 (107)	24.07 (78)	6.32 (29)****
Marital status			
Married/living together	86.97 (681)	93.83 (304)	82.14 (377)
Not currently in union	13.03 (102)	6.17 (2.55)	17.86 (82)****
Ethnicity			
Akan	43.04 (337)	22.22 (72)	57.73 (265)
Mole-Dadgbani	24.65 (193)	27.47 (89)	22.56 (104)
Grum	13.54 (106)	21.30 (69)	8.06 (37)
Other	18.77 (147)	29.01 (94)	11.55 (53)****
Parity			
1	23.63 (185)	14.51 (47)	30.07 (138)
2	18.26 (143)	14.20 (46)	21.12 (97)
3	17.75 (139)	18.21 (59)	17.43 (80)
4	11.75 (92)	14.51 (47)	9.80 (45)
5	9.71 (76)	11.42 (37)	8.50 (39)
6+	18.92 (148)	27.17 (88)	13.08 (60)****
Region			
Central	48.53 (380)	26.85 (87)	63.83 (293)
Northern	51.47 (403)	73.15 (237)	36.17 (166)****
Who usually makes decision about your health care:	67.11 (457)	77.30 (235)	58.89 (222)
Husband alone	27.17 (185)	16.45 (50)	35.81 (135)
Respondent alone/ both partners	5.73 (185)	6.25 (19)	5.31 (20)****
Other			
	Mean (95% CI)	*Mean (95% CI)*	*Mean (95% CI)*
Network structure			
Network size	3.66 (3.36-3.96)	3.87 (3.52-4.22)	3.51 (3.16-3.85)
Number of network members that respondent interacted with	2.81 (2.56-3.07)	3.13 (2.82-3.44)	2.59 (2.34-2.85)
Number of network members that respondent	1.59 (1.43-1.76)	1.69 (1.47-	1.52 (1.33-1.72)

lived near		1.91)	
	Percent (N)	Percent	Percent
Social influence			
Close relatives approval of facility-based pregnancy and delivery care:			
Lower approval	19.67 (153)	27.73 (89)	14 (64)
Higher approval	80.33 (625)	72.27 (232)	86 (393)****
Close friends approval of facility-based pregnancy and delivery care:			
Lower approval	36.63 (285)	33.75 (109)	38.68 (176)
Higher approval	63.37 (493)	66.25 (214)	61.32 (279)
Number of women respondent know that have gone to a facility for pregnancy-related care:			
Fewer number	9.92 (77)	17.08 (55)	4.85 (22)
Some	26.29 (204)	31.68 (102)	22.47 (102)
Greater number	63.79 (495)	51.24 (165)	72.69 (330) ****
Instrumental support			
There was someone to help with daily chores:	41.00 (321)	45.37 (147)	37.91 (174)
Less of the time	59.01 (462)	54.63 (177)	62.09 (285)*
More of the time			
There was someone to help seek health care:			
Less of the time	33.76 (264)	40.56 (131)	28.98 (133)
More of the time	66.24 (518)	59.44 (192)	71.02 (326)**
Emotional support			
There was someone to listen, if respondent had any problems:	37.72 (295)	37.04 (120)	38.21 (175)
Less of the time	62.27 (487)	62.96 (204)	61.79 (283)
More of the time			
There was someone who could understand and support respondent through pregnancy:			
Less of the time	38.06 (298)	40.43 (131)	36.38 (167)
More of the time	61.94 (485)	59.57 (193)	63.62 (292)
Informational support			
There was someone to give respondent advice:			
Less of the time	35.38 (277)	37.65 (122)	33.77 (155)
More of the time	64.62 (506)	62.35 (202)	66.23 (304)
There was someone respondent could turn to for suggestions on dealing with concerns:			
Less of the time	38.19 (299)	40.42 (131)	36.60 (168)
More of the time	61.81 (484)	59.57 (193)	63.40 (291)

Sample size is slightly smaller for some variables that had missing data. Significance tests compare homebirth with facility birth; *p≤0.05; **p≤0.01; ***p≤0.001; ****p≤0.0001

Table 5.2: Logistic regression odds ratios of association between network characteristics and health facility birth among women with most recent childbirth

Network characteristics	**Health Facility birth**	
Network structure	**OR (95% CI)**	**P value**
Network size	1.04 (0.97-1.12)	0.28
Number of network members that respondent interacted with	0.98 (0.90-1.07)	0.64
Number of network members that respondent lived near	1.07 (0.93-1.25)	0.35
Social influence		
Close relatives approval of facility-based pregnancy and delivery care:		
Lower approval	1.0	
Higher approval	2.16 (1.27-3.68)	< 0.01
Close friends approval of facility-based pregnancy and delivery care:		
Lower approval	1.0	
Higher approval	1.30 (0.88-1.93)	0.19
Number of women respondent know that have gone to a facility for pregnancy-related care:		
Fewer number	1.0	
Some	1.85 (0.96-3.58)	0.07
Greater number	2.20 (1.21-4.00)	0.01
Instrumental support		
There was someone to help with daily chores:		
Less of the time	1.0	
More of the time	1.31 (0.95-1.81)	0.10
There was someone to help seek health care:		
Less of the time	1.0	
More of the time	1.60 (1.10-2.34)	0.01
Emotional support		
There was someone to listen, if respondent had any problems:		
Less of the time	1.0	
More of the time	1.07 (0.71-1.63)	0.74
There was someone who could understand and support respondent through pregnancy:		
Less of the time	1.0	
More of the time	1.32 (0.93-1.87)	0.12
Informational support		
There was someone to give respondent advice:		
Less of the time	1.0	
More of the time	1.66 (1.08-2.54)	0.02
There was someone respondent could turn to for suggestions on dealing with concerns:		
Less of the time	1.0	
More of the time	1.51 (0.99-2.28)	0.05

Note: we run separate regression models for each independent variable, controlling for age, education, employment, household wealth, parity, marital status, religion ethnicity, region, and decision-making autonomy.

Table 5.3: Logistic regression odds ratios of the association of interactions between network characteristics with health facility birth among women with most recent childbirth

	Facility delivery vs. non-facility delivery
Network structure by social support	**Interaction model 1**
Number of network members that respondent lived near	0.83 (0.65-1.05)
There was someone to give respondent advice: Less of the time More of the time	 1.0 1.08 (0.59-1.98)
Number of network members that respondent lived near * There was someone to give respondent advice	1.37 (1.00-1.87) +
Social support by social influence	**Interaction model 2**
There was someone to give respondent advice: Less of the time More of the time	 1.0 0.66 (0.23-1.92)
Number of women respondent know that have gone to a facility for pregnancy-related care: Fewer number Some Greater number	 1 0.67 (0.28-1.61) 1.54 (0.59-4.01)
There was someone to give respondents advice*number of women respondent know that have gone to a facility for pregnancy-related care: Fewer number Some Greater number	 1 5.58 (1.64-19.02)** 0.65 (0.48-5.65)

Note: each regression model controlled for age, education, employment, household wealth, parity, marital status, religion ethnicity, region, and who usually make decision about your healthcare.*p≤0.05; **p≤0.01; ***p≤0.001; +p=.052

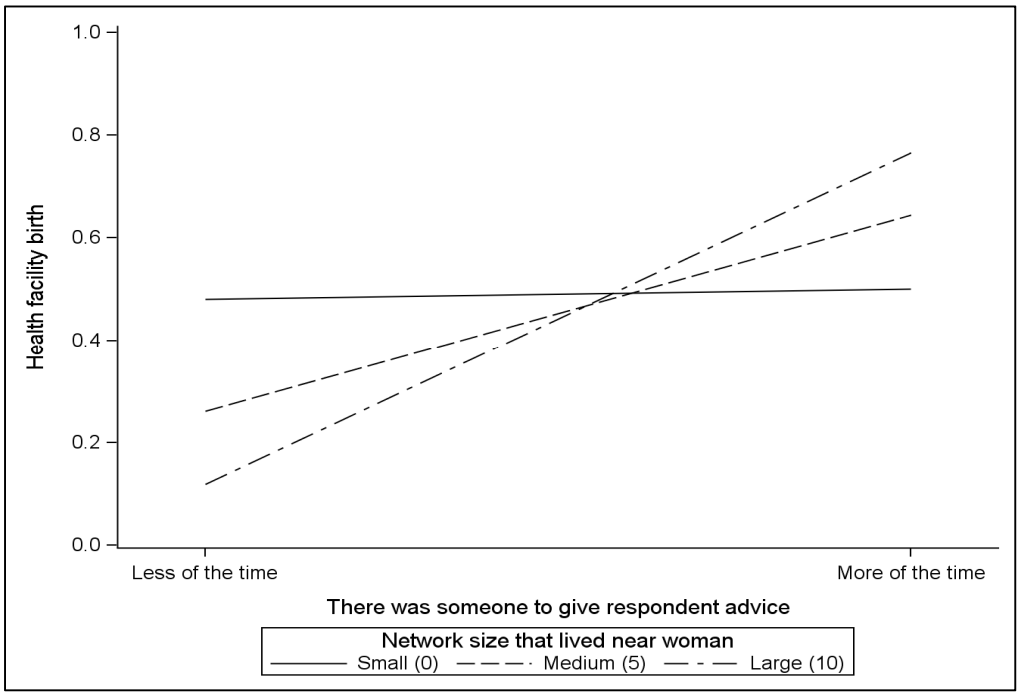

Figure 3: *Health facility birth by network structure and informational support* (number of network members that lived near respondent, and there was someone to give respondent advice)

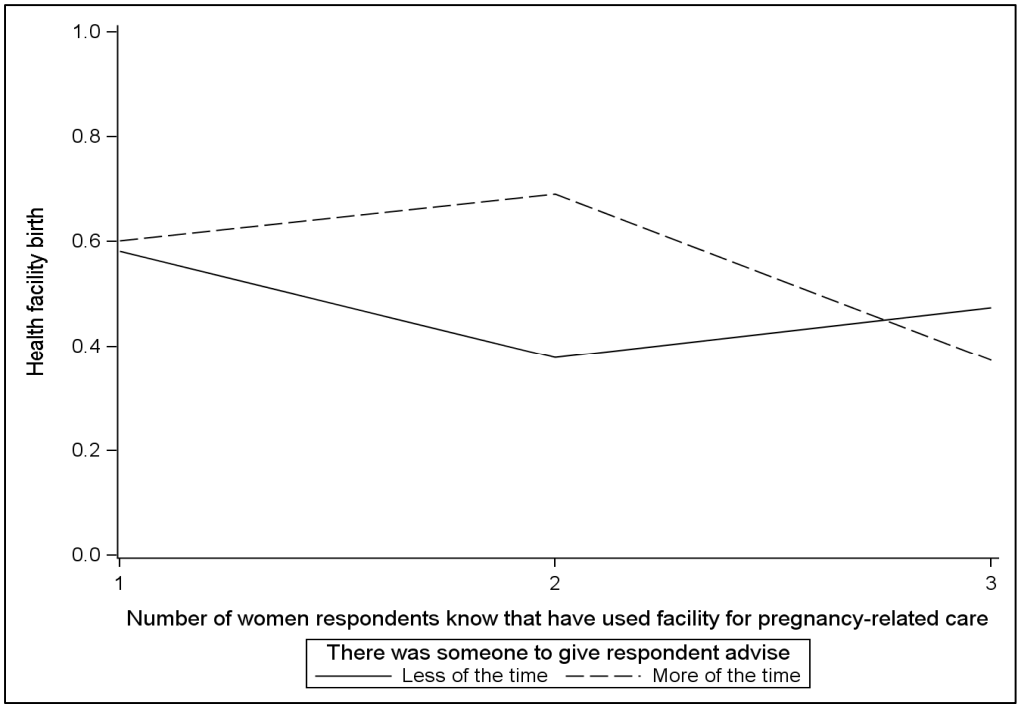

Figure 4: Health facility birth by informational support and descriptive norm *(number of women respondent know that have gone to a facility for pregnancy-related care, and there was someone to give respondents advice)*

CHAPTER 6: A QUALITATIVE STUDY OF WOMEN'S NETWORK COMPOSITION, SOCIAL SUPPORT AND FACILITY DELIVERY IN RURAL GHANA

Introduction

Sub-Saharan African countries account for approximately 62% of the world's maternal mortality, which includes death from pregnancy, childbirth or within 42 days postpartum (WHO et al., 2015). Maternal deaths occur as a result of health risks of non-facility births that include pregnancy related complications such as hypertensive disorder during pregnancy, postpartum hemorrhaging, sepsis, and complications from childbirth or unsafe abortions (Say et al., 2014). One of the most efficient and cost-effective ways to reduce maternal mortality is health facility delivery (Gabrysch & Campbell, 2009; UNICEF, 2014). In Africa over half of all births occur outside of health facilities (UNICEF, 2014). According to the 2014 Ghana Demographic Health Survey (GDHS) 73% of births in Ghana occurred in health facilities, whereas only 59% of births in rural areas were in facilities (GSS et al., 2015). Further improvement in uptake of facility delivery is needed, as more than half of Ghana's population lives in rural settings.

Determinants of health facility delivery among women in Africa include maternal socio-demographic, economic, physical access and facility-related factors (e.g. health provider attitude, privacy, and quality of care) (Moyer & Mustafa, 2013; Tey & Lai, 2013). In Ghana, affordable pregnancy-related care, short distance and accessible transportation to a health facility are associated with facility births (Mills et al., 2008; Crissman et al., 2013; Gething et al., 2012; Doku et al., 2012). Maternal characteristics such as older age, higher education level, positive perceptions about quality of health care and treatment received from health providers are also

associated with facility delivery (Galaa & Daare, 2008; Akazili et al., 2011; Sakeah et al., 2014a; Doku et al., 2012; D'Ambruoso et al., 2005). Whereas researchers have assessed these individual and structural determinants of facility delivery, exploration of social determinants – e.g. social networks – that may influence whether women delivery in health facilities is very limited. In this study I explored the role of social networks in rural Ghanaian women's use of health facility delivery.

Social Networks in Maternal Health Care

A social network is a web of social relationships among individuals, which has both structural and functional characteristics (Fischer, 1982; Lauman, 1995). Network structure refers to the properties of the relationships between an individual and others in his/her network (Israel, 1982; Mitchel & Trickett, 1980). This includes network composition, which describes the types of individuals in a network (e.g. relatives, neighbors and friends) and the attributes of these individuals (House et al., 1988; Hall & Wellman, 1985).

Previously, network composition and related network structural characteristics (larger network size, closer proximity of network members to each other, higher frequency of contact among network members, and stronger ties among network members) have been positively associated with health services use including maternal health care (Devillanova, 2006; Deri, 2005; St. Clair et al., 1989; Kohler et al., 2001). Conversely, qualitative research on how women's network composition influences maternal care utilization such as facility delivery is lacking. In this paper I explored women's perceptions of their network composition during pregnancy, as this may provide insight into other network structural properties of women, and also how network members provide resources to impact women's facility delivery (Hall & Wellman, 1985; Berkman & Glass, 2000).

Network functions include exchange of social influence and social support among network members (House, 1981; Thoits, 1995). Social influence refers to shared norms and behaviors of network members that can potentially influence members' attitude and behaviors (Marsden & Friedkin, 1994; Leenders, 1997). Available studies suggest that pregnant women tend to adhere to network members' attitudes about where a pregnant woman should give birth (Ono et al., 2013; Story et al., 2012). Members' attitudes are reinforced by their provision of social support for women's pregnancy care (Ono et al., 2013). In this study I examined support provided by women's network within the context of network norms regarding facility delivery.

Social support may be in the form of informational support, e.g. advice and suggestions provided by network members; instrumental support, e.g. aid or assistance provided by network members; and emotional support, e.g. empathy, care and trust received from network members (Berkman & Glass, 2000). Story et al., (2012) qualitatively explored husband's involvement in women's use of facility delivery in rural Bangladesh and found that women whose husbands provided them with informational, emotional and instrumental support were more likely to experience facility births, compared with those whose husbands were unsupportive. Whereas recent evidence from Ghana suggest that women were dependent on network members around them for instrumental support (economic or logistics) to get them to a health facility for childbirth (Moyer et al., 2014), researchers have not examined in-depth all network members in women's network in order to gain comprehensive knowledge on various kinds of support provided by different members. Understanding network functions such as social support provision in women's pregnancy experiences could underscore the benefit of incorporating social networks in intervention strategies to increase uptake in facility delivery (Moyer & Mustafa, 2013; Gabrysch & Campbell, 2009; Say & Raine 2007).

In this study, I qualitatively explored whether and how network composition, social support, and norms are related to women's use of health facility births.

Methods

Design and Sample

This study is part of a mixed methods evaluation of an intervention to improve access to maternal and newborn health services and outcomes in rural Ghana by strengthening the referral process for pregnant women and sick newborns with complications. Between January and March 2015, household surveys were administered to 1260 women of reproductive age in 3 districts each in the Northern Region (NR) and Central Region (CR). The NR and CR represent the two geographically, socio-demographically and culturally distinct areas of Ghana. I recruited a subsample of women who participated in the household surveys to participate in individual qualitative interviews (Figure 1).

In-depth interviews (IDIs) were conducted with 20 women from across 2 randomly selected districts each in the NR and CR. Also, a sample of the women's husbands (10 each in the NR and CR) was interviewed. Four focus group discussions (FGDs) were conducted with mothers-in-law (MILs) (8 to 12 per group) who were selected from a community in each of the district where the IDIs were conducted. I purposively sampled women who gave birth, and MILs (unrelated to the women selected for the IDIs) whose daughters-in-law gave birth, in the past 12 months prior to data collection. To enable comparison on use of facility delivery, I also sampled equal numbers of women who had facility birth and those who had homebirth. Two interviews each with NR and CR women, and one interview with a NR husband was lost, due to data corrupted audio files (Table 6.1).

Data Collection

I used an egocentric network approach to collect qualitative data on women's social networks composition and function (Carrington, Scott, & Wasserman, 2005). To assess network composition, women were asked to first provide a comprehensive list of all network members involved in their pregnancy experiences. They then provided information on how they are related, and their frequency of contact and interactions with network members; how long they have known the members; and how far network members live from them. Women also described the type of relationship they have with network members, and also which network members know and interact with each other. To assess network function, women were also asked about how of each network member was involved in their pregnancy experiences, and the kinds of support and influence each member provided on their health service utilization during pregnancy and delivery.

Husbands were asked to describe their wives' pregnancy experiences, identify roles of individuals involved in health decisions about their pregnancy, and describe the kinds of support they and other family members provided their wives. In FGDs MILs were asked to identify roles of individuals involved in health decisions about women's pregnancy, describe community perceptions about place of childbirth, and describe various support MILs and family members provide women.

My objective was to understand important themes related to social network characteristics and women's pregnancy and delivery experiences. Hence, during fieldwork I met with research assistants at the end of each day to review their summaries of the day's interviews and to discuss emerging themes. I determined that we had reached data saturation, the point at which additional data did not yield new insights on key themes relevant to my study (Guest et

al., 2006), before completing the interviews with women and their husbands. However, I did not modify the sample size because my study was part of a larger research study (Table 6.1). I added two more FGDs with mothers-in-law in order to reach saturation for the FGDs.

In each study region, male and female research assistants who were experienced in conducting qualitative data collection in the local languages of the study communities (*Twi* and *Fanti* in the CR and *Dagbani* and *Lekpepkel* in the NR) conducted the interviews and took detailed field notes. I trained them to collect qualitative social network data. Research assistants obtained informed consent from all study participants. As the interviews conducted depended on study participants' availability, genders of the research assistants often did not much with participants'. All interviews were audio recorded and transcribed into English. Ethics review approval was obtained from the Ghana Health Service and the University of North Carolina at Chapel Hill.

Data Analysis

I began my analysis by conducting close readings of all IDI and FGD transcripts. Next, I wrote analytic summaries of each IDI with women and husband on their pregnancy and delivery experiences, and of each FGD with MILs on their perceptions about childbirth experiences of women in their communities. I then generated preliminary descriptive codes and memos on the various roles of network members in women's pregnancy and delivery care experiences using these summaries. Following, another review of the transcripts, and discussions with the research team about emergent themes from the analytic summaries and field notes, I developed a core set of inductive codes in order to conduct thematic analysis of women's social network characteristics and pregnancy/delivery care experiences. I applied these codes to the IDIs and FGDs using Atlas.ti software (version 7.0, Scientific Software Development GmbH, Eden

Prairie, MN), and modified and added new codes during the coding process (Morse, 1994; Charmaz, 2006). To ensure coding quality I conducted coding checks by reviewing all transcripts after completing the coding process, for coding accuracy and consistency. I reviewed transcripts for each group of participants (women, husbands and MILs) twice, and later two-thirds of each group was selected for additional review.

Subsequently, I reviewed the code outputs and developed code summaries and analytic matrices (Miles & Huberman, 1994, Sandelowski, 1995). I used the code summaries, which captured women's interactions with network members during pregnancy, to create a table summarizing women's network composition, and provided contextual information on the supportive and influential roles of network members. In the matrices, I compared women who had facility versus homebirth and NR versus CR women, on themes of how network members' involvement in women's receipt of pregnancy, labor, and delivery care affected their place of delivery.

Results

I examined each woman's (n=36) overall network composition in order to understand women's network structure, and the extent to which network members functioned as a whole in influencing women pregnancy and delivery experiences. In exploring members' intention for women's use of either facility or homebirth and the actual location of women's childbirth, I observed three mutually exclusive groups of women. The first group was women who had health facility birth and had network members that intended for them to have facility delivery. The second group was women who had homebirth but had network members that intended for them to have facility birth. The third group was women who had homebirth birth and had network members that intended for them to have homebirth. I first describe the study population followed

by women's network composition. Then, I examine whether there were any differences in the network composition and network function in these three groups that might explain the differences in network intentions and outcomes.

Study Population Characteristics

Overall, a total of 17 women gave birth in a health facility and 19 had a homebirth (Table 6.2). The average ages of women and husbands, 27 and 36 years respectively, were similar in both regions (Table 6.2). All NR women were married, most had no formal education and were farmers by occupation. Traditionally, NR men marry more than one woman, thus most NR women had co-wives. Also, most NR women (n=8) were Muslim and most men (n=6) were traditionalists, i.e. they observed traditional Ghanaian religious practices. Only 2 CR women were unmarried, most had at least a junior secondary (junior-high) school level education and were farmers. Most CR women (n=17) and men (n=10) were Christians. Most MILs did not know their accurate age and were all married/widowed. Most NR MILs were Muslims and CR MILs Christians.

Traditionally, NR women move from their family home to live with their husband's family after marriage, usually in another village/town. NR participants indicated that it is customary for husbands and mothers-in-law to make decisions about women's pregnancy-related health needs, and to subsequently provide resources for pregnancy and delivery care. Participants also confirmed that husbands consult with other in-laws (e.g. MIL, father-in-law and elder aunt or co-wife) when deciding on health care for women. This follows the local tradition of looking to family heads and elderly women to make decisions about seeking health care for women. Conversely, I found that CR women participated in decision-making about seeking care for their pregnancy. Most indicated that they usually made such decisions with their husbands. Moreover,

it is common practice for MILs and mothers in the CR to contribute to, but not take sole charge of, making health decisions and providing resources for women's pregnancy care, as observed in my study.

Network Composition during Women's Pregnancy-Related Experiences

All women provided a comprehensive list of network members involved in their pregnancy experiences. Women's network size was on average 8 people. All women had blood-relatives and in-laws in their networks; about two-thirds of women's network also included at least one friend. Generally, family members made up more than half of each woman's network. Family members in the NR included husbands and in-laws such as mother/father-in-law, brother-in-law and or his wife, sister-in-law, and co-wife. In the CR family members included husbands and blood relatives – e.g. mother, siblings, grandfather/mother, and aunt/uncles. Typically, family members lived nearby or in the same house with NR and CR women. Family members and friends regularly visited with the women to find out about their health and that of their unborn infants, and also to contribute to meeting their pregnancy-related needs. These network members, particularly those who lived near the women, mostly knew and had contact with each other. Women's network relationships allowed various network members to make relevant contributions to women's pregnancy experiences.

I compared network composition and function by region, and across the three different groups of women to determine if network structure could directly explain the different outcomes in terms of place of delivery. As I did not observe any meaningful differences, I subsequently examined social support and influence received by women across the three groups and found some differences in informational and instrumental social support by group.

Network Support and Influence of Women's Pregnancy and Birth Delivery Experience

All women received some forms of emotional, informational and instrumental support from their network members during pregnancy (Table 6.3). Study participants indicated that it was socially normative for network members to provide pregnant women with more than one kind of social support.

Emotional Support

I did not observe any difference in emotional support received by the three groups of women. Network members commonly expressed care and love by regularly visiting with women in order to enquire about their wellbeing. For example, one woman in the second group (had homebirth birth, but network members intended for her to have facility birth), described how her mother and MIL expressed care:

> *M: …in what ways do you think Sarah (mother) was there for you and attentive to your needs when you were pregnant [waves]?*
> *R: like when am not able to go visit her, she comes to visit me and ask about me, that made me know she loves me*
> *M: what about Cecilia (MIL)?*
> *R: Cecilia too shows me love [inaudible] so she chats with me on things that will bring laughter* [CR woman, Student, 19 yrs.].

This woman lived in the same house with her MIL and her mother lived nearby. Both network members visited with her daily during her pregnancy. She had a "*very close*" relationship with her mother and said of her MIL: "*we are free, open with each other*."

Network members encouraged women, and empathized with their worries including marital strife, worries about personal finances, and sickness during pregnancy. For instance, a number of women mentioned that their in-laws were very attentive to their pregnancy-related worries by daily checking on them and their baby's health. A woman in the first group (had facility birth, as intended by network members) mentioned that her husband encouraged her to

avoid worrying about financial concerns in her pregnancy. She also described emotional support she receive from friends:

> *Respondent: … sister Becky (friend)…and Francisca (friend) said when you are pregnant it is not good to think too much (worry) because if I think it can affect the child and could cause the child to have problems…*
> *Interviewer: so how is your relationship with Sister Sarah (friend)?*
> *Respondent: we are free with each other. If am bothered over something I'm able to talk with her about it and in terms of marital issues if my husband does something that is concerning to me I am able to discuss it with her and because she is older than me she advises me and helps me* [CR woman, Trader, 38 yrs.]

Notably, the 38 yr. old woman had a "very close" relationship with her friend, sister Sarah, who lived nearby and visited with her daily during her pregnancy. Additionally, she also had very close relationships with her brother and father who, despite living in another town, regularly enquired about her wellbeing via phone, especially "*when something is bothering me*."

FGDs with MILs and IDIs with husbands further confirmed the emotionally supportive roles of these network members. Several husbands and MILs explained that due to their intimate relationships with women they listened and conversed with them about their pregnancy related concerns. A few women indicated that they did not have "*close*" relationships with their MILs, but most viewed their MILs as caring, and described their relationship as "*good*". Some women also indicated that their interactions with their husbands were not always positive. Certain women described disputes between them and their husbands, which had to be arbitrated by other network members (e.g. father-in-law). Two women indicated they had little or no interaction with their partners who left them and were unsupportive of their pregnancy.

Informational Support

Women across the three groups received similar kinds of informational support from network members. As indicated in the FGDs with MILs and IDIs with husbands, it is socially normative for in-laws, particularly MILs, and mothers and grandmothers to provide women with

advice and suggestions on how to experience safe pregnancy and delivery. Women generally received advice on how to "*take care of myself well*" and "*eat well*," i.e. healthy foods; and "*that I should not work too hard*" or "*not lift heavy things,*" as that will affect the baby. For example, a woman (NR, Tailor, 23 yrs.) in the third group (had homebirth, as intended by network members) indicated that she received such advice from her husband, and her blood-relatives (mother, sister and brother) who lived in other villages and interacted with her at most weekly during her pregnancy. Although not always the case, network members who provided women with this type of support generally had a "*good*" relationship with, and or regular interactions, with the women.

Most women (n=11) in the first group (had facility birth, as intended by network members) and women (n=8) in the second group (had homebirth birth, but network members intended for her to have facility birth) mentioned that advice and suggestions received from network members included regularly utilizing facility-based pregnancy and or delivery care. These network members lived in close proximity, and generally had good relationships, with the women. For example, a woman in the first group who received support from her in-laws and friends mentioned:

> *Respondent: Hamdia (brother-in-law's wife)…and my husband. They told me not to be working so hard as I used to because now I am pregnant and need to be cautious of the kind of work that I do…Bintu (Friend) was also involved…if I was not feeling well, I would call her and tell her then she will say I should go to the hospital because only in the hospital that we will know what is actually wrong with me...*
> *Interviewer: it's why I ask, how was your own experience* (*with father-in-law*)*?*
> *Respondent: that one if you are sick and your husband is not there, your husband's father would say take her to the hospital and they (in-laws) will do that.* [NR woman, Farmer, 24 yrs.]

This woman interacted with her husband and in-laws daily because they all lived in the house. Her relationship with her husband's family was generally "good," as they regularly enquired

about her wellbeing. The woman noted that she and her brother-in-law's wife "*helped and advised*" each other. She also mentioned that her longtime friend lived in another town, but they had regular phone conversations and saw each other sometimes on market days. She also received advice from her: "*when I have a problem I can go to her for a solution."*

Among the third group of women (had homebirth, as intended by network members) only one (NR woman, Farmer, age unknown) indicated that she received advice from network members on the importance of seeking facility-based pregnancy care regularly. She indicated that her co-wife, husband's brother's wife and aunt advised her to go to the hospital for care when she was feeling sick. None of her network members, however, advised her to give birth at a health facility.

Instrumental Support

The labor and delivery narratives of women and husbands revealed differences in the how instrumental support from network members impacted women's health outcomes across the three groups. In the experience of women in the first group (had facility birth, as intended by network members) different network members, that lived in close proximity and had regular contacts with the women and with each other, collaborated to ensure women's use of facility delivery. In the FGDs MILs confirmed that they involved other network members in women's pregnancy and delivery care. One explained, "*When her husband is not there…you [MIL] then talk to any family member available at that time and that person will look for a motorbike, fuel it and take her to hospital*" (NR MIL). Also, the pregnancy experience of one woman (CR, 24 yr. old unemployed) revealed that during her labor she first informed her MIL who in turn informed other network members. The woman's father-in-law secured a ride from his brother to take her to the health facility, accompanied by her MIL and grandmother. Her network members were able

come together to secure a means for getting her to a health facility, as they lived in close proximity and had frequent interactions with her.

The 24 yr. old woman's experience is analogous to that of other women in the first group. As the husband of another woman explained:

> *Respondent: …I came to the house later and realized that she (wife) was in the room struggling, so I then asked and she said she was having stomach pains. Then I came out and told my mother and she asked me to go and call my auntie, so I invited my auntie and she came she said she (wife) was in labor, they have to take her to the clinic. So I called my brother and we used his motorbike and took her to the clinic. There she delivered [baby crying].*
> *Interviewer: so who assisted her (wife) through this process…?*
> *Respondent: it was my auntie who helped in supporting her (wife) to sit on the motorbike; she sat at the back and we took her to the clinic.* [NR husband, Farmer, 27 yrs.]

Network members of the 27 yr. old husband's wife lived nearby, frequently visited with her during her pregnancy, and thus were able to help her access and utilize facility delivery. Commonly, network members of the first group of women recognized the urgency of the women's labor and readily mobilized resources to get them to a health facility for delivery.

Very few women in the first group had any pregnancy-related complications, which would have required the women to seek treatment at a health facility. There was one instance in which a woman (NR, Farmer, 30 yrs.) had a prolonged labor at home, for four days, before her husband's junior brother and aunt assisted her to the hospital for delivery, reflecting the network support.

Similar to the first group, network members of women in the second group intended to assist the women' use of facility birth. Yet, unlike the first group, network members in the second group tended to first seek the assistance of a TBA during women's labor and also did not make timely arrangements to transport women to a facility. Such delays prevented women from getting to a health facility for birth delivery. For example, one woman mentioned that when she went into labor she informed her mother and they "*…started preparing for us to go the hospital*

but we were too late, as I delivered in the house." She explained that she first informed her mother and sister of her labor:

> *Interviewer: what did your mother do when you told her?*
> *Respondent: she told me to wait for a while because she was going call Esi Eyeh (Traditional Birth Attendant [TBA]) for her to come and see whether the pregnancy was due.*
> *Interviewer: what did Effuah also do?*
> *Respondent: she was praying for me that things would go well.* [CR woman, Trader, 20 yrs.]

The 20 yr. old woman lived with her mother and sister who were available to assist her in getting to a health facility for birth. However, they waited to find a TBA to examine her before preparing to go to the facility. Generally, during women's labor network members including MILs, co-wives or other elderly women (e.g. grandmother) in the women's network were informed of the women's labor. Although these members were available to assist the women, they waited to consult with a TBA or make certain of the woman's labor before attempting to get women to a facility.

In very few exceptions the second group of women gave birth at home shortly after labor, despite network members' efforts to quickly make arrangements to get them to a health facility. For example during her labor a woman (NR, Farmer, 20 yrs.) informed 3 of her brother-in-law's wives who lived with her in the same house, and they in turn called in her "*close and trusted*" friend that live nearby to assist her. She elaborated: *we were preparing to go to Gushegu (hospital) for the delivery and while he (husband) went out to look for a motor bike I gave birth in the house*." A TBA assisted in the 20 yr. old woman's birth delivery, while her husband searched for transportation to the facility. She mentioned that she went into labor and gave birth within the time it takes her family to make the morning porridge.

The labor and delivery experiences of the third group of women (had homebirth, as

intended by network members) were dissimilar from the first and second group of women, in that women in the third group indicated that their network members intended to help them experience safe labor and delivery at home. A husband described the labor experience of his wife:

> *R: She was just in pain for a while and I was just hanging around and monitoring her in the house here and I was just moving around the house praying that she delivers without any problem and they later told me she has delivered…*
> *Facilitator: Ok [paused] so who assisted her through this process?*
> *Respondent: There was two people who helped her…they were lakpeku (TBA) and Ayi (brother-in-law's wife)* [NR husband, Farmer, 37 yrs.]

The 37 yr. old husband's wife corroborated his account. She mentioned that her brother-in-law's wife called a TBA to assist in her childbirth at home. She lived in the same house with her brother-in-law's wife and they had a good relationship, as "*they advised each other on how to live with their husbands.*" Generally, the third group of women indicated that network members relied on TBAs to assist in their delivery at labor onset. Network members made no plans to send women to a health facility. Instead, once women inform network members of their labor, a husband, MIL, bother-in-law's wife would call in a TBA to assist in the women's labor and delivery.

Despite these differences all the three groups of women indicated that it was common practice for especially husbands, in-laws and blood-relatives to provide instrumental support for women's during pregnancy. Across all three groups of women in-laws in the NR and female blood relatives in CR who lived in close proximity with women typically provided help with house chores – e.g. fetching water, washing and cooking. Also, network members who lived far and or had infrequent contact with women tended to send, or provide during their visits with women, money, food and items to help with pregnancy related care.

Discussion

Overall, I found that social networks contribute in important ways to women's use of facility-based pregnancy and delivery care. Women's proximity, frequency and nature of interaction with network members were similar across the three groups of women. These network dynamics enabled the involvement of different members in providing various types of support for women's pregnancy.

Network members such as husbands, MILs and mothers play prominent roles in influencing women's pregnancy and delivery care experiences (Upadhyay et al, 2014; Somé, Sombie, & Meda, 2013; Moyer et al., 2014). For example, previous studies reported that women in rural Burkina Faso and rural Ghana relied on their husband and (mother-, father- and brother-) in-laws to make decisions about their use of facility-based pregnancy and delivery care (Somé et al., 2013; Moyer et al., 2014). Similar to my finding, the authors of these studies suggested that the influential role of network members included provision of needed resources including money for pregnancy care. My data additionally indicated that network support was possible because most network members lived near women and regularly visited with them during their pregnancy. Women also mentioned that they had established "*good*" or "*close*" relationships with these members – the kind of relationship that allowed members to fulfill social expectations of supporting women's pregnancy and delivery care.

Generally, in settings like rural Ghana there is a sense of shared responsibility in ensuring that women experience safe labor and birth delivery (Moyer et al., 2014; Raman et al., 2014; Ono et al., 2013). For network members this sense of responsibility is born out of their social ties with women, which creates opportunities for them to influence women's maternal health services use (Berkman & Glass, 2000; Ono et al., 2013). In my data I identified three groups of women

based on their network members' intention for whether they would deliver at a health facility or home, and where they actually delivered. The roles played by network members of women in each group highlights the different way in which members were able to impact whether or not women experienced facility delivery.

Most women in the first group (had facility birth, as intended by network members) and second group (had homebirth, but network members intended for them to have facility deliver), unlike those in the third (had homebirth, as intended by network members), indicated that their network members advised them to utilize facility-based pregnancy and delivery care. Through advice network members are able to inform women on their options for facility delivery and what to do to seek and access facility care, and they usually provide resources to facilitate women's use of care (Story et al., 2012; Ono et al, 2013). As in my findings, previous studies have shown that various family members including husbands, mothers, MILs and siblings provided money and transportation for pregnancy related care, help with house chores and food for pregnant women (Carter & Speizer, 2005; Kwambai et al., 2013; Story et al., 2012; Parkhurst et al., 2006; Ono et al., 2013). These network members also provided women with advice, to seek facility-based care. Both advice and instrument support received by pregnant women are significantly related with facility delivery (Ono et al., 2013).

During women's labor network members have to address challenges to facility delivery including distance, transportation and costs associated with delivery (Gabrysch and Campbell, 2009; Moyer & Mustafa, 2103; Tey & Lai, 2013). Also, delays in getting women to a health facility would prevent women from receiving appropriate labor care or assistance in managing any birth and labor complication (Gabrysch & Campbell, 2009). These concerns were irrelevant for the first group of women in data, as their network members worked together to organize

resources to support women's access and use of facility birth. The collective action of network members and the sense of immediacy with which they sought care for women enabled women's use of facility birth.

Conversely, I found that support provided by network members of the second group of women was oriented towards seeking the services of a TBA to make sure that the women were in labor before making preparation for the women to seek facility care. Although these network members provided support for women's labor, their actions did not reflect the sense of urgency required to avoid delays in getting women in labor to a facility. The experience of network support by women in the second group indicates that social support provision does not necessary lead to facility delivery.

Social support may even be oriented toward ensuring that women give birth at home. For instance, network members of the third group of women had no intention of getting women to a facility for delivery. I found no indication of network support oriented towards encouraging or facilitating women's use of facility birth. This suggests that in order for social support to lead to facility birth network members' attitudes and behaviors should reflect a normative belief in facility delivery. In my data all women who had facility birth (first group) and the majority of women who had homebirth (second group) indicated that their network members intended to facilitate their use of facility birth, and moreover received informational (advice) and or instrumental support for facility birth. This finding contributes to growing evidence that point to a shift in social norms toward use of facility birth in Ghana (Mills & Bertrand, 2005; Jansen, 2006; Crissman et al., 2011, 2013; Moyer et al., 2014).

Perceived norms regarding the importance of health facility births are positively associated with health delivery (Stephenson et al., 2006; Kruk et al., 2010; Danforth et al., 2009;

White et al., 2013). Research in a number of African countries revealed that women whose husbands and mothers-in-law had positive perceptions about health facility birth were more likely to deliver in a health facility than those whose husbands and mothers-in-law did not have such perceptions (Danforth et al., 2009; White et al., 2013; Speizer et al., 2014). My data suggest that this is because across the different groups of women informational and instrumental support provided by these network members were often oriented towards helping women to utilize facility-based pregnancy and delivery care. I however, note that network members of the third group of women may not necessarily adhere to the normative belief regarding the importance of facility birth. As such, their support provision for women's pregnancy care was not oriented toward facility birth.

A few limitations in my study are worth mentioning. Participants were interviewed in their native languages and the data were translated into English. Therefore, there was potential for translation errors and the nuance in meaning may have been lost. In efforts to maintain data integrity I reviewed interview transcripts while listening to the original audio interviews to ensure accuracy in translation. There was potential for recall bias, as participants were interviewed after women's pregnancy and childbirth. Also, response bias may have occurred in instances when research assistants interviewed participants whose gender is opposite theirs. Certain pregnancy and childbirth related issues are considered inappropriate topics of discussion between a man and woman who are not related. Hence, study participants may have provided socially desirable responses, and neglected to provide a full account of network members' involvement in their pregnancy experiences. Research assistants were trained to use probing questions to ensure that participants were provided as much accurate and relevant information as possible.

Conclusion

National efforts to improve health services utilization in Ghana have contributed to an increase in acceptance of facility births as normative in the NR and CR (Dzakpasu et al., 2012). In addition to receiving social support during pregnancy from various members in their networks, most women in my study indicated that these members intended to facilitate their health facility delivery. Women who experienced facility delivery had network members that responded to labor onset with a sense of urgency by immediately mobilizing resources to facilitate women's health facility delivery. From my findings it is clear that network members can and do work together to provide women with needed support to overcome barriers to facility-based delivery care. Future public health education campaigns and maternal health interventions should highlight the critical role of network members in ensuring that pregnant women receive such care during labor.

Table 6.1: Sample size of participants

		North (N) 2 Districts: ~15 communities	**Central** (N) 2 Districts: ~15 communities	**Total** (N)
Qualitative methods: *Individual interview*	Women	18	18	36
	Husbands	9	10	19
	MILs	2	2	4

Table 6.2: Demographic characteristics of women and husbands

		North (N)			**Central** (N)			**Total** (N)		
Age (Max| *mean*| Min)	Women	40	*26*	20	38	*27*	17	40	*27*	17
	Husbands	58	*35*	26	62	*37*	23	62	*36*	23
Married		18			16			33		
Education (Women | Husbands)	None	11	5					11	5	
	Primary	3	1		5	2		8	3	
	JSS	5	1		13	3		18	4	
	SSS		1			5			6	
	A level		1						1	
Occupation (Women | Husbands)	Farmer	15	7		5	5		20	12	
	Trader/seller				6			6		
	Skilled worker	3	2		2	5		5	7	
	Unemployed				5	1		5	1	
Religion (Women | Husbands)	Moslem	8	1					8	1	
	Christian	5	2		17	10		22	12	
	Traditionalist	4	6					4	6	
Place of delivery	Facility birth	8			9			17		
	Homebirth	10			9			19		

Table 6.3: Social support and network composition among three groups of women that had either health facility of homebirth

Dynamics of network relationships	**Groups of women**	**Emotional support**	**Informational support**	**Instrumental support**
Similar across network support patterns: *Network proximity* – most network members lived in the same house with women, or nearby *Frequency of contact* – most members regularly visited with women (at least a few times daily *Nature of relationships* – women general had "good" and or "close" relationships with network members Most members in women's network knew and had contact with each other	***I*** **–** Network members intended to facilitate women's facility delivery, and actually did so (n=17)	Across network support patterns most women indicated that network members were caring/ showed empathy in their interactions with them	Most women (n=11) received advice to use facility-based pregnancy and or delivery care	Network members worked together to facility women use of health facility delivery
	II **–** Network members intended to facilitate women's facility delivery, but women had homebirths (n=10)		Most women (n=8) received advice to use facility-based pregnancy and or delivery care	Network members did not make arrangement in time to get women to a health facility for birth delivery
	III **–** Network members had no intention of facilitating women's delivery in a health facility, so women had homebirths (n=8)		Only 1 women received advice to use facility-based pregnancy (antenatal) care	Network members provided support oriented towards ensuring safe homebirth for women

CHAPTER 7: DISCUSSION

My dissertation research demonstrates that social network characteristics are important determinants of maternal health services use for birth delivery. I used a convergent mixed methods research approach to examine the relationship between network characteristics and health facility delivery among rural Ghanaian women. The quantitative study, based on my analysis of a household survey of women in the Northern and Central regions of Ghana, examined the association between network structural and functional characteristics, and health facility birth. The qualitative study, including in-depth interviews with women and husbands, and focus groups with mothers-in-law from the two regions, explored how the characteristics of women's social networks influenced their pregnancy, labor and delivery experiences. Findings from my quantitative study provide insights into the specific network characteristics that are associated with facility delivery, whereas as my qualitative findings further explain how these network characteristics are related to facility delivery.

In my quantitative analysis, I found that informational support (perception that there was someone to give respondent advice) and instrumental support (there was someone to help respondent seek health care) are significantly associated with having a facility delivery. Also, both the injunctive norm (perception that close relatives approve of facility-based pregnancy and delivery care) and the descriptive norm (perception of the number of women the respondent knows that have gone to a facility for pregnancy-related care) were significantly associated with facility delivery. These findings suggest that besides the role of health services providers in advising women to utilize facility-based pregnancy and delivery care, network members can play

seminal roles in reinforcing such advice to women. Future work should implement programs that focus on changing network norms to favor maternal health services use by, raising awareness among network members about the beneficial role they play in supporting women's pregnancy. Network members can also learn ways to optimize their efforts in providing social support to facilitate women's use of facility birth.

The observed relationships between network functions and facility delivery in my quantitative results are further explained by my qualitative findings. In the context of women's network composition, network support was possible because most network members lived near women and regularly visited with them during their pregnancy. Through their regular interactions with women network members were able to adhere to the normative expectations of providing support for women's pregnancy and delivery care.

In my quantitative study, I examined interactions between various network characteristics in order to shed light on the complexity of how these characteristics operate to influence facility delivery. This was important in determining which properties of women's network have significant impact on their maternal health services use for birth delivery. My results show that the interaction between having someone to get advice (informational support) and the number of network members that respondent lived near (network proximity) was significantly associated with facility birth. Women who perceived that more of the time there was someone to give them advice and lived near large numbers of network members had a higher odds of facility birth, whereas women who perceived that less of the time there was someone to give them advice and lived near small numbers of network members had lower odds of facility birth. This suggests that although network structural characteristics were not directly associated with facility delivery, they appear to interact with other network characteristics to influence facility delivery. This

means that while social support is critical to facilitating health facility delivery, this support can be further enhanced by women's network structure. For instance, larger numbers of network members living near women will increase the availability and variety of support pregnant women may receive for pregnancy and delivery care use, and thus increase their likelihood of using facility delivery. On the contrary, network structure can augment the negative effect of receiving limited social support for facility delivery. Women with low levels of social support for facility delivery will be much less likely to utilize facility delivery, if they live near a small number of network members. This is because women would have a small number of network members to depend on for support.

Previously, the only other study to examine the interaction effect of network characteristics on facility delivery was conducted in rural Bangladesh (Edmonds et al., 2012). The authors found that the interaction between network structural variables (e.g. density, homogeneity) and network function (advice to deliver in a facility or at home) was not significantly associated with facility delivery. Other Studies have sought to examine the underlying mechanism by which network characteristics operate to influence contraceptive use among women, but fell short of specifically examining the interaction effect of different network characteristics on contraception (Kohler et al., 2001; Madhavan et al., 2003).

As described in my quantitative study, the interaction between informational support (perception that there was someone to give respondent advice) and the descriptive norm (number of women respondent know that have gone to a facility for pregnancy-related care) was significantly associated with facility birth. Specifically, among respondents who perceived that some women they know have gone to a facility for pregnancy-related care the probability of facility birth was high for those who perceived that more of the time there was someone to give

them advice, and low for those who perceived that less of the time there was someone. This finding highlights the importance of both social support and social norms in women's use of facility birth. Separately, social support and social norms increase the likelihood of women using facility-based pregnancy and delivery care. Support from network members ensures that women receive needed resources, information, and encouragement to access health facility delivery. Network members adopt normative beliefs and expectations of their influential network members, and hence tend to adhere to network norms favoring facility delivery. Interestingly, the combined effect of the interaction between social support and social norm has an added benefit. Meaning, in settings where network norms favoring facility delivery is low, informational support in the form of advice for women to utilize facility delivery can greatly contribute to women's use of facility birth.

My qualitative findings elaborated on the relevance of network characteristics. Women, husbands and mothers-in-law indicated that it was socially normative for network members to provide different types of social support for women in their pregnancy period. Hence, all women received emotional, informational and instrumental support from network members. Notably, most women irrespective of their place of birth delivery received advice from their network members to utilize facility-based pregnancy and delivery care. This serves as additional evidence of the shift in norms towards the use of facility delivery in Ghana, as described in previous literature (Mills & Bertrand, 2005; Jansen, 2006; Crissman et al., 2013; Moyer et al., 2014).

Most recently Moyer et al. (2014) highlighted the perspectives of various community members in rural Northern Ghana about the changing trend favoring use of facility-based pregnancy and delivery care. Reasons for this include the enactment of free birth delivery for all pregnant women in 2005, the National Health Insurance Scheme in 2008 to provide free health

insurance for all pregnant women, and the scale-up of Community-Based Health Planning and Services (CHPs) program (Witter et al., 2007; Sakkeah et al., 2014a). The CHPs program was initially implemented in 2000, resulting in the training of community health officers (CHOs) as midwives who assist deliveries in health facilities known as CHPs compounds in rural areas (Nyonator et al., 2005). Equally important, the scale up Project Fives Alive across Ghana, as well as the implementation of the Maternal and Newborn Referral project has contributed to efforts to increase maternal health services use among women across Ghana (Singh et al, 2016).

Network members' provision of instrumental support, as demonstrated in my quantitative study, additionally highlights the relevance of social support in women's use of facility delivery. In my qualitative study show that although women received instrumental support, there was a group of women who had homebirth and had network members that intended for them to have homebirth. There were two other groups of women. Network members in one group worked together to organize resources to support women's access and use of facility birth during labor. Conversely, network members in the other group tended to first seek the services of a TBA before deciding to make preparations to get the women to a facility, thus delaying making arrangements to get women to a health facility. These findings suggest that when network members take initiative in working together without delay to support women's use of facility-based delivery care they are able to address potential barriers such as distance, transportation and cost associated facility delivery.

Study Strengths

The strengths of my dissertation research include my use of an egocentric network approach, which is considered a reliable and feasible means of collecting data on women's network characteristics (Marsden, 1990). The approach was well suited for my mixed methods

research design because it lends itself to collecting both quantitative and qualitative data. Using the egocentric network approach I collected quantitative network data from a large sample of women and to applied conventional statistical analysis in my research. Additionally, the approach enabled me conducted in-depth qualitative interviews with mothers in order to acquire complete list of network members involved in women's pregnancy and labor and delivery experiences, and details on the various roles played by each network member. Ultimately the main benefit of mixed methods study was that I was able to corroborate my quantitative findings with my qualitative results.

For my quantitative study, research assistants used computer assisted interviewing to conduct the household survey interviews in the native languages of study participants. This was done in the privacy of the women's homes. In my qualitative study I purposively sampled women who had homebirth and facility because this was useful in comparing and contrasting women network characteristics by place of birth. I further strengthened my qualitative data by collecting data from husbands and mothers-in-law because as influential network members they provided additional perspectives on network members' involvement in women's pregnancy experiences.

In order to gain the perspectives of women in areas that are not easily accessible for data collection women living in very remote parts of the Northern and Central regions were interviewed. This was especially important for my study because women living in remote areas face major barriers to facility-based pregnancy and delivery care including longer distance, high cost and limited transportation to health facilities.

Study Weaknesses

In both the quantitative and qualitative studies few limitations are worth noting. First, my quantitative study was based on cross-sectional data, thus I was unable to establish temporal relationships between network characteristics and use of facility delivery. Future work can focus on longitudinal studies to help to establish causality between network characteristics and facility birth. An element of recall bias may have been introduced in this study, since I focused my analysis on women who had given birth three years prior to the survey administration. Also, because I did not collect data from women's network members, my network data was limited to information provided by the women themselves. Another limitation of this study is that I did not measure other network structural characteristics (e.g. density, social ties, and reciprocity) that were previously examined in the maternal health literature (Madhavan et al., 2003; Edmonds et al., 2012; Devillanova, 2007), in order to determine if my study population might produce any additional findings.

Second, in the qualitative studies, interviews were conducted in native Ghanaian languages and transcribed and translated into English. Therefore, errors in translations and nuances in meaning may have been missed. In anticipation of this concern research assistants wrote interview summaries and memos during fieldwork. I met with them at the end of each day of interviewing to review the interviews conducted that day. We discussed relevant and or interesting findings, emerging themes, concerns about any aspect of the fieldwork, and any modifications or additions to be made to the interview questions moving forward. Research assistants translated and transcribed nearly all of their interviews into English. To assist with the workload and to gain access to transcripts in a timely fashion two experienced transcribers assisted in the transcription.

Participants were interviewed after the pregnancy and childbirth of women participants, thus recall bias on the part of participants may have been an issue. Possibly, study participants may have also elected to provide limited information on network involvement in women's pregnancy experiences, in effort to provide socially desirable responses. Discussion of some pregnancy and childbirth topics between men and women who are unrelated is considered inappropriate. Therefore in cases where the gender of research assistants did not match with study participants, response bias may have occurred. Participants were asked probing questions to gain as much insight as possible into relevant information they provided.

Future Directions

My dissertation findings have immediate implications for increasing uptake in women's use of pregnancy related health services. First, previous intervention strategies have focused on women (Prost et al., 2013; Lewycka et al., 2013). These included peer counseling, one-on-one interactions with pregnant women and mothers of newborns, and interactions with women's groups in order to educate them about the importance of maternal and child health services (Bhutta et al., 2011; Gogia et al., 2011; Prost et al., 2013). The next step to consider is community-based interventions that will emphasize that role of women's network members as a whole. In Ghana this can have immediate impact on quality improvement efforts under the Maternal and Newborn Health Referral project.

Presently, established quality improvement teams made up of community and health provider partnerships work together in developing innovative strategies to improve the process of referring pregnant women in labor from local health facilities to higher level facilities such as health centers and hospitals for pregnancy care. These teams are best positioned to develop strategies that will raise awareness about the importance of women's social networks, and to

engage community members in mobilizing women's networks in facilitating maternal services use for pregnancy relate care. In light of my dissertation findings specific community programs at the local level should focus on changing network norms surrounding facility-based maternal health care utilization. Efforts should be made to raise awareness of the need for network members to actively engage in helping pregnant women to utilize facility-based delivery care. Women's network members should be made aware that they are best positioned in their roles as network members to facilitate women's health services use by working together to advise women on using facility care and providing them with essential resources during pregnancy – e.g. money and transportation for accessing the facility, accompanying women to the facility, and help with their house chores.

In order to create an environment that fosters a change in network norms in favor facility delivery, health facilities should be transformed into a more welcoming environment. Previously, women and network members have indicated that disrespect and mistreatment experienced from health providers, poor care received providers, and lack of privacy as reasons women did not utilize health facility delivery (Akazili et al., 2011; Moyer & Mustafa, 2013; Tey & Lai, 2013). Health providers and key community leaders could work together on addressing these concerns, inform network members about ways in which these concerns are being addressed, and subsequently encourage the members to accompany women to the health facilities. During facility visits, women along with network members should be informed about health promoting behaviors and recommendations that are helpful for women to maintain health pregnancy and delivery.

At the national level, the Ghana Health Service can expand its policy of working with local community health volunteers and CHOs that are trained to collaborate with community

members in their health services provision to women in rural areas (Sakeah et al., 2014b). Namely, by collaborating with local community members CHOs can implement community health outreach programs that would effectively promote the integration of women's social networks into the process of providing pregnancy related care for women.

In addition to these program implications, there are also several implications of my dissertation for future research. Since my dissertation was cross-sectional, future research can build on my work by conducting a longitudinal study to examine the effect of social network characteristics on women's use of health delivery over time. This will result in knowledge on the temporal relationship between network characteristics and health delivery. A prospective study may further provide insight on the underlying mechanism by which network characteristics influence facility delivery. Network characteristics may have mediating effects, or be mediated by other determinants of facility delivery such as socioeconomic and physical accessibility determinants (Moyer & Mustafa, 2013; Tey & Lai, 2013; Brighton et al., 2013). For instance, compared with those with a smaller social network size women who have a larger network size may have resources to access and use maternal health services, and in turn women who have such resources would be more likely to utilize facility delivery than women who do not the resources. Additionally, a longitudinal study would be a useful way to test the effect of interventions that target network social support provision and changes in network norms in favor of health facility delivery. Data from such research endeavor would lend itself complex statistical analysis such as structural equation modeling and multilevel modeling. For example, an examination of the variance in women's use of facility delivery that can be attributed to each network characteristic over and above women's personal characteristics and the other determinants of facility delivery could be undertaken.

In respect to Ghana, health facilities within each district of the country work together to provide health services to various communities. Therefore, social network concepts such as network structure and functions could be applied to study the dynamics of how health providers in these facilities collaborate to improve services deliveries to different communities. This research can examine how health providers may be conceptualized as a network of service providers, whose roles could be mobilized to further improve services delivery and utilization. Potential questions to address include 1) what are the network characteristics of the health providers from different facilities who work together to improve maternal and child health services delivery in underserved areas? 2) What functional roles do the providers perform beyond their conventional responsibilities as service providers? 3) In what ways do health providers interact with women's networks as part of their community health outreach and service delivery efforts? Findings from this research could advance knowledge on how to combine resources of health providers and women's networks to improve efficiency in care delivery and utilization.

A final area for future research would be using a socio-centric approach to social network analysis. Socio-centric network assessment is the examination of the structure of entire social relations of people within a network (Wellman & Berkowitz, 1988). Using this approach will enable researchers to collect data from the each member in women's network, in order to gain a more holistic perspective on the involvement of network members in women's pregnancy experiences. Previously, researchers have used the socio-centric approach to examine superdyadic effects on health, by focusing on the spread of obesity among individuals in social networks (Fowler & Christakis, 2008; Valente, fujimoto, Chou & Spruitx-Metx, 2009). For example, Fowler and Christakis (2008) found that the spread of obesity was dependent on the

nature of social ties. Individuals' likelihood of becoming obese increased (57%) if their friends became obese, and the effect was more pronounced among same sex friends. The likelihood of an individual becoming obese increased by 40%, if his/her sibling became obese, and a higher effect was observed among same sex siblings. Conducting socio-centric studies to maternal health services use including birth delivery will provide insight into specific types of network members' behaviors and attitudes regarding maternal health services use, and subsequently how that influences women's own services use.

Examining entire networks of women is useful for determining the structural patterns of networks and identifying which members have the resources women would need to facilitate their use of health facility delivery. Conversely, it is worth noting that this approach is costly, and time consuming, and would be difficult to accomplish. All of women's network members would have to be tracked down and interviewed, which would require considerable resource and logistic coordination. There is concern of recall bias when participants are asked to list members in their networks, which can affect the accuracy of the data. Also, the socio-centric approach is not conducive to prospective research or analysis because of the time and resources required in accomplish the research.

In sum my dissertation study reveals that social network structure and functions are directly associated with health facility delivery. Also these network characteristics have some interactive effect on facility delivery. This presents opportunities to further explore the relationship between network characteristics and facility delivery, while enhancing existing maternal health interventions to promote health facility delivery by accounting for the critical roles of women's social networks. Social determinants of maternal health services use such as facility delivery are critical to further advancing maternal and child health promotion and

reduction in morbidity and mortality. Global efforts to reduce maternal and child mortality will greatly benefit from research that advances understanding of various social determinants or barriers to maternal health services use.

APPENDIX A: PARTICIPANT CONSENT FORM

PARTICIPANT INFORMATION AND VERBAL CONSENT FORM

Study title: Maternal and Newborn Referral Project

Principal investigators: Dr. Nana Amma Twum-Danso, MD

Co-Investigators: Kavita Singh, PhD
Dr. Pierre Barker
Dr. Sodzi Sodzi-Tettey

Hello my name is _____

Study purpose:
I am working with the University of North Carolina, a partner of Project Fives Alive, on evaluating a project here in your community known as the Maternal Referral Project. This project seeks to find ways to help pregnant women get to a health facility to receive care, especially during labor. The main purpose of this study is improve maternal and children care and reduce mortality by finding ways to improve the referral process for mothers and newborns who need to get to a higher level health facility to receive treatment.

We therefore, want to interview (mothers, fathers, or mothers-in-law) like you who can provide us with information on the kinds of experiences women faces during pregnancy, as well as people in women's lives who play an influential role in women's pregnancies.

Eligibility:
Mothers

- Experience of pregnancy in the past three years
- At least 18 years of age

Fathers

- Wife/partner experienced pregnancy in the past three years
- At least 18 years of age

Mothers-in-law

- Daughter-in-law experienced pregnancy in the past three years

If you choose to participate in this interview and feel uncomfortable answering any of the questions I ask, you can refuse to answer the question and ask me to move on to the next questions. There are no consequences for refusing to answer any of the questions and this will not reflect poorly on you.

Voluntary participation
This study is voluntary, so you can choose end the interview at any time, or refuse to answer any question that make you feel uncomfortable. None of the information you provide us can be linked to you.

Risk and Discomforts
The questions you will be asked are about pregnancy related experiences. Therefore, you (or someone you knows) may have had negative experiences with pregnancy and childbirth, such as complications, sickness and even death of a baby. I realize this may be a very troubling experience to remember. Therefore, you can choose to not answer any question that makes you feel uncomfortable.

Benefits
It is possible that this study may not have a direct benefit to you. However, the study is important for all women in your community because we seek to understand women's pregnancy related experiences in order to determine ways to improve their access to appropriate health care during pregnancy, labor and delivery.

Confidentiality
Your participation in this study will be anonymous. We will not ask you any personal information that can be connected back to you. For example, we will not ask you your name and where you live. The interview will be recorded, and the audio, transcripts, and reports from the interview will be kept under lock and key. The recorded interviews will not be linked to any information that can identify you.

Cost
There are no costs associated to participating in this study.

Do you have any questions related to the interview or the research project that you would like me to address?

The researchers of the study are Dr. Nana Twum-Danso and Dr. Sodzi Sodzi-Tettey. If you have any questions please contact Dr. Twum-Danso at:

C/o National Catholic Secretariat, Department of Health
P. O. Box, KA 9712, Accra, Ghana
752-3084 (ntwumdanso@ihi.org)

Statement of consent
The research assistant has explained the purpose of the study to me in a language a can understand. I understand the potential risks and benefits of participating in this study. I realize my participation in this study is completely voluntary, and I can choose to withdraw my participation at any time. I verbally agree to participate in this study.

APPENDIX: B HOUSEHOLD SURVEY

	HOUSEHOLD SURVEY		
	The goal of this survey is to understand the ways individuals may choose to use or not use health facilities for antenatal care, skilled delivery and care for their children. First, I would like to start by asking some questions about your life in general.		
	QUESTIONS	**CODING**	**SKIP/ NOTES**
Q1	In what month and year were you born?	MONTH [__|__] YEAR [__|__][__|__]	
Q2	How old were you on your last birthday? COMPARE AND CORRECT Q1 IF INCONSISTENT	AGE IN COMPLETED YEARS [__|__]	
Q3	Have you ever attended school?	1=YES 2=NO	 2→Q5
Q4	What is the highest level of school you have completed?	1 = PRE-SCHOOL 2 = PRIMARY 3 = MIDDLE/JSS/JHS 4 =SECONDARY/SSS/SHS/TECH/VOC 5 = HIGHER 96 = DON'T KNOW	
Q8	What is your religious affiliation?	1 = CATHOLIC 2 = ANGLICAN 3 = METHODIST 4 = PRESBYTERIAN 5 = PENTECOSTAL/CHARISMATIC 6 = OTHER CHRISTIAN 7 = MOSLEM 8 = TRADITIONAL/SPIRITUALIST 9 = NO RELIGION 10 = OTHER_____ (SPECIFY)	
Q9	To which ethnic group do you belong?	1 = AKAN 2 = GA/DANGME 3 = EWE 4 = GUAN 5 = MOLE-DAGBANI 6 = GRUSSI 7 = GRUMA 8 = MANDE 9 = OTHER_____ (SPECIFY)	
Q10	What is your current marital status?	1 = MARRIED OR LIVING TOGETHER 2 = DIVORCED/ SEPARATED 3 = WIDOWED 4 = NEVER MARRIED/NEVER LIVED TOGETHER	 2→Q17 3→Q17 4→Q17
Q16 A	Who usually makes decisions about health care for yourself: you, your	1=RESPONDENT 2=HUSBAND/PARTNER	

	husband/partner, you and your husband/partner jointly, your mother or father, your mother-in-law or father-in-law, or someone else?	3=RESPONDENT AND HUSBAND/PARTNER JOINTLY 4=MOTHER 5=FATHER 6=MOTHER-IN-LAW 7=FATHER-IN-LAW 8=SOMEONE ELSE_____ (SPECIFY)	

HOUSEHOLD OWNERSHIP OF FUNCTIONAL ASSETS

Now I would like to ask some questions about some functional assets that you and your household own and their number where necessary.

Q24	**Asset**	**Response category**	
A	Car	YES =1 , NO=2	
B	Motor bike	YES =1 , NO=2	
C	Bicycle	YES =1 , NO=2	
D	TV	YES =1 , NO=2	
E	Radio	YES =1 , NO=2	
F	Radio-cassette player	YES =1 , NO=2	
G	VCD/DVD Player	YES =1 , NO=2	
H	Sewing machine	YES =1 , NO=2	
I	Mobile phone	YES =1 , NO=2	
J	Telephone (fixed line)	YES =1 , NO=2	
K	Refrigerator	YES =1 , NO=2	
L	Freezer	YES =1 , NO=2	
M	Electric iron	YES =1 , NO=2	
N	Laptop	YES =1 , NO=2	
O	Computer	YES =1 , NO=2	
P	Washing machine	YES =1 , NO=2	
Q	Room furniture	YES =1 , NO=2	
R	Air conditioner	YES =1 , NO=2	
S	Buckets	YES =1 , NO=2	
T	Lanterns/gas lights	YES =1 , NO=2	
U	Electric power-generator	YES =1 , NO=2	
V	Stove (electric)	YES =1 , NO=2	
W	Stove (gas)	YES =1 , NO=2	
X	Stove (kerosene)	YES =1 , NO=2	
Y	Torches	YES =1 , NO=2	
Z	Cutlery/utensils	YES =1 , NO=2	
AB	Plates	YES =1 , NO=2	
AC	Tractor	YES =1 , NO=2	
AD	Truck/bus	YES =1 , NO=2	
AE	Iron (box)	YES =1 , NO=2	
AF	Fan	YES =1 , NO=2	
AG	Musical instruments	YES =1 , NO=2	
AH	Motor-driven lawn mower	YES =1 , NO=2	

DWELLING CHARACTERISTICS AND HOUSEHOLD POSSESSIONS

Now I would like to ask some questions about some assets that you and your household own and their number where necessary.

	QUESTIONS	CODING	
Q25	Type of dwelling:	1= SEPARATE HOUSE 2=SEMI-DETACHED 3=FLAT 4=COMPOUND HOUSE	5=HUT 6=KIOSK/CONTAINER 7=TENT 8=OTHER (specify)_____
Q26	Tenure/holding:	1=OWNING 2=RENT-FREE	3=RENTING 4=PERCHING
Q27	Main roofing material:	1=THATCHED/PALM 2=SLATE/ASBESTOS 3=BAMBOO 4=MUD/MUD BRICKS 5=WOOD	6=CEMENT/CONCRETE 7=METAL SHEET/ZINC 8=ROOFING TILES 9=OTHER (specify)_____
Q28	What is the main construction material used for the floor?	1=EARTH/MUD/MUD BRICKS 2=WOOD 3=STONE 4=CEMENT/CONCRETE 5=BURNT BRICKS	6=VINYL TILES 7=CERAMIC/MARBLE/TILES 8=TERRAZZO 9=OTHER (specify)_____
Q29	Number of rooms excluding bathrooms and kitchen:	_____ROOMS	
Q30	Number of rooms primarily for sleeping:	_____ROOMS	
Q31	What is the main source of lighting?	1=ELECTRICITY 2=KEROSENE LAMP 3=GAS LAMP 4=SOLAR	5=NONE 6=TORCHES 7=OTHER (specify)_____
Q32	What is the main source of drinking water?	1=PIPE INSIDE 2=PIPE OUTSIDE 3=TANKER 4=SPRING/RAIN 5=WELL	6=BOREHOLE 7=RIVER/STREAM 8=DUGOUT 9=SACHETS 10=OTHER (specify)_____
Q33	Type of toilet use:	1=WC 2=PIT LATRINE IN HOUSE 3=KVIP IN HOUSE 4=BUCKET/PAN	5=PUBLIC TOILET 6=ANOTHER HOUSE 7=BUSH/FREE RANGE 8=OTHER
Q34	What fuel do you use for cooking?	1=WOOD 2=ELECTRICITY 3=KEROSENE 4=CHARCOAL 5=ANIMAL/CROP WASTE	6=COCONUT HUSK 7=LPG GAS 8=BIOGAS 9=NO FOOD COOKED IN HH 10=OTHER (specify)_____
Q35	Kitchen space:	1=OUTSIDE/IN FRONT OF ROOM/VERANDAH 2=SEPARATE ROOM IN HOUSE 3=SHARED WITH OTHER	4=ENCLOSED WITHOUT ROOF 5=STRUCTURE WITH ROOF, NO WALLS

		HOUSEHOLDS	6=BEDROOM/HALL
Q36	What type of bathing facility do you use?	1=OWN BATHROOM 2=SHARED WITH OTHER PEOPLE 3=PRIVATE OPEN CUBICLE 4=SHARED CUBICLE	5=OTHER HOUSE 6=OPEN SPACE 7= POND/RIVERSIDE 8=OTHER (specify)_____
Q37	How does the house dispose of rubbish?	1=COLLECTED 2=BURNT 3=PUBLIC DUMP	4=DUMPED ELSEWHERE 5=BURIED 6=OTHER (specify)_____
Q38	How does the house dispose of liquid waste?	1=SEWAGE SYSTEM 2=THROWN IN OPEN COMPOUND 3=THROWN ON STREET	4=THROWN IN GUTTER 5=OTHER (specify)_____
Q39	Do you have nets on your bedroom windows?	1=YES 2=NO	

PREGNANCY HISTORY-ANC SKILLED DELIVERY AND PNC

Now I would like to ask some questions about your pregnancy, birth experiences and use of maternal and newborn services.

	QUESTIONS	**CODING**	**SKIP/ NOTES**
Q40	Have you ever given birth?	1=YES 2=NO	2→Q48 A
Q41	Do you have any sons or daughters whom you have given birth to who are now living with you?	1=YES 2=NO	2→Q43
Q42A	How many sons live with you?	____ SONS LIVING AT HOME	
Q42B	And how many daughters live with you?	___ DAUGHTERS LIVING AT HOME	
Q43	Do you have any sons or daughters to whom you have given birth who are alive but do not live with you?	1=YES 2=NO	2→Q45
Q44A	How many sons are alive but do not live with you?	_____ SONS LIVING ELSEWHERE	
Q44B	And how many daughters are alive but do not live with you?	_____ DAUGHTERS LIVING ELSEWHERE	
Q45	Have you ever given birth to a boy or girl who was born alive but later died? IF NO, PROBE: Any baby who cried or showed signs of life but did not survive?	1=YES 2=NO	2→Q47
Q46A	How many boys have died?	_____ BOYS DEAD	
Q46B	How many girls have died?	_____ GIRLS DEAD	
Q47	SUM ANSWERS TO Q42A, and Q42B, Q44A and Q44B, Q46A and Q46B AND ENTER TOTAL.	_____TOTAL	

DELIVERY AND PNC CARE FOR WOMEN WITH A PREVIOUS PREGNANCY IN THE LAST 3 YEARS		
	QUESTIONS	**CODING**
Q67B	Where was your most recent delivery – regardless of whether the child was born alive or not?	1=HOME 2=HOME OF TBA 3=OTHER PLACE (NOT FACILITY)_____ (SPECIFY) 4=HOSPITAL 5=HEALTH CENTER 6=CHPS 7=OTHER FACILITY:_____ (SPECIFY)

APPENDIX C: MEASURES OF SOCIAL NETWORK CHARACTERISTICS

For the following set of questions I would like you to think about people you consider important in your life. Especially, those who come to mind when you think about your recent pregnancy and birth experiences.			
1.	How many of your relatives do you feel close to – people you feel at ease with, can talk to about private matters, and can call on for help (this includes all family members both immediate and extended)? [Include husbands, children, in-laws, sibling, and parents etc.]	Relatives_____ Refused_____ DK_____ NA_____	SN size
2.	How many of these relatives live in your village (community)?	Relatives_____ Refused_____ DK_____ NA_____	SN proximity
3.	How many of these relatives do you have contact or interact with at least once a month?	Relatives_____ Refused_____ DK_____ NA_____	SN frequency
4.	In general, how many close friends do you have – people you feel at ease with, can talk to about private matters, and can call on for help?	Friends_____ Refused_____ DK_____ NA_____	SN size
5.	How many of these friends live in your village (community)?	Friends_____ Refused_____ DK_____ NA_____	SN proximity
6.	How many of these friends do you have contact or interact with at least once a month?	Friends_____ Refused_____ DK_____ NA_____	SN frequency
7.	Are there one or two people in your life that you especially feel very close and intimate with – that is someone you can confide in, share your feelings with, and can depend on? […can be friends and relatives]	Yes____ No____	
8.	How far from you does this person live?	In the village (community)___ Right outside your village____ Far from your village____	SN proximity
9.	How often do you see or interact with this person?	At least once… A week____ Every two	SN frequency

		weeks____ A month____ Every few months____	
Please respond to the following questions based on your interactions with close relatives, confidant(s), friends, and others in your community you described in the previous section.			
	*During the period of your **pregnancy, labor and delivery** how often was each of the following kinds of help and assistance available to you when you needed it?* How often was there…		
10.	Someone to help you with your daily chores (including housework, preparing meals, and childcare) when you needed it.	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____	SS instrumental
11.	Someone to help you seek health care – i.e. take you to get care, or give you money for transportation, medicine, and fees for medical/ traditional care.	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____	
12.	Someone you could count on to listen to you when you had any problems, concerns, or fears.	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____	SS emotional
13.	Someone who has gone through pregnancy and could understand what you were going through and be supportive to you through your pregnancy experience.	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____	

14.	Someone who gave you good advice about crisis or situation you were experiencing	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____	SS informational
15.	Someone you could turn to when you needed suggestions and advice on how to deal with any concerns or problems.	All of the time____ Most of the time____ Some of the time____ A little of the time____ None of the times____	
The next following questions are about social norms regarding the use of health facilities for care during pregnancy and labor.			
16.	How much do your close relatives and friends you described in the previous section approve or encourage the use of health facilities for care during pregnancy and childbirth?	Strongly approve____ Approve____ Somewhat approve___ Do not approve____	SI
17.	How much does your community in general approve or encourage the use of health facility for care during your pregnancy and childbirth?	Strongly approve____ Approve____ Somewhat approve____ Do not approve____	
18.	How many of the people you know of (e.g. relatives, friends, acquaintances) have gone to the health facility for pregnancy related care?	Most____ Many____ Some_____ Few_____	

APPENDIX D: INTERVIEW GUIDES

Interviews with Mothers

Data of interview: _____(day) _____ (month) _____ (year)

Interviewers: _____

Location: _____ Region: _____ Sub-district: _____

Interviews completed (#):

Individual interview: Mothers ( )
Fathers ( )
Collaborative network leaders ( )

Participant socio-demographics:

Age: _____
Position in community: _____
Occupation: _____
Highest education _____

Hello, my name is _____.
Thank you for agreeing to participate in this focus group today.
I am working with the University of North Carolina, a partner of Project Fives Alive, on evaluating a project here in your community known as the Maternal Referral Project. This project seeks to find ways to help pregnant women get to a health facility to receive care, especially during labor. We are speaking with mothers like you who experienced pregnancy in the last three years. We are interested in learning about your most recent pregnancy including your use of health services, the kind of assistance or referral you may have received, and people in your social circle who provided some kind of assistance during your pregnancy and childbirth.

Before we begin are there any questions related to the interview or the project that you would like me to address?

I would like to begin by having you talk about your most recent pregnancy experience.

Describe what you remember about your pregnancy experience?

How did you find out that you were pregnant?

When did you find out?

Did you go to the health facility to find out/ confirm your pregnancy?

What kind of care did you receive during your pregnancy?

Did you receive any antenatal care (ANC)? If so, where?

When did you begin seeking ANC?

Who did you see for ANC?
If not what were your reasons for not seeking ANC?

How often did you go to a health facility for ANC (how many visits)?

How did you get there?

Did you receive any other forms of care during your pregnancy?

… for example from traditional healers such as herbalist, TBAs, spiritual leaders?

Did you experience any pregnancy related complications?

(If so…) please explain what happened.

Next, let's talk about specific people in your life who are important to you or you are close with, that played a part in your pregnancy experiences.

Who did you tell when you first thought you were pregnant, or when you first found out that you were pregnant? (Please list all the people you remember telling)

Who else did you tell?

[Note names, and relationships with respondents if unclear] …what is your relationship with _____?

Who did you ask for information about your pregnancy? (Please list all the people you remember asking)

Who else provided you with information about your pregnancy?

[Note names, and relationship with respondents if unclear] …what is your relationship with _____?

What types of information did you get from _____?

(i.e. what kind of things did _____ tell you about)?

Who assisted you or provided you with any kind of help during your pregnancy, before you went into labor? (Please list all the people you remember)

Who else assisted you or provided you with any kind of help?

[Note names, and relationship with respondents if unclear] …what is your relationship with _____?

What things did _____ assist or help you with?

Did anyone provide you with any type of care or affection through your personal and emotional experiences during your pregnancy? (Please list all the people you remember).

Who provided you with that care or affection?

In what ways do you think _____ provided you with the care or affection you needed?

Now, I want us to talk about your labor and delivery experiences.

Please describe your labor and delivery experiences, what do you remember about her most recent experience?

When did you go into labor?

What happened when you went into labor?

Who assisted you through this process?

Did you experience any labor and delivery complications?

(If so…) please explain what happened.

Next, let's talk about specific people in your life who are important to you or you are close with, that played a part in your labor and delivery experiences.

Who did you tell when you first thought you were in labor? (Please list the people you remember telling)

Anyone else?

[Note names, and relationships with respondents if unclear] …what is your relationship with _____?

What did _____ do when you told him/her?

What kinds of assistance or help did _____ provide?

Who else provided any kind of assistance when you were in labor, and also during birth? (Please list any one you remember providing any type of help around that time)

How did _____ assist you?

What things did _____ do to help or support you with?

Now let's talk about any plans you had for where you would give birth when you became pregnant?

During your pregnancy, did you have a place in mind that you preferred to give birth?

What were your reasons for preferring that particularly place?

Did you and your husband agree on your preferred place of birth delivery for her? If not what were the reasons for your disagreement?

Can you think of others, who may have influenced your preference to give birth in _____?

Who are they? [List]

In what ways did they influence your preference?

Did you have a birth preparedness plan (i.e. plan ahead of time where your baby would be born, and what to do to ensure that you experienced safe delivery)?

If so, please tell me about this plan.

What type of preparations did you make?

Who were involved in helping you carry out this plan?
How did they help?

Were you able to deliver at your preferred place of childbirth?

If this was a health facility, how did you get there (means of transport)?

Next, I would like us to talk about the health decision process for your care during your recent pregnancy.

Who were involved in making health care related decisions about your (recent) pregnancy? (Please list all the people you remember).

What role did your husband play in this process (i.e. what type of decisions)?

What role did _____ play in this process? [Other relatives etc.]

To what extent did you have control over this decision process?

Now please tell me about any referral to a health facility you may have experienced.

At any time during your pregnancy when you initially sought care for a particular issue, were you referred for further care somewhere else?

If so, please tell me about this experience, i.e. how it happened?

Where did you initially seek care?

Where you were then referred?

Who made the referral?

How did you get to the referral place (means of transport)?

Let's talk about the community's role in providing assistance to pregnant women in need of help.

What is the role of the community in helping pregnant women?

What kinds of support are available to women in your community who need to get to a health facility for care, especially for birth delivery?

Who are key community leaders that have contributed to improving the pregnancy and safe birth experiences of women?

In recent years do you know of any communitywide efforts taken to improve pregnant women's access to care in health facilities? Please explain.

What improvements, if any, have you observed?

Have such improvements been personally beneficial to your pregnancy and labor experiences?

Interview with Fathers

Date of interview: _____(day) _____ (month) _____ (year)

Interviewers: _____

Location: _____ Region: _____ Sub-district: _____

Interviews completed (#):

Individual interview: Mothers ( )

Participant socio-demographics:

Age: _____
Married: Yes _____ NO_____
Position in community: _____
Occupation: _____
Highest education _____

Hi, my name is _____.
Thank you for agreeing to participate in this study today. I am working with the University of North Carolina and the ISSER, partners of Project Fives Alive, on evaluating a project here in your community known as the Maternal Referral Project. This project seeks to find ways to help pregnant women get to a health facility to receive care, especially during labor. We are speaking with fathers like you whose wives experienced pregnancy in the last two years. We are interested in learning about your views on their most recent pregnancy including their use of health services, the kind of support/ referral they may have received.

Before we begin are there any questions related to the interview or the project that you would like me to address?

I would like to begin by talking about your wife's most recent pregnancy and labor experience.

Please describe what you remember about your wife's most recent pregnancy experience.

How did you find out she was pregnant?

When did you find out?

Did she go to the health facility to find out/ confirm her pregnancy?

What kind of care did your wife receive during her pregnancy?

Did she receive antenatal care (ANC)? If so, where?

When did she begin seeking ANC?
If not what were the reasons for not seeking ANC?

How did she get to the place of care?

Did your wife experience any others forms of care during her pregnancy?

... for example from traditional healers such as herbalist, TBAs, spiritual leaders?

What about your wife's labor and delivery experience, what do you remember about her most recent experience?

When did she go into labor?

What happened when she went into labor?

Who assisted her through this process?

Did your wife experience any pregnancy related complications?

Now let's talk about any plans you had for where your wife would give birth, when she was pregnant?

During your wife's pregnancy, did you have a place in mind where you preferred for her to give birth?

What were the reasons for your preference for this particular place?

Did you and your wife agree on your preferred place of birth delivery for her?
If not what were the reasons for your disagreement?

Did you and your wife have a birth preparedness plan (i.e. plan ahead of time where your baby would be born, and what to do to ensure that she delivered safely)?

If so, please tell me about this plan.

What type of preparations did you make?

Who were involved in helping carry out this plan? How?

Was your wife able to deliver at your preferred place of delivery?

If this was a health facility, how did you get there (means of transport)?

Next, I would like us to talk about the process of making decisions to get your wife health care during her pregnancy.

Who was involved in making health care related decisions about your wife's recent pregnancy? (Please list all the people you remember).

What role did you play in this process (i.e. what type of decisions)?

What role did _____ play in this process? [Other relatives etc.]

To what extent did your wife have control over making decisions to get care for her pregnancy?

Now please tell me about any referral to a health facility your wife may have experienced.

At any time during her pregnancy when your wife initially sought care for a particular issue, was she referred for further care somewhere else?

If so, please tell me about her experience, i.e. how it happened?

Where did she initially seek care?

Where was she then referred?

Who made the referral?

How did she get to the referral place (means of transport)?

Let's talk about the community's role in providing assistance to pregnant women in need of help.

What is the role of the community in helping pregnant women?

What kinds of support are available to women in your community who need to get to a health facility for care, especially for birth delivery?

Who are key community leaders that have contributed to improving the pregnancy and safe birth experiences of women?

In recent years do you know of any communitywide efforts taken to improve pregnant women's access to care in health facilities? Please explain.

What improvements, if any, have you observed?

Have such improvements been personally beneficial to your wife?

Now, I want you to describe your, and your family's, role in assisting your wife through her pregnancy.

How did you help your wife through her last pregnancy?

What things did you do to support or assist her through her pregnancy?

How about other family members who provided any kind of assistance to your wife, describe the kinds of support they provided to your wife.

Name family members you remember playing a supportive role for your wife.

What specific roles did they play?

Focus group interview with Mothers-in-law

Data of interview: _____(day) _____ (month) _____ (year)

Interviewers:

Location: _____ Region: _____ Sub-district: _____

Interviews completed (#):

Focus Group Discussion: Collaborative network team ( )
Mothers-in-law ( )

Participant socio-demographics:

For each FG participant include
Age
Position in community
Occupation
Highest education

Hi everyone, my name is _____.
Thank you for agreeing to participate in this focus group today. I am working with the University of North Carolina, a partner of Project Fives Alive, on evaluating a project here in your community known as the Maternal Referral Project. This project seeks to find ways to help pregnant women get to a health facility to receive care, especially during labor. We are speaking with in-laws such as you, whose daughters-in-laws recently gave birth (in the past three years). Our interest is to learn about the women's experiences in accessing care for their pregnancy and labor experiences, particularly in health facilities. We also want to learn about any forms of support available to pregnant women in the community, including the kinds of assistance you provide as mothers-in-law.

Before we begin are there any questions related to the interview or the project that you would like me to address?

I would like to begin by discussing the birth experiences of women in your community.

Tell me about where women go to deliver in this community. (Think of all the places that women give birth here in your community)

In what ways have pregnant women's childbirth practices changed overtime?

Consider places where women used to give birth in past and where they now usually give birth, would you say this has changed overtime? Please explain.

Think about previous birth experiences of your daughters-in-law (or daughters), how would you describe what happened during their labor and birth experiences?

Where did they give birth?

Who assisted in their birth delivery?
(Use of TBAs, family – mothers, in-laws, or elderly relatives?)

What complications did they experience if any?

Did they experience any delays in seeking care in health facilities (if health facility was used)?

How did they get to the place of delivery (if they had to travel for birth delivery)?

Are you aware of whether your daughters-in-law had a birth preparedness plan (i.e. did they plan ahead of time where their babies would be born, and what to do to ensure that they experienced safe delivery)?

Did they plan in advance where they would give birth?

With whom did they make this decision?

What preparations did they make ahead of time to ensure that their planned place of delivery would be possible?
If they planned for home deliveries, did they think of an alternative plan ahead of time in case of unforeseen birth complications?
(*…probe about any plans made to get to a health facility if they needed to*)

I would now like to discuss where women usually get care during their pregnancy.

Where do pregnant women generally go to receive pregnancy related care?

How about your daughters-in-law, where did they receive care during their pregnancy?

To what extent do pregnant women in your community go to the health facility for antenatal care?

How about your daughters-in-law?

What other types of care do pregnant women go to receive from health facilities?

Next, I would like us to talk about the health decision process for pregnant women's care.

Generally, in your community who are involved in making health decisions about a woman's pregnancy?

Is it just the woman herself, or are other family members involved in the process?

In your family specifically, who were involved in making health care related decisions about your daughters-in-law's (recent) pregnancy.

To what extent did the pregnant women themselves have control over this decision process?

What other family members were involved?

What role did you play, if any, in this process?

In your opinion where do you think women in your community generally prefer to give birth?

What are reasons for women's preference?

What about your own daughters-in-law, where did they prefer to give birth?

Reasons?

Let's talk about the community's role in providing assistance to pregnant women in need of help.

What is the role of the community in helping pregnant women?

What kinds of support are available for women in your community who need to get to a health facility for care, especially for birth delivery?

Who are key community leaders that have contributed to improving the pregnancy and safe birth experiences of women?

In recent years do you know of any communitywide efforts taken to improve pregnant women's access to care in health facilities? Please explain.

What improvements, if any, have you observed?

Now, I want you to describe your, and your family's, role in assisting your daughters-in-law throughout the process of their pregnancy.

What is the community's expectation of you as in-laws in providing assistance to your daughters-in-law?

What specific roles did you play in assisting your daughters-in-law during their previous pregnancies?

Think about your daughters' past pregnancies, what did you do to support or assist them?

How about other family members who provided any kind of assistance to your daughters-in-law, describe the kinds of support they provided to the women.

Name family members you remember playing a supportive role.
What specific roles did they play?

REFERENCES

Adams, A. M., Madhavan, S., & Simon, D. (2002). Women's social networks and child survival in Mali. *Social Science & Medicine*, *54*(2), 165–178.

Adanu, R. M. (2010). Utilization of obstetric services in Ghana between 1999 and 2003: original research article. *African Journal of Reproductive Health*, *14*(3), 153-158.

Addai, I. (2000). Determinants of use of maternal–child health services in rural Ghana. *Journal of Biosocial Science*, *32*(01), 1-15.

Adegoke, A. A., & Van Den Broek, N. (2009). Skilled birth attendance-lessons learnt. *BJOG: An International Journal of Obstetrics & Gynaecology*, *116*(s1), 33-40.

Akazili, J., Doctor, H. V., Aboky, L., Hodgson, A., & Phillips, J. F. (2011). Is there any relationship between antenatal care and place of delivery? Findings from rural northern Ghana. *African Journal of Health Science*, *18*(1-2), 62-73.

Alexander, A., Mustafa, A., Emil, S. A. V., Amekah, E., Engmann, C., Adanu, R., & Moyer, C. a. (2014). Social support during delivery in rural central Ghana: a mixed methods study of women's preferences for and against inclusion of a lay companion in the delivery room. *Journal of Biosocial Science*, *46*(5), 669–85.

Allison, P. D. (2002). Missing data series: Quantitative applications in the social sciences. *Thousand Oaks. CA: Sage*.

Antonucci, T. C. (1986). Measure social support networks: hierarchical mapping techniques. Generations, X, 10-12.

Asamoah, B. O., Moussa, K. M., Stafström, M., & Musinguzi, G. (2011). Distribution of causes of maternal mortality among different socio-demographic groups in Ghana; a descriptive study. BMC Public Health, 11(1), 159.

Bazzano, A. N., Kirkwood, B., Tawiah-Agyemang, C., Owusu-Agyei, S., & Adongo, P. (2008). Social costs of skilled attendance at birth in rural Ghana. *International Journal of Gynaecology and Obstetrics*, *102*(1), 91–4.

Berkanovic, E., & Telesky, C. (1982). Social networks, beliefs, and the decision to seek medical care: an analysis of congruent and incongruent patterns. *Medical Care*, *20*(10), 1018–26.

Berkman, L. F., & Glass, T. A. (2000). Social integration, social networks, social support, and health. In L. F. Berkman, & I. Kawachi (Eds.), Social epidemiology (pp. 137e173). New York, NY: Oxford University Press.

Berkman, L., & Syme, S. (1979). Social networks, host resistance, and mortality: A nine-year follow-up of Alameda County residents. *AJE*, 109, 186-204.

Bhutta, Z. A., Soofi, S., Cousens, S., Mohammad, S., Memon, Z. A., Ali, I., ... & Martines, J. (2011). Improvement of perinatal and newborn care in rural Pakistan through community-based strategies: a cluster-randomized effectiveness trial. *The Lancet*, *377*(9763), 403-412.

Bourdieu, P. 1986. "The Forms of Capital." In *The Handbook of Theory: Research for the Sociology of Education*, ed. J. G. Richardson, 241–58. New York: Greenwood Press.

Bove, R. M., Vala-Haynes, E., & Valeggia, C. R. (2012). Women's health in urban Mali: social predictors and health itineraries. *Social Science & Medicine (1982)*, *75*(8), 1392–9.

Brighton, A., D'Arcy, R., Kirtley, S., & Kennedy, S. (2013). Perceptions of prenatal and obstetric care in Sub-Saharan Africa. *International Journal of Gynecology & Obstetrics*, *120*(3), 224-227.

Campbell, O. M., & Graham, W. J. (2006). Strategies for reducing maternal mortality: getting on with what works. *The Lancet*, *368*(9543), 1284-1299.

Carrington, P. J., Scott, J., & Wasserman, S. (Eds.). (2005). *Models and methods in social network analysis* (Vol. 28). Cambridge university press.

Carter, M. (2002). Husbands and maternal health matters in rural Guatemala: wives' reports on their spouses' involvement in pregnancy and birth. *Social Science & Medicine (1982)*, *55*(3), 437–50.

Carter, M. W., & Speizer, I. (2005). Salvadoran fathers' attendance at prenatal care, delivery, and postpartum care. *Pan American Journal of Public Health*, *18*(3), 149–56.

Central Intelligence agency [CIA]. (2015). The World Fact book: Ghana. Retrieved from https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html

Charmaz, K. (2006). *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. London: Sage.

Cialdini, R. B., & Trost, M. R. (1998). Social influence: Social norms, conformity, and compliance. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The Handbook of Social Psychology* (4th ed., Vol. 2, pp. 151– 192). Boston: McGraw-Hill

Cofie, L. E., Barrington, C., Singh, K., Sodzi-Tettey, S., & Akaligaung, A. (2015). Birth location preferences of mothers and fathers in rural Ghana: Implications for pregnancy, labor and birth outcomes. *BMC Pregnancy & Childbirth*, *15*(1), 1.

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, *98*(2), 310-35.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, 94(Suppl.), S95–S120.

Coleman, J. S. (1990). The Foundations of Social Theory. Cambridge, Mass.: Belknap Press.

Creswell, J. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.

Creswell, J. W., & Clark, V. L. P. (2011). *Designing and conducting mixed methods research* (2nd Ed.). Thousand Oaks: Sage publications Inc.

Crissman, H. P., Crespo, K., Nimako, D., Domena, J., Engmann, C. M., Adanu, R. M., & Moyer, C. A. (2011). Intention to deliver in a healthcare facility and healthcare facility-based delivery rates among women in Akwatia, Ghana. *International Journal of Gynecology & Obstetrics*, *113*(2), 161-162.

Crissman, H. P., Engmann, C. E., Adanu, R. M., Nimako, D., Crespo, K., & Moyer, C. A. (2013). Shifting norms: pregnant women's perspectives on skilled birth attendance and facility–based delivery in rural Ghana. *African Journal of Reproductive Health*, *17*(1), 15-26.

Dako-Gyeke, P., Aikins, M., Aryeetey, R., McCough, L., & Adongo, P. B. (2013). The influence of socio-cultural interpretations of pregnancy threats on health-seeking behavior among pregnant women in urban Accra, Ghana. *BMC Pregnancy and Childbirth*, *13*, 211.

D'Ambruoso, L., Abbey, M., & Hussein, J. (2005). Please understand when I cry out in pain: women's accounts of maternity services during labour and delivery in Ghana. *BMC Public Health*, *5*, 140.

Danforth, E. J., Kruk, M. E., Rockers, P. C., Mbaruku, G., & Galea, S. (2009). Household decision-making about delivery in health facilities: evidence from Tanzania. *Journal of Health, Population, and Nutrition*, *27*(5), 696.

Dean, A., & Lin, N. (1977). The stress-bearing role of social support. J. Nervous & Mental Dis., 165, 403-416.

de Bernis, L., Sherratt, D. R., AbouZahr, C., & Van Lerberghe, W. (2003). Skilled attendants for pregnancy, childbirth and postnatal care. *British medical bulletin*, *67*(1), 39-57.

Deri, C. (2005). Social networks and health service utilization. *Journal of Health Economics*, *24*(6), 1076–107.

Devillanova, C. (2008). Social networks, information and health care utilization: evidence from undocumented immigrants in Milan. *Journal of Health Economics*, *27*(2), 265-286.

Doku, D., Neupane, S., & Doku, P. N. (2012). Factors associated with reproductive health care

utilization among Ghanaian women. *BMC International Health and Human Rights*, *12*(1), 29.

Durkheim, E., (1897). Le Suicide. Paris. Translation: Simpson, G., 1952 (Ed.), Suicide, a Study in Sociology. Routledge and suicides. Kegan Paul, New York, NY.

Dzakpasu, S., Soremekun, S., Manu, A., Ten Asbroek, G., Tawiah, C., Hurt, L., & Kirkwood, B. R. (2012). Impact of free delivery care on health facility delivery and insurance coverage in Ghana's Brong Ahafo Region. *PloS One*, *7*(11), e49430.

Edmonds, J. K., Hruschka, D., Bernard, H. R., & Sibley, L. (2012). Women's social networks and birth attendant decisions: application of the network-episode model. *Social Science & Medicine (1982)*, *74*(3), 452–9.

Emerson, R., Fretz, R., & Shaw, L. (1995). *Writing Ethnographic Field Notes*. University of Chicago Press: Chicago.

Erickson, B. H. (1988). The relational basis of attitudes. In B. Wellman, & S. D. Berkowitz, *Social Structures: A Network Approach* (pp. 99-121). New York: Cambridge University Press.

Family Care International. (2000). *skilled attendance at delivery: A review of the evidence.* New York: Safe Motherhood Inter-Agency Group.

Fischer, C. S., Jackson, R. M., Steuve, C. A., Gerson, K., Jones, L. M., & Baldassare, M. (1977). Networks and places. New York: Free Press.

Fischer, C. S. (1982). *To dwell among friends: personal networks in town and city*. Chicago: University of Chicago Press.

Fowler, J. H. and Christakis, N. A. (2008). Dynamic Spread of Happiness in a Large Social Network: Longitudinal Analysis over 20 Years in the Framingham Heart Study. *British Medical Journal* 337: a2338.

Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology research. *Journal of counseling psychology*, *51*(1), 115.

Friedkin, N. E. (1998). A structural theory of social influence. Cambridge, MA: Cambridge University Press.

Gabrysch, S., & Campbell, O. M. (2009). Still too far to walk: literature review of the determinants of delivery service use. *BMC Pregnancy and Childbirth*, *9*(1), 34.

Galaa, S. Z., & Daare, K. (2008). Understanding barriers to maternal child health services utilization in northern Ghana. *Journal of Social Development in Africa*, *23*(2).

Gayen, K., & Raeside, R. (2007). Social networks, normative influence and health delivery in rural Bangladesh. *Social Science & Medicine*, *65*, 900–914.

Gething, P. W., Johnson, F. A., Frempong-Ainguah, F., Nyarko, P., Baschieri, A., Aboagye, P., & Atkinson, P. M. (2012). Geographical access to care at birth in Ghana: a barrier to safe motherhood. *BMC Public Health*, *12*(1), 991.

Ghana Statistical Service [GSS]. (2011). Ghana Multiple Indicator Cluster Survey with an Enhanced Malaria Module and Biomarker, 2011, Final Report. Accra, Ghana.

Ghana Statistical Service [GSS]. (2013). *2010 Population and Housing Census: National Analytic Report*. GSS, Accra.

Ghana Statistical Service [GSS]. (2013a). *2010 Population and Housing Census: Regional Analytic Report. Northern Region*. GSS, Accra.

Ghana Statistical Service [GSS]. (2013a). *2010 Population and Housing Census: Regional Analytic Report. Central Region*. GSS, Accra.

Ghana Statistical Service (GSS), Ghana Health Service (GHS) & ICF Macro. (2009). *Ghana Demographic and Health Survey 2008*. Accra, Ghana: GSS, GHS, and ICF Macro.

Ghana Statistical Service (GSS), Ghana Health Service (GHS) & ICF International. (2015). *Ghana Demographic and Health Survey 2014.* Rockville, Maryland, USA: GSS, GHS, and ICF International.

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: Aldine Publishing Company.

Glass, T. A., De Leon, C. F. M., Seeman, T. E., & Berkman, L. F. (1997). Beyond single indicators of social networks: a LISREL analysis of social ties among the elderly. *Social science & medicine*, *44*(10), 1503-1517.

Gogia, S., & Sachdev, H. S. (2010). Home visits by community health workers to prevent neonatal deaths in developing countries: a systematic review. *Bulletin of the World Health Organization*, *88*(9), 658-666.

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology*, *78*(6), 1360-1380.

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field methods,* 18, 59-82.

Gyimah, S. O., Takyi, B. K., & Addai, I. (2006). Challenges to the reproductive-health needs of African women: On religion and maternal health utilization in Ghana. *Social Science & Medicine*, *62*(12), 2930-2944.

Hall, A., & Wellman, B. (1985). Social networks and social support. In S. Cohen, & S. L. Syme, Social support and health (pp. 23-41). Orlando: Academic Press.

Harvey, S. A., Blandón, Y. C. W., McCaw-Binns, A., Sandino, I., Urbina, L., Rodríguez, C., ... & Djibrina, S. (2007). Are skilled birth attendants really skilled? A measurement method, some disturbing results and a potential way forward. Bulletin of the World Health Organization, 85(10), 783-790.

He, Y. (2010). Missing Data Analysis Using Multiple Imputation Getting to the Heart of the Matter. *Circulation: Cardiovascular Quality and Outcomes*, *3*(1), 98-105.

Henderson, R. H., & Sundaresan, T. (1982). Cluster sampling to assess immunization coverage: a review of experience with a simplified sampling method. *Bulletin of the World Health Organization*, *60*(2), 253.

Hodnett, E. D., Gates, S., Hofmeyr, J. & Sakala, C. (2007) Continuous support for women during childbirth. *Cochrane Database of Systematic Reviews*. Issue 3, Art. No. CD003766.

Hofmeyr, G. J., Nikodem, V. C., Wolman, W. L., Chalmers, B. E. & Kramer, T. (1991) Com-panionship to modify the clinical birth environment: effects on progress and perceptions of labor, and breastfeeding. *British Journal of Obstetrics and Gynecology* 98, 756–764.

House, J. S. (1981). *Work, stress and social support*. Reading, MA: Addison Wesley.

House, J. S., Landis, K. R., & Umberson, D. (1988). Social relationships and health. *Science*, *241*(4865), 540-545.

ICF Macro. (2010). Trends in Demographic, Family Planning, and Health Indicators in Ghana, 1960-2008: Trend Analysis of Demographic and Health Surveys Data. Calverton, Maryland, USA.

Israel, B. A. (1982). Social networks and health status: Linking theory, research, and practice. *Patient Counseling and Health Education*, *4*(2), 65-79.

Jansen, I. (2006). Decision making in childbirth: the influence of traditional structures in a Ghanaian village. *International Nursing Review*, *53*(1), 41–6.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed Methods Research: A research paradigm whose time has come. *Educational Researcher*, *33*(7), 14–26.

Johnson, F. A., Padmadas, S. S., & Brown, J. J. (2009). On the spatial inequalities of institutional versus home births in Ghana: a multilevel analysis. *Journal of Community Health*, *34*(1), 64–72.

Kahn, R., & Antonucci, T. (1980). Convoys over the life-course: attachment, roles and social

support. In P. B. Baltes, & O. Brim, Jr. (Eds.), *Life span development and behavior* (Vol. 3, pp. 253-286). New York: Academic Press.

Kassebaum, N. J., Bertozzi-Villa, A., Coggeshall, M. S., Shackelford, K. A., Steiner, C., Heuton, K. R., ... & Templin, T. (2014). Global, regional, and national levels and causes of maternal mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. The Lancet, 384(9947), 980-1004.

Kawachi, I., & Berkman, L., (2000). Social cohesion, social capital, and health. In: Berkman, L., Kawachi, I. (Eds.), Social Epidemiology. Oxford University Press, New York, NY, pp.174–190.

Kawachi, I., Subramanian, S. V., & Kim, D. (2008). Social capital and health: A decade of progress and beyond. In I. Kawachi, S. V. Subramanian, & D. Kim (Eds.), Social capital and health (pp. 1–26). New York, NY: Springer.

Kohler, H. P., Behrman, J. R., & Watkins, S. C. (2001). The density of social networks and fertility decisions: Evidence from South Nyanza district, Kenya. *Demography*, *38*(1), 43–58.

Kruk, M. E., Rockers, P. C., Mbaruku, G., Paczkowski, M. M., & Galea, S. (2010). Community and health system factors associated with facility delivery in rural Tanzania: a multilevel analysis. *Health Policy (Amsterdam, Netherlands)*, *97*(2-3), 209–16.

Kwambai, T. K., Dellicour, S., Desai, M., Ameh, C. a, Person, B., Achieng, F., … Ter Kuile, F. O. (2013). Perspectives of men on antenatal and delivery care service utilization in rural western Kenya: a qualitative study. *BMC Pregnancy and Childbirth*, 13(1), 134.

Lapinski, M. K., & Rimal, R. N. (2005). An explication of social norms. *Communication Theory*, 15, 127–147.

Lauman, E. O. (1973). *Bonds of pluralism*. New York: Wiley.

Lewycka, S., Mwansambo, C., Rosato, M., Kazembe, P., Phiri, T., Mganga, A., ... & Pulkki-Brännström, A. M. (2013). Effect of women's groups and volunteer peer counselling on rates of mortality, morbidity, and health behaviors in mothers and children in rural Malawi (MaiMwana): a factorial, cluster-randomized controlled trial. *The Lancet*, *381*(9879), 1721-1735.

Leenders, R. Th. A. J., (1997). Longitudinal behavior of network structure and actor attributes: modeling interdependence of contagion and selection. In: Doreian, P., Stokman, F.N. (Eds.), *Evolution of Social Networks*. Gordon and Breach, New York.

Levy, P., & Wong, W. (2010). *Cultures of the world, Ghana.* Marshall Cavendish.

Lozano, R., Wang, H., Foreman, K. J., Rajaratnam, J. K., Naghavi, M., Marcus, J. R., ... &

Introduction: Studying social structures. In Wellman, B., and Berkowitz, S.D. (eds.), *Social Structures: A Network Approach*, 1-14. Cambridge, England: Cambridge University Press.

Luke, D. A., & Harris, J. K. (2007). Network analysis in public health: history, methods, and applications. *Annual Review of Public Health*, *28*, 69–93.

Madhavan, S., Adams, A., & Simon, D. (2003). Women's Networks and the Social World of Fertility Behavior. *International Family Planning Perspectives*, *29*(2), 58–68.

Maimbolwa, M. C., Sikazwe, N., Yamba, B., Diwan, V., & Ransjö-Arvidson, A. B. (2001). Views on involving a social support person during labor in Zambian maternities. *Journal of Midwifery & Women's Health*, *46*(4), 226–34.

Marsden, P. V. (1990). Network data and measurement. Annual review of sociology, 435-463.

Marsden, P. V., & Friedkin, N. E. (1994). Network studies of social influence. In S. Wasserman, & J. Galaskiewicz, *Advances in Social Network Analysis: Research in the Social and Behavioral Sciences* (pp. 3-25). Thousand Oaks, CA: Sage.

Mason, W. A., Conrey, F. R., & Smith, E. R. (2007). Situating social influence processes: dynamic, multidirectional flows of influence within social networks. *Personality and Social Psychology Review : An Official Journal of the Society for Personality and Social Psychology, Inc.*, *11*(3), 279–300.

Mattson, S. (2010). Millennium development goals and global women's and infants' health. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, *39*(5), 573–9.

Mbekenga, C. K., Christensson, K., Lugina, H. I., & Olsson, P. (2011a). Joy, struggle and support: postpartum experiences of first-time mothers in a Tanzanian suburb. *Women and Birth : Journal of the Australian College of Midwives*, *24*(1), 24–31.

Mbekenga, C. K., Pembe, A. B., Christensson, K., Darj, E., & Olsson, P. (2011b). Informal support to first-parents after childbirth: a qualitative study in low-income suburbs of Dar es Salaam, Tanzania. *BMC Pregnancy and Childbirth*, *11*(1), 98.

McCarty, C., 2002. Structure in personal networks. Journal of Social Structure 3, 1. Retrieved from http://zeeb.library.cmu.edu:7850/JoSS/McCarty.htm.

McLeroy, K. R., DeVellis, R., DeVellis, B., Kaplan, B., & Toole, J. (1984). Social support and physical recovery in a stroke population. Journal of Social and Personal Relationships, 1(4), 395-413.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Sage.

Mills, S., & Bertrand, J. T. (2005). Use of health professionals for obstetric care in northern Ghana. *Studies in Family Planning*, *36*(1), 45-56.

Mills, S., Williams, J. E., Adjuik, M., & Hodgson, A. (2008). Use of health professionals for delivery following the availability of free obstetric care in northern Ghana. *Maternal and Child Health Journal*, *12*(4), 509-518.

Ministry of Health. (2008). National consultative meeting on the reduction of maternal mortality in Ghana: Partnership for action, a synthesis report. Retrieved from http://www.moh-ghana.org/UploadFiles/Publications/Synthesis%20Report%20-%20MDG5120427093223.pdf.

Mitchell, J. C. (1969). The Concept and Use of Social Networks. In J. C. Mitchell (ed.), *Social Networks in Urban Situations*. Manchester: University Press.

Mitchell, R. E., & Trickett, E. J. (1980). Task force report: Social networks as mediators of social support. *Community Mental Health Journal*, *16*(1), 27-44.

Morse, J. (1994). "Emerging from the Data." Cognitive Processes of Analysis in Qualitative Research. In Janice J. (Ed.), *Critical Issues in Qualitative Research Methods* (pp.23-41). Thousand Oaks, CA: Sage.

Moyer, C. A., & Mustafa, A. (2013). Drivers and deterrents of facility delivery in sub-Saharan Africa: a systematic review. *Reproductive Health*, *10*(1), 40.

Moyer, C. A., Dako-Gyeke, P., & Adanu, R. M. (2013). Facility-based delivery and maternal and early neonatal mortality in sub-Saharan Africa: a regional review of the literature. African Journal of Reproductive Health, 17(3), 30–43.

Moyer, C. A., Adongo, P. B., Aborigo, R. A., Hodgson, A., Engmann, C. M., & DeVries, R. (2014). “It’s up to the woman’s people”: how social factors influence facility-based delivery in Rural Northern Ghana. Maternal and child health journal, 18(1), 109-119.

National Health Insurance Authority. (2008). Providing free maternal and neonatal healthcare through NHIS, NHIA Presentation at Health Summit, Accra, 2008.

Nikodem, V. C., Nolte, A. G., Wolman, W., Glumezoglu, A. M. & Hofmeyr, G. J. (1998) Companionship by a lay labor supporter to modify the clinical birth environment: long-term effects on mother and child. *Curationis* 21(1), 8–12.

Prata, N., Passano, P., Rowen, T., Bell, S., Walsh, J., & Potts, M. (2011). Where there are (few) skilled birth attendants. *Journal of Health, Population, and Nutrition*, *29*(2), 81–91.

Prost, A., Colbourn, T., Seward, N., Azad, K., Coomarasamy, A., Copas, A., ... & MacArthur, C. (2013). Women's groups practicing participatory learning and action to improve maternal and newborn health in low-resource settings: a systematic review and meta-analysis. *The*

Lancet, *381*(9879), 1736-1746.

Putnam, R. D. (1993). *Making Democracy Work: Civic Traditions in Modern Italy. Princeton*, N.J.: Princeton University Press.

Nyonator, F. K., Awoonor-Williams, J. K., Phillips, J. F., Jones, T. C., & Miller, R. A. (2005). The Ghana community-based health planning and services initiative for scaling up service delivery innovation. *Health Policy and Planning*, *20*(1), 25-34.

Ono, M., Matsuyama, A., Karama, M., & Honda, S. (2013). Association between social support and place of delivery: a cross-sectional study in Kericho, Western Kenya. *BMC Pregnancy and Childbirth*, *13*(1), 214.

O'Reilly, P. (1988). Methodological issues in social support and social network research. *Social Science & Medicine*, *26*(8), 863–873.

Parkhurst, J. O., Rahman, S. A., & Ssengooba, F. (2006). Overcoming access barriers for facility-based delivery in low-income settings: insights from Bangladesh and Uganda. *Journal of Health, Population, and Nutrition*, *24*(4), 438–45.

Patton, M. (2002). *Qualitative research and evaluation methods*. 3rd ed. Thousand Oaks, CA: Sage.

Penfold, S., Harrison, E., Bell, J., & Fitzmaurice, A. (2007). Evaluation of the delivery fee exemption policy in Ghana: population estimates of changes in delivery service utilization in two regions. *Ghana Medical Journal*, *41*(3), 100.

Raman, S., Srinivasan, K., Kurpad, A., Dwarkanath, P., Ritchie, J., & Worth, H. (2014). "My mother…my sisters… and my friends": sources of maternal support in the perinatal period in urban India. *Midwifery*, *30*(1), 130–7.

Rock, D. L., Green, K. E., Wise, B. K., & Rock, R. D. (1984). Social support and social network scales: a psychometric review. *Research in Nursing & Health*, *7*(4), 325–32.

Sakeah, E., Doctor, H. V, McCloskey, L., Bernstein, J., Yeboah-Antwi, K., & Mills, S. (2014a). Using the community-based health planning and services program to promote skilled delivery in rural Ghana: socio-demographic factors that influence women utilization of skilled attendants at birth in northern Ghana. *BMC Public Health*, *14*(1), 344.

Sakeah, E., McCloskey, L., Bernstein, J., Yeboah-Antwi, K., Mills, S., & Doctor, H. V. (2014b). Is there any role for community involvement in the community-based health planning and services skilled delivery program in rural Ghana? *BMC Health Services Research*, *14*(1), 340.

Sandelowski, M. (1995). Qualitative analysis: What it is and how to begin. *Research in nursing & health,* 18, 371-375.

Sarason, B. R., Sarason, I. G., & Pierce, G. (1990). *Social support: an interactional view*. New York: Wiley.

Sarason, I., Sarason R., Shearin, E., & Pierce, G. (1987). A brief measure of social support: Practical and theoretical implications. Journal of Social and Personal Relationships, 4, 497–510.

Sarason, I. G., Levine, H. M., Basham, R. B., & Sarason, B. R. (1983). Assessing social support: The Social Support Questionnaire. *Journal of Personality and Social Psychology*, *44*(1), 127–139.

Say, L., & Raine, R. (2007). A systematic review of inequalities in the use of maternal health care in developing countries: examining the scale of the problem and the importance of context. *Bulletin of the World Health Organization*, *85*(10), 812-819.

Say, L., Chou, D., Gemmill, A., Tunçalp, Ö., Moller, A. B., Daniels, J., ... & Alkema, L. (2014). Global causes of maternal death: a WHO systematic analysis. *The Lancet Global Health*, *2*(6), e323-e333.

Seeman, T. E. (1996). Social ties and health: The benefits of social integration. Annals of Epidemiology, 6(5), 442–451.

Seeman, T. E., & Berkman, L. F. (1988). Structural characteristics of social networks and their relationship with social support in the elderly: who provides support. *Social Science & Medicine (1982)*, *26*(7), 737–49.

Simon, D., Adams, A. M., & Madhavan, S. (2002). Women's social power, child nutrition and poverty in Mali. Journal of Biosocial Science, 34,193e213.

Singh, K., Speizer, I., Handa, S., Boadu, R. O., Atinbire, S., Barker, P. M., & Twum-Danso, N. A. (2013). Impact evaluation of a quality improvement intervention on maternal and child health outcomes in Northern Ghana: early assessment of a national scale-up project. *International journal for quality in health care*, mzt054.

Singh, K., Brodish, P., Speizer, I., Barker, P., Amenga-Etego, I., Dasoberi, I., ... & Sodzi-Tettey, S. (2016). Can a quality improvement project impact maternal and child health outcomes at scale in northern Ghana? *Health Research Policy and Systems*, *14*(1), 45.

Smith, K. P., & Christakis, N. A. (2008). Social networks and health. *Annu. Rev. Sociol*, *34*, 405-429.

Somé, D. T., Sombié, I., & Meda, N. (2013). How decision for seeking maternal care is made-a qualitative study in two rural medical districts of Burkina Faso. *Reproductive health*, *10*(1), 1.

Speizer, I. S., Story, W. T., & Singh, K. (2014). Factors associated with institutional delivery in Ghana: the role of decision-making autonomy and community norms. *BMC pregnancy and childbirth*, *14*(1), 1.

St Clair, P. A., Smeriglio, V. L., Alexander, C. S., & Celentano, D. D. (1989). Social network structure and prenatal care utilization. *Medical Care*, *27*(8), 823-832.

Story, W. T., Burgard, S. A., Lori, J. R., Taleb, F., Ali, N. A., & Hoque, D. M. E. (2012). Husbands' involvement in delivery care utilization in rural Bangladesh: A qualitative study. *BMC Pregnancy and Childbirth*, *12*(1), 28.

Stephenson, R., Baschieri, A., Clements, S., Hennink, M., & Madise, N. (2006). Contextual influences on the use of health facilities for childbirth in Africa. *American Journal of Public Health*, *96*(1), 84.

Sullivan, T. R., & Hirst, J. E. (2011). Reducing maternal mortality: a review of progress and evidence-based strategies to achieve millennium development goal 5. *Health Care for Women International*, *32*(10), 901–16.

Teddlie, C., & Tashakkori, A. (2009). *The foundations of mixed methods research: Integrating quantitative and qualitative techniques in the social and behavioral sciences*. Thousand Oaks, CA: Sage.

Tey, N. P., & Lai, S. L. (2013). Correlates of and Barriers to the Utilization of Health Services for Delivery in South Asia and Sub-Saharan Africa. *The Scientific World Journal*, *2013*.

Thaddeus, S., & Maine, D. (1994). Too far to walk: maternal mortality in context. *Social science & medicine*, *38*(8), 1091-1110.

Thoits, P. A. (1995). Stress, coping, and social support processes: Where are we? What next?. *Journal of Health and Social Behavior*, 53-79.

The Prevention of Maternal Mortality Network. (1992). Barriers to treatment of obstetric emergencies in rural communities of West Africa. *Studies in Family Planning* 2, 3, 279-291.

Twum-Danso, N. A. Y., Akanlu, G. B., Osafo, E., Sodzi-Tettey, S., Boadu, R. O., Atinbire, S., … Barker, P. M. (2012). A nationwide quality improvement project to accelerate Ghana's progress toward Millennium Development Goal Four: design and implementation progress. *International Journal for Quality in Health Care Journal of the International Society for Quality in Health Care ISQua*, *24*, 601–11.

United Nations Children's Fund [UNICEF]. (2014). UNICEF Data: Monitoring the situation of children and women. Maternal Health. Retrieved from http://data.unicef.org/maternal-health.

United Nations Population Fund [UNFPA]. (2009). *Stepping up efforts to save mothers' lives United Nations Fund for Population Activities*. Retrieved from http://www.unfpa.org/mothers/.

Upadhyay, P., Liabsuetrakul, T., Shrestha, A. B., & Pradhan, N. (2014). Influence of family members on utilization of maternal health care services among teen and adult pregnant women in Kathmandu, Nepal: a cross sectional study. *Reproductive health*, *11*(1), 1.

Valente, T. W., Fujimoto, K., Chou, C. P., & Spruijt-Metz, D. (2009). Adolescent affiliations and adiposity: a social network analysis of friendships and obesity. *Journal of Adolescent Health*, *45*(2), 202-204.

Van den Broek, N. R., & Falconer, A. D. (2011). Maternal mortality and Millennium Development Goal 5. *British medical bulletin*, *99*(1), 25-38.

Van Lerberghe, W., & De Brouwere, V. (2001). Of blind alleys and things that have worked: history's lessons on reducing maternal mortality. In: De Brouwere V., Van Lerberghe W. (eds.) Safe Motherhood Strategies: A Review of the Evidence. *Stud Health Serv Organ Policy*, 17, 7–33.

Wellman, B., & Berkowitz, S.D. (1988). Introduction: Studying social structures. In Wellman, B., and Berkowitz, S.D. (eds.), *Social Structures: A Network Approach*, 1-14. Cambridge, England: Cambridge University Press.

Wellman, B., & Leighton, B. (1979). Networks, Neighborhoods, and Communities Approaches to the Study of the Community Question. *Urban Affairs Review*, *14*(3), 363-390.

Wheaton, B. (1985) Models for the stress buffering functions of coping resources. *Journal of Health & Social Behavior* 26(4), 352–364.

White, D., Dynes, M., Rubardt, M., Sissoko, K., & Stephenson, R. (2013). The influence of intrafamilial power on maternal health care in Mali: Perspectives of women, men and mothers-in-law. *International perspectives on sexual and reproductive health*, 58-68.

Witter, S., Arhinful, D. K., Kusi, A., & Zakariah-Akoto, S. (2007). The experience of Ghana in implementing a user fee exemption policy to provide free delivery care. *Reproductive Health Matters*, *15*(30), 61-71.

Wolman, W. L., Chalmers, B., Hoffmeyr, J. & Nikodem, V. C. (1993) postpartum depression and companionship in the clinical birth environment: a randomized controlled study. *American Journal of Obstetrics and Gynecology* 168, 1388–1393.

World Bank (2014). How does the World Bank classify countries? Retrieved on 2014 from https://datahelpdesk.worldbank.org/knowledgebase/articles/378834-how-does-the-world-bank-classify-countries.

World Health Organization (2004a). *International statistical classification of diseases and related health problems: 10th revision* (Vol 2). Retrieved from http://www.who.int/classifications/icd/ICD-10_2nd_ed_volume2.pdf.

World Health Organization (2004b) Making pregnancy safe; critical role of skilled birth attendant. World Health Organization: Geneva.

World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), The World Bank, & United Nations Population Division. (2015). Trends in maternal mortality: 1990 to 2013. Estimates by WHO, UNICEF, UNFPA, The World Bank and the United Nations Population Division. Geneva: World Health Organization.