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PREDICTORS OF INTRAPARTUM STILLBIRTHS IN SINGLETONS IN SIX PUBLIC HOSPITALS IN THE GREATER ACCRA REGION, GHANA

BY

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DECLARATION

I hereby declare that with the exception of references made of other people's work which have been duly cited in the study, this report is the result of my own research work and that it has not been submitted either in part or whole to any other institution for another degree.

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ABSTRACT

Introduction
Globally, 2.6 million stillbirths are recorded annually: 50% occur during labour (intrapartum). Ghana records 11,000 stillbirths annually and 40% occur during labour. The Greater Accra Region records 2000 stillbirths annually: 40 % of them occur intrapartum. An understanding of the contributory factors will facilitate the development of preventive strategies to reduce the huge numbers of intrapartum stillbirths.

Objectives
The objectives of this study were to identify contributors to intrapartum stillbirths; explore perceptions about stillbirth from women with experience of intrapartum stillbirth, document views of health professionals about causes and prevention of intrapartum stillbirths and develop a model to predict intrapartum stillbirths.

Method
This was a retrospective 2:1 unmatched case-control study with a qualitative component. The study sample was all deliveries between 1st January to 31st December 2016 in six public hospitals in the Greater Accra Region. Cases were selected through census while controls were selected from the live births using systematic random sampling. Relevant information was retrieved from clinical records for both cases and controls. Thirteen (10%) women from the cases and 14 health workers were purposively selected for in-depth interviews. Bivariate and multivariable data analyses were used to determine association between the variables and intrapartum stillbirth. Qualitative data were analysed by themes using NVIVO 11. The Area Under the Receiver Operating Characteristics Curve (AUROC) and the Brier Score (BS) were used to identify factors to include in the model to predict intrapartum stillbirths. Approval for the study was obtained from the Ghana Health Service Ethics Review Committee.

Results
During the study period, there were 36,168 deliveries with 918 stillbirths; 362 (39%) occurred intrapartum. Through the census, 125 cases were identified, in addition, 250 controls and 27 participants were included in the study. Mean age of cases and controls were 28.8± 5.54 and 28.9 ± 6.05 years respectively. Mean gestational age was 36.5 ± 3.95 weeks for cases and 38.8 ± 2.69 weeks for controls; median birth weight was 2.7kg ± 0.92 for cases and 3.1kg ± 0.65 for controls. The following maternal factors were associated with intrapartum stillbirths: pregnancy-induced hypertension (PIH) (aOR 3.70); antepartum haemorrhage (APH) (aOR, 3.28) and premature rupture of membranes (PROM) (aOR 3.36). The major fetal contributory factor was low gestational age (aOR, 0.86). Service delivery factors included lack of trained health staff, inadequate number of beds, theatre space, nonuse of partograph to monitor women in labour and non-auditing of perinatal deaths. Fetal autopsy was not performed on stillbirths. The best model to predict intrapartum stillbirth was the model with combination of maternal (PIH, APH and PROM); fetal (low gestational

age) and service delivery (mode of delivery and health provider who conducted the delivery) factors.

Conclusions and recommendations

Improved management of PIH, APH, PROM and preterm delivery will reduce intrapartum stillbirth. Hospitals should improve on monitoring of women during labour. Auditing of intrapartum stillbirths should be mandatory for all hospitals and Ghana Health Service (GHS) should include fetal autopsy in stillbirth auditing to identify other causes of fetal deaths. The best model to predict intrapartum stillbirth is a combination of maternal, fetal and health service delivery factors. Thus, interventions to reduce intrapartum stillbirth must combine maternal, fetal and service delivery factors to make them effective.

DEDICATION

I dedicate this work to God Almighty for His continued grace and mercy that have seen me through my studies.

I dedicate the work to my dear father who encouraged me but did not live to see the end of it, Dad, I am very grateful. To my wonderful family in recognition of their prayers, tolerance, encouragement and for standing with me throughout my study, I dedicate this to you. I love you all.

This work is also dedicated to the many families that have experienced stillbirths and have suffered in silence seeking answers to the important questions: *"...why did it happen to us?" "...Is there something we should or should not have done?"*

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LIST OF ABBREVIATIONS

ANC	Antenatal Clinic
APH	Antepartum Haemorrhage
AUROC	Area Under the Receiver Operating Characteristics Curve
BS	Brier Score
CHAG	Christian Health Association of Ghana
CPD	Cephalopelvic Disproportion
CRVS	Civil Registration and Vital Statistics
C/S	Caesarean Section
DHIMS	District Health Information Management System
DHS	Demographic and Health Survey
DMiP	Diabetes Mellitus in Pregnancy
ENAP	Every Newborn Action Plan
EWEC	Every Woman Every Child
GAR	Greater Accra Region
GDHS	Ghana Demographic and Health Survey
GDM	Gestational Diabetes Mellitus
GHS	Ghana Health Service
HAP	Household Air Pollution
Hb	Haemoglobin
HBM	Health Belief Model
HDP	Hypertensive Disorders of Pregnancy
HELLP	Haemolysis; Elevated Liver function tests and Low Platelets
HICs	High Income Countries
HIP	Hypertension in Pregnancy

HIV	Human Immunodeficiency Virus
IAP	Indoor Air Pollution
IDI	In-depth Interview
ITN	Insecticide Treated Net
IPTp	Intermittent Preventive Treatment in pregnancy
IUFGR	Intra Uterine Fetal Growth Restriction
LBW	Low Birth Weight
LEKMA	Ledzekoku Krowu Metropolitan Assembly
LMICs	Low and Middle Income Countries
LPG	Liquefied Petroleum Gas
MDGs	Millennium Development Goals
MICE	Multiple Imputations by Chained Equations
MoH	Ministry of Health
NCDs	Non Communicable Diseases
NHIS	National Health Insurance Scheme
PI	Principal Investigator
PIH	Pregnancy Induced Hypertension
PNC	Post Natal Clinic
PROM	Premature Rupture of Membranes
RDD	Research and Development Division
SP	Sulphadoxine Pyrimethamine
TBA	Traditional Birth Attendant
UHC	Universal Health Coverage
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.0 Background and Rationale for the Study

Stillbirth is an extremely painful pregnancy outcome that affects about 2.65 million births worldwide annually; about 98% occur in developing countries. About 1.3 million of the stillbirths occur during labour and most of them are preventable (Burden et al., 2016; Lawn et al., 2016). In Ghana and also in the Greater Accra Region, about 1.7% of deliveries end in stillbirth with 40% occurring intrapartum (Ghana Health Service., 2017a). Despite the fact that almost half of stillbirths occur during the intrapartum period and strategic interventions can reduce intrapartum deaths, stillbirths have remained "an invisible public health priority" (Lawn, Gravett, Nunes, Rubens, & Stanton, 2010) and they have received very little attention (Xiong et al., 2018). The absence of a way of predicting stillbirth will lead to continued delivery of preventable stillbirths (Gardosi, Madurasinghe, Williams, Malik, & Francis, 2013). This study is relevant because the findings from this study would assist to unearth the contributors to intrapartum stillbirths and contribute to development and implementation of context-specific interventions that would lead to a reduction of preventable intrapartum stillbirths in Ghana.

This chapter presents the background information and the scope of the study. The chapter initially discusses the World Health Organization "Every Newborn Action Plan" (ENAP), and Ghana's National Newborn Health Strategy and Action Plan 2014 – 2018 as road maps for reducing neonatal deaths including stillbirths. The chapter looks at the priority areas for these road maps in their efforts at reducing neonatal deaths and stillbirths and goes on further to discuss the problem statement, justification for the study; the research objectives, research questions and the significance of the study.

1.1 Background

Most pregnancies progress normally from conception to delivery. However, others do not go through smoothly because of antepartum or intrapartum maternal, fetal and health sector factors that place the mother, the fetus, or both at a higher risk for developing complications than pregnancies without those factors (Menezes et al., 2009). Such pregnancies lead to the death of the babies, mothers or both by the end of pregnancy and delivery (Adane, Ayele, Ararsa, Bitew, & Zeleke, 2014; Adekanbi, Olayemi, Fawole, & Afolabi, 2015).

Stillbirth is defined as the birth of a baby at or after 28 weeks gestation who does not show any signs of life (World Health Organization, 2015). Stillbirths can be described as - intrapartum stillbirths: these are late fetal deaths that occur during labour, the babies do not show any signs of skin disintegration and are clinically described as fresh stillbirths (Abeje, Azage, & Setegn, 2014; Lawn et al., 2009)

Macerated stillbirths: these are babies born dead and show signs of skin disintegration at delivery (World Health Organization, 2015). In this current study, the researcher used the WHO definition because it allowed for international comparisons between countries, and fetuses born after 28 weeks gestation with access to cost-effective interventions have chances of surviving even in low and middle-income countries (Barros et al., 2010; World Health Organization., 2018). Previous global health agenda did not feature stillbirth possibly because its impact had not been scientifically analyzed or made known (Burden et al., 2016). Stillbirth has not been widely studied, especially in low and middle-income countries (LMICs) and it has not been considered as part of major global maternal and child health strategies, although it is a reflection of the quality of a country's healthcare system for pregnant women (Ghana Health Service., 2017a; Gordon, Raynes-Greenow, McGeechan,

Morris, & Jeffery, 2013). The Millennium Development Goal 4 focused on reducing under-five child mortality rate by two thirds between 1990 and 2015; however, there were no specific targets set for the reduction of stillbirths despite the fact that studies showed that intrapartum stillbirths contributed significantly to newborn deaths (J. E. Lawn et al., 2009). Following this lack of attention, the global Every Newborn Action Plan (ENAP), launched in 2014 by WHO provided a road map of strategic actions for ending preventable newborn mortality including stillbirths. The inclusion of stillbirths in a global agenda shows that there is currently some commitment and determination at the highest level of health development and care to make stillbirth visible and a priority in every country's health agenda. The ENAP has a clear direction with specific global and national milestones to be followed to prevent newborn deaths and stillbirths by 2020. The identification of the causes of stillbirths in LMICs, including Ghana will contribute significantly towards newborn survival since over 99% of intrapartum stillbirths and intrapartum related neonatal deaths occur in these countries (J. E. Lawn et al., 2009).

Poor data capture and record-keeping have resulted in lack of timely and accurate data on the incidence of intrapartum-related hypoxic events such as intrapartum-related neonatal deaths and intrapartum stillbirths in LMICs where the burden of stillbirth is the greatest (Lawn et al., 2016).

The Ghana National Newborn Health Strategy and Action Plan 2014 – 2018, developed as a national road map to reduce neonatal deaths in Ghana did not set targets for stillbirths: the only recommendation made for reduction of stillbirth was the conduction of perinatal death audits. However, improving survival at birth goes beyond perinatal death auditing since several maternal; fetal and health service factors come into play to determine birth outcomes

and all of them may not be captured in the pregnant woman's records during antenatal and at time of admission during labour. The absence of stillbirth as a priority area in the strategic document may be due to the lack of understanding of the causes of stillbirths since there is a paucity of research focused on stillbirths and lack of data on contributory factors to stillbirths in Ghana. The limited focus on stillbirths in the Ghana Newborn Strategy and Action Plan makes this study relevant. The availability of relevant and scientific data will contribute to the understanding of the phenomenon of stillbirths in Ghana and support the development and implementation of contextual interventions to reduce the incidence of intrapartum stillbirths.

Ghana relies on different sources of data to assess performance within the Health Sector. There are the periodic national surveys such as the Ghana Demographic and Health Survey (which is conducted as a collaboration between Ghana Statistical Service, Ghana Health Service Accra and The Demographic Health Survey Program), the Maternal Health Survey and the National system for capturing data known as the District Health Information Management System (DHIMS) which is managed by the Ghana Health Service. The DHIMS captures data from all Government of Ghana Health Facilities and some private health facilities. Since GHS is the largest service provider (>60%) in Ghana, the data in DHIMS are usually used as a proxy for national health performance. DHIMS reports have shown inter-regional and intra-regional variations in the incidence of intrapartum fetal deaths and although it is generally believed that urban dwellers have better health access and health outcomes, the same cannot be said for stillbirths. Despite its urban nature, the rate of stillbirth in the Greater Accra Region is higher than in some deprived regions in Ghana such as the Upper East and Upper West Regions (Ghana Health Service., 2017a). The national Ghana Maternal Health Survey (GMHS) 2017 reported on stillbirth but there was no classification

into fresh (intrapartum) and macerated (antepartum) thus preventing a clear picture of the contribution of intrapartum stillbirths to newborn deaths. A clear understanding of the factors that contribute to intrapartum stillbirths in the Greater Accra Region will have an impact on the preventive strategies to employ to reduce them (Agarwal & Levine, 2010).

Poor pregnancy outcomes have been linked to several maternal factors including the low socioeconomic status of pregnant women; rural dwelling; environmental factors; low ANC attendance; pre-pregnancy medical diseases and illnesses that occurred during the pregnancy; intrapartum events; beliefs and practices (Ameh et al., 2016; Jebet, Oyore, & Agina, 2012; Kiguli, Namusoko, Kerber, Peterson, & Waiswa, 2015). Fetal factors that contribute to stillbirths include pre-term birth; intrauterine growth restriction and adverse intrapartum conditions. The health system factors include an inadequate number of trained health personnel; poor referral system; lack of logistics and poor access to prompt obstetric care for emergencies (Jebet et al., 2012). The sturdiness of the health system to identify and promptly respond to emergencies also has a significant impact on pregnancy outcomes.

1.2 Problem statement

Recent global estimates have revealed that intrapartum stillbirths as a single birth outcome exceed the contribution of malaria to child deaths (Joy E. Lawn et al., 2009). Stillbirths lead to an enormous burden on the health system, especially in LMICs and cause a lot of grief and depression for women and their families (Afulani, 2016). Of the 650,000 deliveries that were recorded annually in public health facilities in Ghana, 1.7% ended as stillbirths with 40% occurring intrapartum (Ghana Health Service., 2017a). While globally it is estimated that over 4.2 million women are living with depression after stillbirth, the number of women and their families suffering from depression and prolonged grief after stillbirth in Ghana is

not known since the District Health Information System (DHIMS) does not capture such data. Global targets and indicators for stillbirth are now included in a worldwide agenda to give relevant stakeholders opportunities to act together to end all preventable stillbirths (de Bernis et al., 2016). The Global Strategy for Women's, Children's and Adolescents' Health 2016-2030 developed in 2015, acknowledged that remarkable gains would be made by 2030 if financing is increased and sustained to contribute to preventable stillbirths while reducing maternal, newborn, child and adolescent deaths.

In collaboration with Development Partners, Ghana has invested enormous resources into maternal and child healthcare with the hope of improving newborn, child and maternal survival. Unfortunately, the challenges of unacceptable numbers of newborn and maternal deaths still persist in Ghana with GAR contributing significantly towards this persistence. GAR contributes about 1.7% of total stillbirths in Ghana annually. Out of the 100,000 deliveries recorded annually in GAR in public health facilities, 1.7% ended up as stillbirths with 40% occurring intrapartum (Greater Accra Regional Health Directorate, 2016). Although the global community is calling for renewed efforts to make stillbirths visible by improving registration and data capture, there are still gaps and these affect the documentation of underlying causes and associated conditions which form the framework for understanding stillbirths (Frøen et al., 2009). There are few studies that have focused on unexplained stillbirths and there is a vast gap in translating knowledge into proven strategies to reduce stillbirth, especially in low-income countries (Frøen et al., 2009). Despite the huge numbers of intrapartum stillbirths recorded in GAR, there is paucity of research on the factors that contribute to these intrapartum stillbirths and this gap needs to be filled. The main problem which formed the basis of this study was thus the persistence of huge number of intrapartum stillbirths in GAR and poor understanding of the factors that contribute to

these numbers despite the numerous interventions to improve birth outcomes, access to skilled birth attendants, abundance of health facilities and the relative urban nature of the GAR. A clear understanding of the factors that contribute to these intrapartum stillbirths will facilitate the development of interventions to inform policy, programme and practice to reduce preventable intrapartum stillbirths. The outcome of this study will serve as a basis for future research on preventable stillbirths in GAR.

1.3 Research questions

The study was conducted to answer the following research questions:

1. What are the maternal, fetal and service delivery factors that contribute to intrapartum stillbirths?
2. What are the perceptions of women with histories of intrapartum stillbirth about causes and prevention of stillbirths?
3. What do health professionals perceive as contributory factors and preventive measures for intrapartum stillbirths?
4. What model can be used to predict intrapartum stillbirths in singleton pregnancies?

1.4 Study Objectives

The main objective of the study was to investigate contributors and predictors of intrapartum stillbirths in singleton pregnancies. The specific objectives were:

1. To examine maternal, fetal and service delivery factors that contribute to intrapartum stillbirths
2. To explore the perceptions of women with experience of stillbirth about causes and prevention of intrapartum stillbirths.

3. To assess the perceptions of health professionals about the causes and prevention of intrapartum stillbirths.
4. To develop a model to predict intrapartum stillbirths in singleton pregnancies

1.5 Significance of the study

Ghana has not seen much reduction in the incidence of stillbirths in the past three years and adverse intrapartum events are among the three major causes of neonatal deaths (Ghana Health Service., 2017a). Although intrapartum fetal deaths constitute about 40% of the total stillbirths in Ghana and similarly in GAR , the contributory factors and predictors are poorly understood because they have not been extensively studied and documented. The challenge of persisting huge numbers of stillbirths in GAR without a clear understanding of the causal factors justifies the need for this study. Studies that have documented causes and contributors of stillbirths have focused mainly on the magnitude of the contribution of each factor. The significance of this study is the development of a model of predictors of intrapartum stillbirths taking into account maternal, fetal and health system factors that work independently or together to cause intrapartum stillbirths. Significantly, the perceptions from the women with previous experiences of intrapartum stillbirths will throw more light on the phenomenon of intrapartum stillbirths in GAR. The findings from the study would contribute to the development of context-specific interventions for the prevention of stillbirths (Zulfiqar A. Bhutta, Darmstadt, Haws, Yakoob, & Lawn, 2009) and form the basis for future studies. Although the quality of care was not assessed, the study would contribute to the literature on pregnant women's perception about the quality of care they receive during labour which could be used during the development of improved intrapartum care (Dickson et al., 2014).

The health system gaps identified would form the basis for the development of contextualized scalable interventions (Z. A Bhutta et al., 2014) for Ghana and the lessons learned from the study would form the basis for policy formulation on intrapartum stillbirths in Ghana and other developing countries.

1.6 Conceptualization of stillbirth

Research philosophy addresses the beliefs, values and principles on which a research is built (A. Aliyu, Musa Singhry, Adamu, Mu 'awuya, & Abubakar, 2015). There are conceptual issues in this study that underpin adherence to ethical principles relating to the understanding of reality (ontology); knowledge (epistemology) and value enquiry (axiology) which are relevant to this study. The conceptual issues are drawn from the research paradigm and appropriate methodologies, discussed in the next chapter, and they form the basis for the conceptual framework (A. Aliyu et al., 2015).

1.6.1 Ontology

The axiological perspective of a research paradigm is aimed at depicting the level of consistency, reliability or otherwise reconstructing or extending the previously held theories or construction The principle of ontology applied in this study refers to recognizing the fetus that is 28 weeks or more gestation, like a fetus that is viable and capable of surviving outside the mother's womb. The WHO classifies stillbirth using 28 weeks gestation as cut off to show that such a fetus will survive outside the womb in HICs as well as in LMICs. The study also recognizes that a woman who carries her pregnancy to 28 weeks gestation would have gone through the discomforts of early stages of pregnancy including vomiting and anxiety of losing her pregnancy: thus, would look forward to a healthy live baby. The study recognizes that a singleton has a higher chance of survival

compared to fetuses in multiple pregnancies; that science has evolved to the extent that babies who are delivered at 20 weeks gestation survive when they receive appropriate care. The study also appreciates the fact that midwives and doctors have the requisite skills and knowledge to identify women with complications in labour and intervene appropriately to avert poor outcomes such as intrapartum stillbirths.

1.6.2 Epistemology

Epistemology is the study of how we know the things we know and defines what it means to be human because that is our special feature as human beings (Kivunja & Kuyini, 2017). The epistemological basis of this study is derived from extensive study of previous work published in the literature by researchers on perinatal death; stillbirth and intrapartum stillbirth as well as unpublished reports on similar topics.

1.6.3 Axiology

Axiology or value-enquiry is concerned with the ethical issues that have to be systematically addressed by the researcher when he/she is planning a research proposal; to ensure that participants are not coerced, harmed or exploited during the research (Kivunja & Kuyini, 2017). Axiology ensures minimal physical; psychological; legal; social and economic risk to the participants. Axiology also requires rigour which implies validity and reliability. This study ensured that ethical issues were properly addressed: these are discussed in chapter 3 on methodology. The study took steps to address the sensitive nature of mothers talking about their loss by making the services of a clinical psychologist available at all times during the interviews at no cost to the mothers. This was done to cater for any woman who would breakdown when talking about her baby who did not survive after going through labour.

1.7 The Conceptual Framework

The purpose of the conceptual framework in this study is to provide a vivid pictorial view of the various contributors to intrapartum stillbirth and show how the factors either work together or individually to contribute to the delivery of intrapartum stillbirths. The various variables were derived from extensive review of literature on similar topics and the three delays model by Thaddeus and Maine. The three-delay model refers to the length of delay encountered by pregnant women as they access appropriate care (Calvello, Skog, Tenner, & Wallis, 2015). The first delay relates to the woman's decision to access care. This may be influenced by several factors including the inability to recognize danger signs. The second delay relates to the identification of an appropriate health facility and transportation system to get there. The third delay relates to the care received at the health facility when the woman finally gets there (Musafili et al., 2017). Any delay encountered during emergencies which delay access to optimal care by pregnant women lead to maternal and fetal deaths (Martins et al., 2019).

The conceptual framework in this study is based on the premise that the causes of intrapartum stillbirth are multifactorial and that intrapartum stillbirths are affected by delays in access to appropriate care during pregnancy, labour and delivery (Martins et al., 2019). Therefore, reduction in intrapartum stillbirth can effectively be achieved if the linkages are well understood to inform the development of interventions for policy, programme and practice. The conceptual framework thus depicts maternal; fetal; environmental and health service factors that contribute individually or through other factors to lead to intrapartum stillbirths. Without a clear understanding of how the various factors work and finally lead to intrapartum stillbirth, it would not be possible to develop context-specific interventions based on reality (Martins et al., 2019). The interventions based on reality can then be

implemented at all levels of care to address specific gaps. Maternal demographic characteristics such as educational background and socio-economic status (SES) and valid national health insurance card affect her use of the health facility for antenatal and delivery services (Musafili et al., 2017). Her attendance and subsequent participation in health education sessions influence her knowledge and awareness of complications in pregnancy and preparedness to respond in cases of emergency. Non-attendance at ANC has been identified to contribute to poor pregnancy outcomes including stillbirth (Musafili et al., 2017). The mother's educational level, economic status and traditional practices affect the kind of cooking fuel used in the household. The use of solid fuel for cooking is associated with household air pollution which affects the growth of the fetus and negative pregnancy outcome including stillbirth (Ashish et al., 2016; Lakshmi et al., 2013). Health service gaps such as lack of trained staff and logistics lead to delay in service provision which can lead to intrapartum stillbirth (Martins et al., 2019). The various health service factors coupled with maternal factors can cause undue delay in the woman accessing care and the health facilities also providing care at the right time.

1.7.1 Theoretical Model

Thus, the theoretical model underpinning the study is the 3 Delays model which has been used extensively in the study of maternal mortality and near misses.

There are several reasons why pregnant women choose to attend or not to attend ANC; deliver with a skilled birth attendant or with a TBA and follow up with a postnatal clinic (PNC) or refuse to attend the PNC. In most instances, women attend ANC because they want to stay healthy and have healthy babies at the end of their pregnancies (Titaley et al., 2010). However, there are other factors that influence the use or nonuse of health facilities

by pregnant women including staff attitude; traditional beliefs and practices; religious beliefs and presence of alternative care providers such as TBAs. Other factors such as access to funds: awareness about the range of services in a particular health facility, knowledge about complications and how to respond appropriately affect the use of health facilities (Martins et al., 2019). Maternal factors such as maternal age; place of residence; mother's occupation and gestational age at the start of ANC influence selection of place of delivery (Boah, Mahama, & Ayamga, 2018). The presence of such influencers can delay a pregnant woman's decision to access needed care.

Health system factors such as access to a skilled professional during labour and delivery, non-availability of logistics and supplies, availability and affordability of services and access to timely quality emergency care influence birth outcomes. Delay in pregnant women seeking care and delay in health providers instituting appropriate care, including delivery through caesarean section lead to poor birth outcomes including stillbirth. Such delays have been well presented to depict the stages of delays from the home through to the health facility in the 3 Delays model. Although the 3 delays model has been applied mainly to maternal health and maternal mortality, the same delays can lead to poor birth outcomes for the newborn. This is because the baby's survival is intricately linked to the survival of the mother. Therefore, anything that delays access to quality care for the pregnant woman intrapartum invariably leads to delay in care for the unborn child during the same period.

The factors in the conceptual framework show their relationships to each other and how they finally contribute to intrapartum stillbirth. Antenatal care is a critical component for education, assessment of the pregnant woman and provision of interventions throughout pregnancy until she gets into labour. However, attendance at ANC is influenced by

sociodemographic and economic factors such as marital status and access to funds. Registration with health insurance (HI) removes the financial barrier to care to a large extent; thus, the lack of health insurance can lead to delay in accessing care which in turn can lead to poor fetal oxygenation and death. Maternal diseases such as syphilis, diabetes mellitus and malaria have an effect on the fetus including large baby, intrauterine growth restriction, congenital abnormalities, preterm delivery, low birth weight and asphyxia. All these fetal conditions affect the oxygen supply and placental perfusion leading to intrapartum stillbirths. Household air pollution (HAP) affect the fetus in-utero and lead to the low birth weight which can lead to fetal death through poor oxygenation and fetal death or lead directly to intrapartum stillbirth.

A well functioning health system is essential in ensuring the survival of pregnant women and their babies. Gaps in the various areas required to provide optimal care contribute significantly to poor birth outcomes including intrapartum stillbirth. The main pathway leading to fetal death is seen in delay in providing appropriate care to the pregnant woman; including access to emergency services.

The various contributory factors depicted in the conceptual framework figure were measured either quantitatively or qualitatively as shown in Table 1.1.

1.7.2 Conceptual Framework

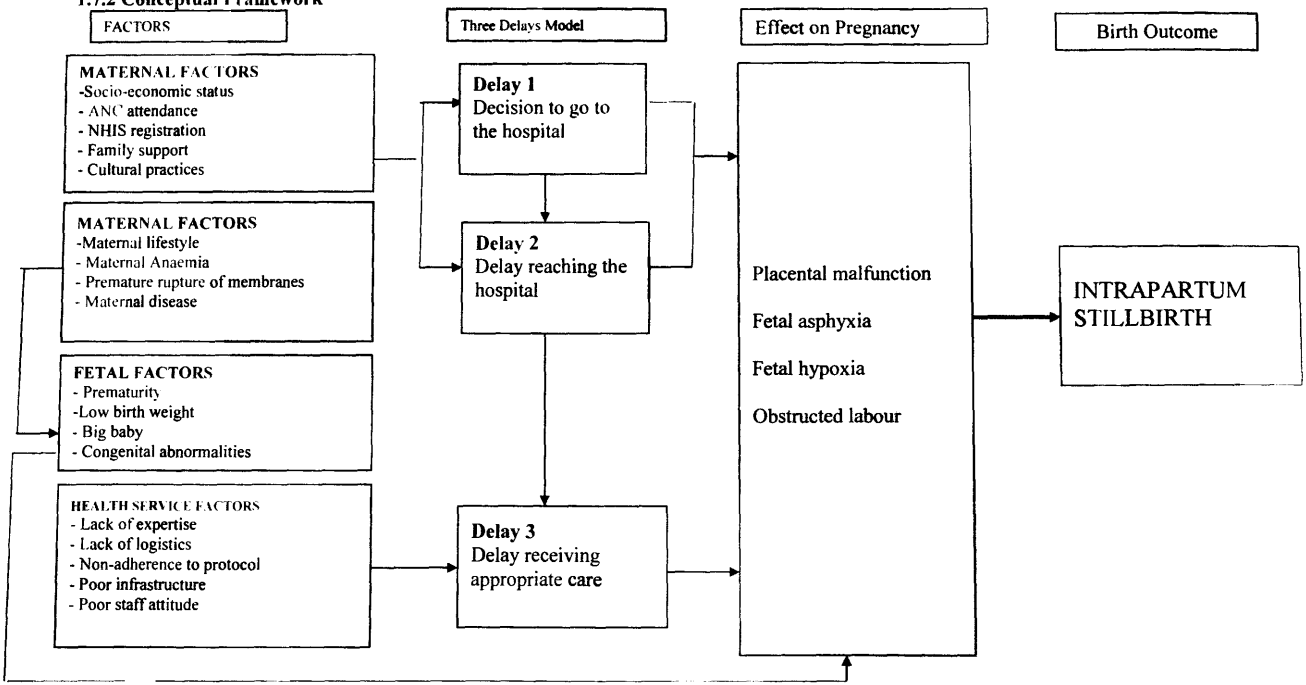

Figure 1.1: Conceptual framework, developed by PI

Table 1.1: Factors measured quantitatively and qualitatively

Factors measured quantitatively	Factors measured qualitatively
Maternal age	Awareness of complications in pregnancy
Maternal occupation	Response to complications
Marital status	Herbal use in pregnancy
Place of residence	Type of cooking fuel used
Educational background	Alcohol use in pregnancy
ANC attendance	Maternal history of stillbirths/neonatal deaths
Anaemia in pregnancy	Logistics and equipment availability
Maternal infections	Availability and adherence to protocol
Presence of maternal illness (hypertension, diabetes, syphilis, malaria)	Availability of medicines, blood and blood products
Previous history of stillbirth or neonatal death	Health staff availability
Premature rupture of membranes	Health staff capacity
Mode of delivery	Staff attitude
Skilled attendant at birth	Incentives for health professionals
Gestational age	Professional background of health staff
Birth weight	Client waiting time
Congenital abnormalities	Care during labour and immediate postnatal period
	Referral system
	Theatre space and bed availability
	Monitoring and evaluation
	Perinatal death auditing
	Contributions from stakeholders

1.7.3 Definition of terms used

Maternal age: this was categorized into below 35 years and above 35 years

Maternal occupation: this was categorized into unemployed, non-formal and formal employment

Marital status: this was categorized into married or co-habiting and unmarried or single

Place of residence: this was categorized into urban and rural

Educational background: this was categorized into none, primary, junior high school, senior high school and tertiary based on when the woman ended her education

ANC attendance: defined as attendance at the antenatal clinic. They were categorized into less than or more than four times

Anaemia in pregnancy: this was defined as a haemoglobin level below 11gm/dl.

Maternal infections: this referred to infections existing before pregnancy or acquired during the pregnancy such as syphilis and malaria

Presence of maternal illness: this referred to pre-existing and diseases acquired during pregnancy such as hypertension and diabetes

Previous history of stillbirth or neonatal death: this was defined as the outcome of a previous pregnancy in which the baby was born dead or the baby was born alive but died within one month of birth

Premature rupture of membranes: this was defined as a pregnancy in which the woman started losing liquor before 37 weeks gestation

Mode of delivery: this was defined as the channel through which the baby was delivered. This was categorized as assisted (such as caesarean section) or spontaneous vaginal delivery

Skilled attendant at birth: this was defined as the professional background of the health professional who assisted the woman to deliver the baby

Gestational age: this was categorized into preterm (before 37 weeks) and term (after 37 completed weeks) determined by the woman's last menstrual date or based on clinical assessment of the baby

Birth weight: this was categorized into low birth weight (<2.5kg) and normal birth weight (>2.5kg)

Congenital abnormalities: this was defined as physical evidence of abnormality which was present at the time of birth. This was categorized as a present or absent congenital abnormality

Herbal use in pregnancy: this was defined as women who used herbal preparation (in any form) during the antenatal period

Type of cooking fuel used: this was defined as the source of fuel used for cooking in the household

Alcohol use in pregnancy: defined as the woman drinking alcohol during the antenatal period

Logistics and equipment availability: defined as the presence and functioning of equipment and logistics needed for the provision of care to pregnant women

Availability and adherence to the protocol: defined as the presence and use of required protocol as per the policy of the Ghana Health Service such as the partograph

Availability of medicines, blood and blood products: defined as the presence and easy access to optimal quantities of medicines, blood and blood products for use at the time when they are needed

Health staff availability: defined as the presence of a required cadre of staff at the time when required to attend to a pregnant woman

Health staff capacity: defined as the ability of the health professional to perform a professional task at the time when that skill is required

Staff attitude: defined as the behaviour of the health professional when providing care to a pregnant woman

Incentives for health professionals: defined as the additional monetary or non-monetary provision made to a health professional in addition to the regular means of remuneration (salary paid at the end of the month)

The professional background of health staff: defined as the professional training and qualification of the health professional.

Client waiting time: defined as the period between the time the pregnant woman arrived at the hospital and when she was given professional care.

Referral system: defined as the system in place to move a pregnant woman from one level of care to another level to receive appropriate care

Intrapartum monitoring: defined as the process used to continuously assess and track the progress of labour and the conditions of the woman and the baby to promptly identify deviations and provide required intervention before the baby is born.

Perinatal death auditing: defined as the process of using the perinatal death audit tool developed by Ghana Health Service to audit all stillbirths reported in health institutions

Contributions from stakeholders: defined as suggestions and proposals that health professionals and non-health professionals can contribute to possible solutions to reduce stillbirth

Theatre space: defined as surgical theatre in the hospital equipped to perform caesarean section

Bed availability: defined as number of available/unoccupied beds to be allocated to pregnant women when they report in labour

Monitoring and evaluation: defined as continuous assessment of labour and delivery by skilled birth attendant using approved protocols

1.8 Thesis structure

The thesis is presented in six chapters. Chapter one discusses the background information to the study, the research objectives and research questions and how the study would contribute to policy. The chapter also shows the conceptual framework which depicts the relation between the various independent variables and the dependent variable which is intrapartum stillbirth and the conceptualization of stillbirth. Chapter two is about literature review, conceptual framework, the global call to action and Ghana's strategy for reduction of newborn deaths. Chapter three is dedicated to the methodology of the study and covers methods of data collection, the research design, the epistemology and study sites. Chapter four is focused on the presentation of the research findings. Chapter five is dedicated to the discussion of the findings and this relates to the results to findings from researches in similar domains. Finally, chapter six is focused on conclusions and recommendations from the study and how these could be used to inform policy and develop interventions to reduce intrapartum stillbirths.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on global and country perspectives on stillbirth and factors that contribute to intrapartum stillbirths. The aim of the chapter is to throw light on the major maternal, fetal, health service delivery, socio-cultural, economic and environmental factors that significantly contribute to intrapartum stillbirths. The chapter thus examines existing literature on contributions of the various factors to intrapartum stillbirth as a birth outcome and brings out the conceptualization of stillbirths with focus on what is already known as well as existing gaps regarding the phenomenon of intrapartum stillbirth. These factors form the basis for the conceptual framework of the study.

The chapter also examines existing systems for the provision of maternal and newborn health care in Ghana in the context of the Safe Motherhood programme and the Ghana Newborn Health Strategy and Action Plan and how they relate to the prevention of intrapartum stillbirth. Intrapartum stillbirth in GAR is discussed as part of the performance in maternal and newborn health in GAR. The latter part of the chapter looks at health models that have an influence on fetal survival as well as the reality (ontology) and understanding of knowledge (epistemology) as they relate to the study. The final part of the chapter reviews existing models for predicting intrapartum stillbirths.

2.2 Search methodology

A comprehensive search strategy was developed and regularly reviewed for the electronic databases Medline, Google Scholar and PubMed for the time period 2000 to 2018 using English only text from peer reviewed journals. The search terms *predictors* and *intrapartum*

stillbirth, intrapartum fetal death, singleton pregnancy, gestational age equal or greater than 28 weeks were used to locate articles relevant to this study. Due to lack of academic articles specifically on predictors of intrapartum stillbirths in singleton pregnancies, the search strategy was broadened using terms such as stillbirths, adverse pregnancy outcomes, perinatal deaths, perinatal death audits, causes of stillbirth and contributors to stillbirths to identify relevant studies for inclusion in this study. Case control studies, descriptive studies, published and unpublished reports and reviews which which were relevant based on definition of intrapartum stillbirth, age of pregnancy and singleton pregnancy were selected and included in this study.

Abstracts and full text articles were reviewed to determine their relevance for inclusion. There was no interaction with authors for further clarifications. The reference lists of studies identified through the search strategy were checked for additional relevant studies and these were also reviewed. The programme of work for Ministry of Health, Ghana Health Service, annual reports for Ghana Health Service, Greater Accra Regional Health Directorate and World Health Organization reports were also reviewed and relevant portions selected for inclusion in this study.

2.3 Global perspective of stillbirths

2.3.1 Global overview

Most pregnancies progress normally and end in the delivery of live babies and the mothers stay healthy; however, between 2/1000 (high income countries) to 47/1000 (low income countries) end in stillbirths either before labour (antepartum stillbirth) or during labour (intrapartum stillbirth) (Lawn et al., 2016; Menezes et al., 2009). Stillbirth, a devastating birth outcome, occurs in 2.65 million births annually worldwide, but it has not received

international prominence; it has not featured in global agenda and its wider ramifications have not been analytically studied (Burden et al., 2016; Lawn et al., 2010). The lack of focus; studies and appropriate documentation of the cause of death on stillbirth occur in both developed and developing countries (Edmond et al., 2008; Gordon et al., 2013). The estimation of the various causes of stillbirth has been hampered by the multiplicity of existing classification systems and unreliable data capture. Despite these weaknesses, maternal infections such as malaria and syphilis; non-communicable diseases; nutrition and lifestyle; maternal age >35 years and postdate pregnancies are modifiable maternal conditions that contribute to stillbirths (Lawn et al., 2016). Fetal causal channels commonly include reduced function of the placenta which contribute to intrauterine fetal growth restriction, preterm delivery and stillbirths (Lawn et al., 2016). Stillbirth in Sub Sahara Africa is almost 10 times (28/1000 births) the rate observed in developed countries (3/1000 births) and the annual rate of reduction in stillbirth is lower (0.7%) in developing countries compared to developed countries (3.8%) (WHO, 2015). Additionally, the rate of reduction is slower compared to the reduction in maternal mortality and the global attention accorded maternal and infant morbidity and mortality far outweigh the attention given to the issue of fetal loss thus making stillbirth almost non-existent (Lawn et al., 2016).

2.3.2 Global Interventions

Globally, every country has to achieve a target of 12 stillbirths or fewer /1000 total deliveries by 2030. Although 94 HICs/upper-middle-income countries reached their target by 2015 (MDG target year), 56 countries in LIC have to double their efforts to reach their targets (Lawn et al., 2010; Yakoob et al., 2009).

The annual 1.3 million intrapartum stillbirths recorded globally are associated with a lot of psychosocial and economic cost to families and nations that suffer stillbirths. Parents of stillbirths experience psychological symptoms that often persist long after the death of their babies. Globally, 4.2 million women with a history of stillbirth are living with depression (Lancet, 2016), therefore, respectful maternity and bereavement care would help such families to recover faster from their grief. Culturally perpetrated stigma and taboos further exacerbate trauma for families, and fatalism impedes stillbirth prevention. The stillbirth rate is a sensitive indicator of the level of quality and equity of health care. Since the multi-stakeholder initiative, Every Newborn Action Plan (ENAP), includes action on stillbirths with targets set for 2030, plans for prevention of stillbirths should be integrated into other programmes to foster sustained progress (Lancet, 2016). In the same vein funding for stillbirth needs to follow the pattern for maternal and child health care since such funding inputs lead to a quadruple return on investment by preventing maternal and newborn deaths, stillbirths and improving child development.

Despite the relatively huge global burden of stillbirths, there is poor funding for research and persistence of stigma; taboos and weak bereavement care and support. Stillbirths did not feature in the MDGs and the topic is still not included in the Sustainable Development Goals targets and indicators (Kelley, Rubens, & Gapps Review Group, 2010; Lancet, 2016). Strong leadership worldwide is critical to put stillbirth on the global agenda and the global community on stillbirth needs to utilize every opportunity to include stillbirths in the individual national and organizational agenda (Lancet, 2016). According to Froen et al, (2016), all institutions leading global efforts for mothers and babies must use their leadership positions to encourage healthy and safe pregnancies to reduce stillbirths.

The eight Millennium Development Goals (MDGs) which ended in 2015 were adopted during the largest-ever gathering of Heads of States at the United Nations in New York in 2000 and the aim was to combat poverty and accelerate human development. MDG 4 focused on children and it sought to reduce by 2/3 the child deaths between 1990 and 2015. Various researchers have made reference to the inability of countries, including Ghana, to achieve the MDGs (Frost & Forrest, 1995; Macassa et al., 2012; Zere, Kirigia, Duale, & Akazili, 2012). The failure was attributed to the high numbers of perinatal and neonatal deaths; lack of visibility in global policies and poor documentation; as low as 2% of all stillbirths are reported through vital registration (Lawn et al., 2010). The post-2015 agenda thus presents opportunities for all stakeholders to act together to end all preventable deaths, including stillbirths (de Bernis et al., 2016). Stillbirths are still concealed and intrapartum stillbirth prevention does not feature in child survival interventions (Kidanto, Massawe, Nystrom, & Lindmark, 2006). A lot of pregnancy improvement interventions are focused on reducing maternal deaths but the HIV prevention meant to improve child survival, will not significantly reduce stillbirth (Chi et al., 2007). Advocacy, policy formulation, monitoring, and research are specific actions which need to be developed for stillbirth prevention. In addition to the above, health systems must be strengthened to improve documentation and data management on stillbirths to show effective coverage of proven interventions for prenatal and intrapartum survival (Froen et al., 2016).

2.4 Models for predicting intrapartum stillbirth

Intrapartum stillbirth is a heartbreaking experience that affects about 1.3 million women every year leaving them with various psychological effects including depression. In developing countries, there are very few studies that have identified the reasons for the huge losses that occur every year and more and more women continue to suffer. One of the

objectives of this study is to develop a model to predict intrapartum stillbirth, this prognostic tool will be validated in future research to determine the validity and reliability as a working tool in poor resource countries.

Prediction models are useful tools designed to assist health care providers to determine the possibility or threat that a particular disease or health condition is present (diagnostic models) or that a particular incident will occur in the future (prognostic models). This helps the health care providers in their decision making in the care of their clients (Collins, Reitsma, Altman, & Moons, 2015). A search of the literature revealed that there are studies on the prediction of antepartum stillbirths. The study by Mastrodima et al (2016) used a model to predict antepartum stillbirths based on maternal biochemical and biophysical factors. They reported that more than half of stillbirths due to poor placentation could be predicted in the first trimester based on maternal factors and biomarkers. In a follow-on study, Yerlikaya et al (2016) screened 113,415 women with singleton pregnancies. They reported that one-third of all stillbirths could be predicted within the first trimester based on maternal characteristics and history. The two studies were conducted within the same population in the United Kingdom, however, there is a paucity of data on models to predict intrapartum fetal deaths after 28 weeks gestation in singleton pregnancies which can be used in LMICs where the majority of stillbirths are recorded. In one study with 11 stillbirths (cases) and 829 live births (controls), maternal plasma angiogenic index-1 less than the 2.5th centile (0.126) at 24–28 weeks of gestation was found to contribute to 29 fold increase in the risk of subsequent stillbirths (Chaiworapongsa et al., 2017). Such examinations are not carried out routinely in Ghana and thus relying on such a model to predict intrapartum stillbirth would be challenging. The study also looked at stillbirths at 24-28 weeks which are lower gestation than the definition of stillbirth used in this study since such babies have

much lower chances of surviving in LMICs compared to babies at/after 28 weeks gestation. The study by Yerlikaya et al, (2016) which tested a previously designed and tested model for predicting stillbirth using maternal demographic characteristics and aspects of her history focused on antepartum stillbirths and the gestational age was up to 24+6 weeks. The findings from such a study cannot be extrapolated to cover intrapartum stillbirths since the rate of intrapartum stillbirth is associated more with the level of quality of intrapartum care than the rate of antepartum stillbirths (Robert et al., 2007). In a study by Kayode et al. (2016), the model they developed and tested enrolled stillbirths at 20 weeks gestation in an African Country where babies at this gestation have very low chances of survival compared to babies in developing countries.

Their study did not differentiate between the performance of the tool in predicting intrapartum and antepartum stillbirths and there was no indication of whether they were singletons or included multiple pregnancies. These models could be tested for their transparency and validation using the Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis (TRIPOD); but that is beyond the scope of this study because it was not designed to test an existing predictor model, although one of the objectives of this study is to identify predictors that can be included in a model to predict intrapartum stillbirth (prognostic).

2.5 Risk factors and Causes of stillbirth

Risk is the probability of (frequently) a negative outcome occurring within a specified period of time and it usually denotes a quantifiable concept (Gale, 2018). Risk factors for stillbirth are not the actual causes but they are characteristics linked with stillbirth as a pregnancy outcome. There are other factors which actually lead to stillbirth as a pregnancy outcome

and these are referred to as the causes of stillbirth (Sharma, Salihu, Oyelese, Ananth, & Kirby, 2006). This study looked at Maternal, Fetal and Service- delivery related risk factors and causes that contribute to intrapartum stillbirths.

2.5.1. Maternal Factors

This section examines maternal biomedical and non-biological factors that contribute to intrapartum stillbirths. Maternal risk factors are characteristics of the mother which increase her probability of having a stillbirth. Some of these risk factors are modifiable and include advanced maternal age at the time of pregnancy; low socioeconomic status, maternal malnutrition, diseases during pregnancy, use of biomass fuel for cooking and poor access to health care. Other maternal characteristics are a low level of formal education, non-attendance at ANC, women not living with their partners, short intervals between pregnancies and prior stillbirth (Afulani, 2016; Ashish et al., 2016; Luque-Fernandez, Lone, Gutierrez-Garitano, & Bueno-Cavanillas, 2012). There are other disorders associated with stillbirths that are modifiable and also coexist such as maternal infections; non-communicable diseases; nutrition and lifestyle factors; maternal age older than 35 years and prolonged pregnancies intervals. Other causes of stillbirth are eclampsia, difficult labour consequent on malpresentation and breech presentation. It has been observed that although mortality may occur in instances of obstructed labour especially in primiparae, the loss of life varies directly with the skill of the birth attendant (Lawn et al., 2016). It has been found that a history of the previous stillbirth in a woman significantly increases the risk of further stillbirth in future pregnancies. The causal pathway for the repeat stillbirths involves reduced vascular support system which leads to poor development and function of the placenta. This situation affects optimal oxygen supply to the fetus leading to stillbirth (Yatich et al., 2010). Perinatal health is affected by both short and long birth intervals and

several hypotheses explain how this observation comes about. Short birth intervals lead to exhaustion of maternal nutritional stores since the woman is not able to recover from what she expended during the previous pregnancy and period of lactation before the next pregnancy. Maternal reproductive ability reduces when there is a long birth interval, and diseases that affect the mother also affect fertility and the health of the baby (Lancet, 2016). Maternal morbidity and mortality and fetal deaths are reduced when a birth is appropriately spaced (Barros et al., 2010)

The various risk factors form part of the variables in the current study. The factors are further discussed in the following sections with a focus on how they contribute to intrapartum stillbirth.

2.5.1.1 Maternal Non-Communicable Diseases (NCD)

The health and lives of the mother and fetus can be jeopardized when the mother has a pre-pregnancy chronic medical condition or when she develops the condition during pregnancy. Placental perfusion is reduced in the presence of conditions such as pre-pregnancy hypertension; pre-eclampsia and eclampsia which develop during pregnancy (develops in 6% of all pregnancies). The pathophysiology of poor perfusion leads to poor oxygen supply to the fetus, poor intrauterine growth, and stillbirth (World Health Organization, 2015). Pregnant women may have pre-pregnancy diabetes or develop diabetes mellitus during pregnancy and such women need special care because of the effect on both the fetus and the mother. Diabetes mellitus in pregnancy leads to hyperglycaemia which in turn causes complications in the mother and the fetus including multiple organ malformations through a very complex pathophysiological pathway (Negrato, Mattar, & Gomes, 2012). The life of

the fetus is compromised in the presence of other maternal conditions such as antepartum or intrapartum haemorrhage and rupture of the uterus (Haws et al., 2009).

2.5.1.1.1 Hypertension in pregnancy/Hypertensive disorders of pregnancy

In this study, hypertension in pregnancy and hypertensive disorders of pregnancy are used interchangeably. During normal pregnancy, the pregnant woman's heart output and blood volume increase, the veins open up (vasodilatation) and the blood pressure reduces: however, in about 5-10% of pregnancies the women develop hypertension. Hypertension in pregnancy (HIP) is defined as blood pressure reading of 140/90mmHg or higher after 20 weeks gestation (Garovic, 2000). Hypertension in pregnancy can also be defined as one time blood pressure reading of ≥160/110mmHg in a pregnant woman who was previousely normotensive (Muti, Tshimanga, Notion, Bangure, & Chonzi, 2015). Hypertensive disorders of pregnancy (HDP) are seen mainly in women of extreme ages, nulliparous women; low wealth quintile; multiple gestations and those with the previous history of hypertension in pregnancy. HDP is a leading cause of maternal and fetal morbidity and mortality throughout high income and LMICs. HDP is classified into four categories namely: (1) pre-eclampsia and eclampsia syndrome; (2) gestational hypertension, (3) pre-eclampsia superimposed on chronic hypertension and (4) chronic hypertension (Ministry of Health, 2014; Yatich et al., 2010). The pathogenesis of pre-eclampsia is not fully understood however, it is associated with derangement in placentation at the start of pregnancy, followed by widespread inflammation and progressive endothelial impairment (Gathiram & Moodley., 2016). The various categories are classified based on their manifestations as follows:

1. Pre-eclampsia and eclampsia – these entail hypertension with proteinuria or hypertension with multiple systemic changes without proteinuria. The systemic changes include decreased platelets, kidney dysfunction; liver dysfunction; lung problems; eye problems

with poor vision and brain disturbances. Laboratory tests done during HIP can lead to the identification of haemolysis; elevated liver function tests and low platelets (HELLP) but in some cases, women with HELLP syndrome do not have protein in the urine and the blood pressure is normal. Other significant problems include headache; right-sided upper abdominal pain and general swelling of the body (D'Amico, 2017). The clinical presentation of pre-eclampsia is not predictable because a woman with blood pressure reading depicting mild hypertension and little proteinuria can quickly progress to full-blown eclampsia with fits. Women who develop pre-eclampsia during pregnancy have a higher risk of developing pre-eclampsia in subsequent pregnancies. These characteristics of pre-eclampsia underscore the importance of critically monitoring the pregnant woman instead of describing her condition as mild or severe (D'Amico, 2017).

2. Gestational hypertension – this occurs for the first time in the middle of the pregnancy without protein in the urine. The blood pressure returns to normal within 12 weeks post-delivery: if hypertension persists after 12 weeks it is categorized as chronic hypertension. Health providers should not base their diagnosis on the 30/15 rule which uses 30mmHg rise in systolic and 15mmHg rise in diastolic pressure to make a diagnosis of hypertension since it does not support a good assessment of the prognosis in the women (D'Amico, 2017).

3. Preeclampsia superimposed on chronic hypertension – this is likely when proteinuria occurs after 20 weeks in a known hypertensive. In the case of a pregnant woman with proteinuria before 20 weeks, she experiences an increase in blood pressure reading or dosage of medication in previously well-controlled hypertension. She also shows signs of liver function impairment; decrease in platelets; headaches; pain in the upper abdomen and increased proteinuria (Task Force on Hypertension in Pregnancy, 2013). This classification is associated with serious complications such as cerebral haemorrhage and abruption placenta. It is not clear whether early treatment of hypertension prevents pre-eclampsia

(Garovic, 2000). Pre-eclampsia can also occur in the post-partum period after the woman has been discharged from the hospital (Task Force on Hypertension in Pregnancy, 2013). It is important to educate mothers on symptoms of this condition so that they can report promptly to the hospital for treatment to avert any mortality.

Chronic hypertension –in this category, the pregnant woman's blood pressure before pregnancy or before 20 weeks gestation is 140/90mmHg or more. The health provider should be careful in managing such women, the aim should not be to bring the blood pressure very low and they should not advise the women to stop eating salt (Garovic, 2000).

The adverse impact of hypertensive disorders on outcome of pregnancy, including intrapartum stillbirth has been studied for decades yet the hypertensive disorders continue to lead in the causes of maternal and perinatal deaths including intrapartum stillbirths. It is, therefore, reasonable to say that systems which enhance early diagnosis and institution of appropriate interventions by health providers within a functional health system will contribute greatly to the reduction of poor pregnancy outcomes associated with HDP (Ananth, Savitz, & Bowes, 1995).

2.5.1.1.2. Gestational diabetes mellitus / diabetes in pregnancy

Gestational diabetes mellitus (GDM) is defined as intolerance to glucose with diverse severity which starts or is diagnosed during pregnancy; it affects about 10% of pregnant women (Kaaja & Ronnemaa, 2008). Irrespective of the gestation, the first time hyperglycaemia is detected in a pregnant woman, it should be classified as gestational diabetes mellitus (GDM) or diabetes mellitus in pregnancy (DMiP) (World Health Organization, 2013). There is a difference between the two classifications which is worth noting; the hyperglycaemia in diabetes mellitus in pregnancy is more severe and persists

after pregnancy unlike in GDM. In that regard, there are criteria for the diagnosis of either GDM or DMiP.

The following set of criteria for the diagnosis of GDM is based on the World Health Organization (2013) guidelines. Diagnosis is made when one or more of the following is present in a pregnant woman:

- fasting plasma glucose 5.1–6.9 mmol/L (92–125 mg/dL)
- 1-hour plasma glucose 10.0 mmol/L (180 mg/dL) following a 75 g oral glucose load
- 2-hour plasma glucose 8.5–11.0 mmol/L (153–199 mg/dL) following a 75 g oral glucose load

The criteria for diagnosing DMiP (shown below) is different from criteria for diagnosing GDM (shown above). For example in the GDM, plasma glucose level is measured one hour after the loading dose whilst in DMiP the plasma glucose level used is that assessed after 2hours after the loading dose.

Diabetes mellitus in pregnancy (DMiP) should be made when one or more of the following are present:

- fasting plasma glucose 7.0 mmol/L (126 mg/dL)
- 2-hour plasma glucose 11.1 mmol/L (200 mg/dL) following a 75 g oral glucose load
- random plasma glucose 11.1 mmol/L (200 mg/dL) in the presence of diabetes symptoms.

The pathophysiology of GDM is related to the huge pancreatic defect in β cell performance leading to a steady inability of insulin to respond appropriately to nutrients in these pregnant women (Kaaja & Ronnemaa, 2008) Poor pregnancy outcomes in women with both GDM

and DMiP include: baby who is too big for gestational age (macrosomia), pre-eclampsia/hypertensive disorders in pregnancy and baby's shoulder getting stuck and hard to deliver per vaginum (shoulder dystocia). These poor birth outcomes can be modified through a stepwise process of treatment which entails a change in lifestyle with food and exercise; oral medication to reduce blood sugar and the use of insulin during treatment. The macrosomia can lead to direct obstetric and neonatal complications including birth asphyxia and intrapartum fetal death.

2.5.2 Maternal Infections

Maternal infection in pregnancy can lead to stillbirth through a variety of mechanisms such as severe maternal illness, direct fetal infection, and placental function impairment. Maternal or fetal infections contribute to about 24% of stillbirths in developed countries with a higher estimation of stillbirths in developing countries attributed to infections (McClure, Dudley, Reddy, & Goldenberg, 2010). While this study did not give the contribution of specific infections, it is estimated that group B streptococcus infection contributes to 1% and 4% stillbirth in developed countries and Africa, respectively (Seale et al., 2017). The effect of maternal infection is related more with early (20–28 weeks) than late (after 28 weeks) stillbirths; this is similar to the relationship seen with birth weight (McClure & Goldenberg, 2009). This is significant because the study looks at fetuses at or after 28 weeks gestation. Therefore, the effect of infection as a contributory factor in this study may not be seen. More infection-related stillbirths occur at lower birth weights than in higher birth weights. Therefore, setting stillbirths at or after 28 weeks gestation or birth weight > 1000g will lead to under-reporting of infection-related stillbirths especially in developing countries. This is seen more in developing countries where health workers depend more on birth weight than gestational age: because some of the pregnant women are unable to give accurate menstrual

dates for calculation of gestational age and access to ultrasound services are limited. Maternal infections work through various pathways to determine birth outcomes; these maternal infections account for 50 per cent of stillbirths in developing countries and 10% – 25% in high-income countries (R. L. Goldenberg, Saleem, Pasha, Harrison, & McClure, 2016). In one pathway, the infection leads to systemic illness; high maternal fever and fetal demise without infection of the placenta or the fetus. In another pathway, the organism infects the placenta and diminishes the perfusion of the placenta but does not directly infect the fetus (McClure & Goldenberg, 2009). In other instances, the infection is transmitted to the fetus, directly, leading to organ damage and subsequently to fetal demise. Some of the most common maternal infections can lead to chorioamnionitis and thus fetal demise and in developing countries, Syphilis, Malaria, Gram-negative bacteria such as Klebsiella Pneumonia and E. coli cause significant numbers of stillbirths.

Intestinal helminths, including hookworms and *Trichuris trichura,* have been associated with anaemia because of the chronic blood loss that occurs during an infection and the anaemia leads to a state of chronic hypoxia. The hypoxic state is worsened during pregnancy when demands for oxygen increase due to the ongoing maternal and fetal metabolisms. In such instances, transportation of oxygen to the fetus is decreased and this affects the survival of the fetus (Yatich et al., 2010)

2.5.2.1 Syphilis

Syphilis is a sexually transmitted disease caused by the spirochete called *Treponema pallidum.* Infection rates among women within the reproductive age range between 0.02% in developed countries to 12% in developing countries (McClure & Goldenberg, 2009). At gestations > 14 weeks, the organism is able to cross the placenta to infect the fetus and the

risk of infection increases as gestation progresses. About 45% of infected fetuses die in utero while for fetuses born alive, 30-40% of them show signs of congenital syphilis. Reduced blood flow to the fetus is the major cause of death when placental infection occurs although death from direct fetal infection also contributes to the magnitude of these deaths. Syphilis contributes to 200,000 stillbirths annually through several pathophysiological changes such as villous enlargement, acute villitis, erythroblastosis, and necrotizing funisitis within the placenta leading to reduced blood flow and demise of the fetus. Syphilis can be cured and pre-pregnancy screening and appropriate treatment results in very good response and leads to delivery of normal babies (Chi et al., 2007; Mabey, Marks, Peeling, & Lawn, 2017; McClure & Goldenberg, 2009).

2.5.2.2 Malaria

Malaria is caused by one of the four Plasmodium parasites through the bite of an infected mosquito. In Ghana, malaria is caused mainly by *Plasmodium falciparum* through the bite of an infected female anopheles mosquito. The consequences of malaria in pregnancy are dependent on the type of malaria and the one caused by *Plasmodium falciparum* is associated with most stillbirths. In malaria-endemic areas, the impact of malaria in pregnancy on the birth outcome is a direct reflection of the degree to which the placenta is infected with malaria parasites as well as the level of anaemia in the pregnant woman (McClure & Goldenberg, 2009; Yatich et al., 2010). Research has shown that the pathway for the effects of malaria in pregnancy is multifactorial. According to McClure and Goldenberg (2009), when the placenta is infected, an inflammatory reaction takes place and this leads to accumulation of macrophages and lymphocytes, thickening of the trophoblast basement membrane and release of cytokines. This response to the placental infection hampers passage of blood through the placenta thus negatively affecting the fetus. Placental malaria leads to

increased risk of other complications to the mother such as maternal anaemia; HIV infection and maternal mortality. Fetal complications after placental infection include low birth weight, preterm delivery, anaemia, perinatal death and congenital malaria (Uneke, 2007). Other contributors to stillbirth are a history of stillbirth, sickle cell disease, and a high burden of infectious comorbidities (Yatich et al., 2010).

2.6 Other maternal factors

Pelvic examination is one of the most common examinations performed on pregnant women. In developing countries, this is done by midwives and doctors to assess the adequacy of the pelvis and to predict possible cephalopelvic disproportion (CPD) in cephalic presentations to determine the possibility for delivery through Caesarean Section (C/S). The successful identification of CPD and appropriate management through C/S reduces the risk of obstructed labour and thus intrapartum stillbirth (Haws et al., 2009). More research is, however, needed to give a clearer understanding of the pathophysiology of abnormal placentation and incorporate the findings into the design of screening tests for stillbirth, and assessment of interventions to prevent stillbirth in women whose screening test results come out positive (Volante, Gramellini, Moretti, Kaihura, & Bevilacqua, 2004). Countries have an obligation to adhere to ethical principles in their hunt for ways of predicting and addressing stillbirths.

In this regard screening tests and monitoring tools have to be validated for sensitivity, specificity and positive predictive value before they are accepted and approved as part of their national policy strategic plan (Haws et al., 2009). A strong ethical system will guard pregnant women and their babies from iatrogenic injury; and also foster the cautious use of

limited resources for health care delivery in low- and middle-income settings (Haws et al., 2009).

Researchers have reported differences in birth outcomes based on attendant at birth. It has been observed that compared to women whose deliveries were attended to by Medical Doctors, women whose birth attendants were midwives and traditional birth attendants had a lower risk of delivering stillbirth (McClure et al., 2011). On the contrary, a study conducted in New Zealand could not determine any association between stillbirth and deliveries by midwives compared to deliveries by Doctors. However, they reported more adverse events such as intrauterine hypoxia in deliveries conducted by midwives compared to those conducted by doctors (Wernham, Gurney, Stanley, Ellison-Loschmann, & Sarfati, 2016).

Maternal obesity has been found to be associated with greater risk of stillbirth, although the mechanisms to explain this association are not very clear (Chu et al., 2007; Leddy, Power, & Schulkin, 2008). Other causes which have been identified to be associated with intrapartum fetal deaths include wrong initial diagnosis and poor/inappropriate clinical management of complications of women during labour (Nappi et al., 2016). Other researchers have reported that complications that occur during the development and embedding stages of the placenta invariably lead to placental insufficiency; fetal growth restriction and subsequently stillbirth. Oligohydramnios has been linked to pre-eclampsia; premature rupture of membranes; fetal growth restriction; post-maturity; complications in fetal kidneys; as well as other fetal and placental abnormalities and subsequently stillbirth (Macintosh et al., 2006). All these conditions affect oxygen supply to the fetus and thus through such mechanisms lead to fetal demise. According to Wilson et al, (2008) the risk of

intrapartum stillbirth happens in a dose-dependent fashion and teenagers have the greatest risk.

There is extensive use of herbs during pregnancy among pregnant women especially in developing countries due to reasons such as perceived efficacy; cost-effectiveness and easily accessible alternative treatment to orthodox medicine (Adusi-Poku et al., 2015; Kennedy, Lupattelli, Koren, & Nordeng, 2013; Nakimuli, 2015). Some of the pregnant women who use these herbs do not know the harmful effects on the developing fetus (Fakeye, Adisa, & Musa, 2009) while others assume that they are safe to be used in pregnancy because of the long history of use of plant medicine in the treatment of diseases (Adusi-Poku et al., 2015). Recent research findings have cautioned that some of the plants used in the treatment of diseases and for food are harmful and may even cause cancer and mutations (Nakimuli, 2015). According to Nakimuli (2015), recent scientific results have revealed that many plants used as medicine and food are potentially toxic since they can be mutagenic and carcinogenic. Most orthodox healthcare providers, medical doctors; midwives and pharmacists do not have much knowledge of pharmacology, efficacy, safety margins and the possible drug interaction of the herbal medicines used by their clients in their countries (Fakeye et al., 2009).

2.7 Fetal Factors

This section looks at the fetal factors that contribute to intrapartum stillbirths reported in various studies as well as the existing gaps in understanding the phenomenon of stillbirths. The quest to identify fetal causes of stillbirth dates as far back as the 1900s. Although Cosbie in 1923 reported that anencephaly, spina bifida, hydrocephalus and extrophics contribute to fetal demise there is still a paucity of data on causes of stillbirth, especially in developing

countries. Sudden intrapartum emergencies and inadequate oxygen supply to the fetus lead to poor pregnancy outcome including stillbirth. Congenital anomaly, prematurity, fetal cord accidents, fetal growth restrictions, low birth weight and fetal malpresentation contribute to intrapartum stillbirths (Fretts, 2007; Gandhi, Chaudhari, & Thakor, 2016; McClure, Saleem, Pasha, & Goldenberg, 2009). While some researchers have reported that congenital anomalies contribute to about 5% of stillbirths in developing countries and 7% in developed countries (Kurinczuk et al., 2010; Lancet, 2016), other studies have reported similar findings but with higher rates. Frey et al. (2014) reported that fetuses with an isolated congenital anomaly had a 15-fold increased risk of stillbirth after adjusting for maternal obesity, pregestational diabetes, and black race. The same study reported that the stillbirth rate was even higher when pregnancies are complicated by both a congenital anomaly and fetal growth restriction.

Intra-Uterine Fetal Growth Restriction (IUFGR) which results from poor placenta function is a contributory factor to perinatal mortality and complications of prematurity. Additionally, fetal cord accidents lead to the destruction of the placenta resulting in poor oxygen supply to the fetus. The resultant poor fetal oxygenation from the various fetal factors lead to fetal organ damage which is the final common pathway for many stillbirths (Goldenberg & McClure, 2009). These processes in addition to causing stillbirth, lead to neonatal death, or physical and developmental disabilities in the children who survive (Haws et al., 2009). Babies weighing 4,500 gm or more at birth are also at higher risk of being stillborn compared to babies below 4,500gm due to the prolonged and difficult labour and associated intrapartum hypoxia. However, the single major risk factor for stillbirth remains missed (inability to diagnose) fetal growth restriction during the antenatal period (Cung, Paus, Aghbar, Kiserud, & Hinderaker, 2014; Gardosi et al., 2013)

2.8 Health Service Delivery Factors

2.8.1 The Health Sector

The health sector is very important in the planning, development, implementation, monitoring as well as evaluation of interventions to ensure good pregnancy and delivery outcomes. The World Health Organization has determined that at least four well-spaced antenatal visits will contribute towards good pregnancy outcomes. However, the timing of a woman's first antenatal care visit may not be an important determinant of stillbirths in isolation (Beauclair, Petro, & Myer, 2014). The antenatal clinic is used for the assessment of pregnant women and their fetuses, provide relevant interventions and facilitate timely referral to facilities that are appropriately equipped to provide operative delivery or other interventions for complications prior to or during labour. Inappropriate use of screening and monitoring techniques such as ultrasonography during antenatal and the intrapartum periods could inadvertently lead to avoidable perinatal deaths. Such situations happen when the technique itself could be harmful or because it leads to increased risk of unsuitable or needless use of medications, induction of labour, early delivery, or caesarean section (Haws et al., 2009); this can happen when ultrasound is used by unskilled people. The intrapartum stillbirth rate is a sensitive marker of the quality of care the health system provides to women and babies during labour (Lancet, 2016). A composite global stillbirth classification system, perinatal deaths audits and improved data management will guide and enable tracking of the content and quality of antenatal and intrapartum care (Lancet, 2016). Prompt access to emergency quality care during labour is a decisive sensitivity test of the entire health system to address the health needs of women during labour (Kongnyuy, Hofman, & van den Broek, 2009).

The relatively high numbers of intrapartum stillbirths recorded in LMICs compared to fewer numbers in HICs is a reflection of the inappropriate, delayed or sometimes absent essential obstetric care which women in labour face in developing countries. This shows that access to prompt quality care, including referral during labour can prevent intrapartum stillbirths (Carlough & McCall, 2005; Darmstadt et al., 2009). The health systems can influence the allocation of resources at the national and local levels to improve access to quality of care especially for women at greatest risk of having intrapartum stillbirths, such as those at extremes of age, pregnant unmarried women, illiterate and multiparous (Zhu et al., 2016). The role of the health sector discussed above shows that theoretically, proper management of maternal, fetal risk factors and early detection and management of complications in pregnancy and during labour within a vigorous national health system will avert a large proportion of stillbirths (Haws et al., 2009).

The health system plays a key role in the quality of services women and fetuses receive during the ANC, labour, delivery and postnatal periods and subsequently the outcome of pregnancies. A functional health system with access to emergency obstetric care will reduce poor pregnancy outcomes including stillbirths (Pattinson et al., 2011). Thus, the majority of stillbirths in LMICs and HICs would be avoided if they were linked to prompt access to quality emergency obstetric care. A functional health system is required to address issues such as postdate pregnancy, prolonged labour, maternal infections, proper intrapartum monitoring of fetus and mother since they can lead to hypoxia in the fetus and subsequent fetal death. According to The Global Strategy for Women's Children's and Adolescents' Health 2016 – 2030 (2015), weak referral, delayed access to timely appropriate care by skilled staff and inadequate emergency obstetric care at service delivery point especially in developing countries are the greatest risk of stillbirth. The contribution of the weak health

system to stillbirth has also been documented by other studies (Saleem et al., 2018). The outcome of pregnancies with complications is thus closely linked to the capacity and skill of the health worker who conducts the delivery and access to caesarean section. Human resource is a key component of a well-functioning health sector. In addressing intrapartum stillbirths, it is important to build the skills and capacity of midwives and doctors to enable them to provide quality care to the women and their babies at all times. Funding for innovative healthcare should commensurate with the quantity of work to be done to reduce preventable intrapartum stillbirths. (Lawn et al., 2010; McClure & Goldenberg, 2009; Yakoob et al., 2009).

2.8.1 Screening tools for monitoring fetal and maternal wellbeing

Monitoring of the mother and fetus during labour helps to ensure that labour progress and interventions are introduced at the right time for optimal care and good birth outcomes. Monitoring fetal wellbeing helps to identify fetuses at risk and intervene promptly to save their lives. There are relatively non-invasive techniques for screening throughout pregnancy and the intrapartum period. The screening tool monitors fetal movement; fetal heart rate; fetal growth; fetoplacental and uteroplacental circulatory dynamics. The technique can be used during routine antenatal care (ANC) visits or through more complex screening tests in high-risk and post-term pregnancies (Haws et al., 2009).

Despite the benefits of screening, admission fetal heart tracings are not recommended for a healthy woman when the pregnancy is at term and there are no evident risk factors. However, where there is evidence of the risk of poor perinatal outcome, electronic fetal monitoring is recommended (Liston, Sawchuck, & Young, 2007).

Intrapartum monitoring of women in labour using tools such as partogram is common in Ghana and the partograph has been recommended for use by midwives and obstetricians to record labour observations. The partograph, introduced in the 1970s in Zimbabwe by Philpott and Castle, is an important tool used by midwives and obstetricians to continuously record and monitor labour as well as maternal and fetal well-being with the aim of making a decision to intervene at the appropriate time (Souza et al., 2015) The partogram recordings provide a continuous pictorial overview of the progress of labour. It is believed that the use of partograph helps to identify when the action or intervention has to be implemented when the red line is crossed (Asibong et al., 2014). Despite the goal for which the partograph was introduced, researchers have not reported a single screening test that has been used to show a clearly significant reduction in stillbirth rates within the general population (Smith & Fretts, 2007). However, work done by Haws et al, (2009) showed that there was no significant difference in maternal or perinatal outcomes with the use of partograph versus no partograph use during labour. They also found that there was no evidence that any particular version of the partograph is better than another in preventing perinatal mortality. A similar finding was reported by other studies but they recommended that due to the widely accepted use of partograph to monitor labour, the continued use should be locally determined (Lavender, Hart, & Smyth, 2012).

2.8.2 Use of the information on causes of stillbirth

Although there are systems in place for monitoring pregnancy, labour, delivery and immediate postpartum periods for pregnant women and newborns, data management is poor in health facilities: especially in developing countries (Frøen et al., 2009). The lack of accurate information prevents the design and implementation of appropriate strategies to prevent stillbirths (Stillbirth Collaborative Research Network Writing, 2011). While the

research to identify causes of stillbirth started long ago in developed countries, there is limited research on stillbirth in developing countries where 98% of the world's stillbirths are recorded annually (McClure, Saleem, Jehan, Pasha, & Goldenberg, 2008). Findings from research contribute to a better understanding of stillbirth and the development of preventive or promotive interventions (Frøen et al., 2009).

Historically, demographers have not paid attention to stillbirth in their work because they perceive infant mortality as a more conventional indicator for measuring early human survival changes compared to stillbirths. Despite this lack of attention, the influences on and causal structures of neonatal mortality and stillbirths emerge as broadly similar, with a previous reproductive history linked to a considerable amount of variation (Reid, 2001). According to Iklaki et al (2012) stillbirth is more prevalent in un-booked teenagers than those booked for antenatal care as such proper documentation of data on stillbirth will lead to a better understanding of the causes of stillbirth and contribute to the implementation of interventions to reduce stillbirths. Stillbirth is a very traumatic pregnancy outcome which is also associated with various psychological problems. The huge psychological impact of stillbirth underscores the urgency to improve data capture and information management to inform research and focus attention and resources on interventions that address stigma (Burden et al., 2016).

2.8.3 Stillbirth screening tools

In resource-poor settings, appropriate treatment and referral of pregnant women can be improved if there is a system to facilitate an effective risk screening that is devoid of complex diagnostic equipment and can be used at all levels of care. The health sector can build the capacity of midwives and Doctors to ensure efficiency in the allocation of scarce resources

within the health facilities and the health sector in general (Haws et al., 2009). Countries can reduce intrapartum stillbirths by implementing and monitoring interventions to address socio-demographic contributors to stillbirth such as smoking and obesity. The health sector should facilitate quality and prompt auditing of all intrapartum stillbirths as well as analysis of data and use for decision making on prevention of intrapartum stillbirths. Where available bereaved parents should have access to a perinatal pathologist and placental histopathology (Lancet, 2016) to give them a clearer understanding of why their baby did not survive. The services of such Specialists will improve on intrapartum care since sub-optimal care during labour and delivery contributes significantly to late gestation intrapartum stillbirths (Flenady et al., 2016).

A risk assessment tool is helpful in identifying and appropriately intervening in pregnancies at high risk of ending as intrapartum stillbirths. Majority of such risk scoring structures for evaluating stillbirths have been developed and tested in high-resource settings but they may need to be modified to make them suitable for LMICs. An ANC risk assessment tool can identify the population at risk of fetal or early neonatal death and the results can be used to generate a dataset to develop a statistically derived antenatal risk scoring system which can be used to assess pregnant women (Haws et al., 2009). The development and subsequent testing by Haws et al. (2009) made theirs the first screening tool with a high predictive value for assessment of the risk of stillbirth as a birth outcome. There was also a lack of obvious benefit of routinely prescribing ultrasonography for every pregnant woman as part of efforts to reduce stillbirths compared to conducting it only when required as an adjunct of clinical care (Haws et al., 2009).

In resource-constrained countries, access to complicated investigations is limited compared to resource-rich countries where equipment such as Doppler ultrasound have been used in studies as a non-invasive means to determine the sufficiency of uterine and umbilical cord blood flow. Such investigations contribute to better pregnancy outcome since the results of the cord blood flow impact positively on the management of pregnancies with fetuses at the highest risk of poor perinatal outcomes. These include fetuses with complications such as pre-eclampsia, fetal growth restriction, and congenital malformations; all of which are significant risk factors for intrapartum stillbirth. Another useful investigation used in high-income countries but which is not commonly used in resource-constrained countries is uterine artery Doppler waveform analysis. This is able to correctly identify fetuses with challenges and at risk of being stillborn, especially in pregnancies with reduced placental perfusion related to pre-eclampsia and/or growth restriction: however, no studies have yet shown any ability of the subsequent intervention to prevent stillbirth (Haws et al., 2009). In high-income countries, cardiotocographic monitoring (electronic fetal monitoring) has replaced the intermittent auscultation (periodic listening to the fetal heart rate using a stethoscope or handheld Doppler device) which is still widely used in some low-income countries to monitor fetal heart rate and wellbeing (Haws et al., 2009).

2.8.4 Perinatal death auditing

Although several conditions have been identified as risk factors for stillbirth, a normal pregnancy can end with the delivery of stillbirth and this can occur in 5% to 60% of cases of stillbirth. Despite the lack of explanation in these cases, it is still relevant to investigate every stillbirth to be able to identify clinical professional gaps and institute remedial measures to improve practice (Zulfiqar A. Bhutta et al., 2009) and provide answers to families and appropriately counsel them on future pregnancies (Corabian & Scott, 2005).

This underpins the importance of auditing and conducting research into stillbirths so that all preventable causes can be identified and appropriately addressed to reduce future intrapartum stillbirths. The lack of research in LMICs has led to the paucity of data on risk factors in relation to stillbirths and babies born with very low Apgar scores. The impact of monitoring effectiveness of interventions on stillbirth prevention is contingent on the promptness and appropriate use of the interventions when problems are detected. Some of the available tests are sensitive in detecting fetal distress but there are also other tests that have high false-positive rates giving rise to the issues of ideal timing, frequency of testing and the actual indications to apply the tests (Dassah, Odoi, & Opoku, 2014). Evidence for the effect of intrapartum interventions on stillbirth and perinatal mortality outcomes are yet to be systematically analyzed but available data show that factors within the intrapartum period are the most common causes of intrapartum stillbirths (Awoleke & Adanikin, 2016; Dassah et al., 2014). Physical examination of newborns is not enough as a means of assessing the causes of stillbirths to inform the development of interventions to prevent future occurrences. Whenever possible, it should be complemented with fetal autopsy; placental histology and cytogenetic analysis to provide a full diagnostic evaluation for the fetal demise (Bendon, 2001; Nappi et al., 2016). The poor fetal movement has been linked to stillbirth and perinatal deaths therefore pregnant women are encouraged to monitor and report poor fetal movements to the health provider. However, fetal movement cannot be used universally as part of the surveillance methods on stillbirth prevention due to lack of adequate scientific evidence (Haws et al., 2009). Theoretically, evidence-based screening and monitoring techniques used in HICs, such as ultrasound, can be used to prevent poor pregnancy outcomes including stillbirths in LMICs. The challenge is the poor quality of equipment and the lack of capacity to accurately interpret the report.

2.9. Environmental and sociocultural factors

2.9.1 Environmental Factors

The use of biomass for cooking in a household can have an effect on the health of the members of the household since the smoke contains harmful air pollutants (HAP) such as carbon monoxide (Lakshmi et al., 2013). Globally, about 3 billion of the world's population use solid fuels and kerosene for cooking, heating and to provide lighting in the homes resulting in almost 4 million premature deaths attributed to household air pollution. The HAP is due to incomplete burning of these fuels which result in particulate matter and toxic chemicals such as hydrocarbons, free radicals, oxygenated organic compounds, and carbon monoxide (Patel et al., 2015; WHO, 2018). There are conflicting results about the contribution of HAP to stillbirth and neonatal deaths. While some researchers have reported an association with neonatal mortality in rural communities (Neogi et al., 2015) others have reported that the contribution of HAP to stillbirth and neonatal deaths is not as clear as the risk associated with pneumonia in children and preterm birth (Patel et al., 2015). During the burning of biomass fuels, the smoke that is released contains toxins which are similar to those found in tobacco smoke and ambient air. Although there has not been much research done to identify the association between cooking with biomass fuels and increased risk of stillbirth, the Carbon Monoxide in biomass smoke may cause stillbirth. Women who use biofuels in cooking are two times more likely to experience stillbirths compared to those who use cleaner cooking fuel (Amegah, Quansah, & Jaakkola, 2014; Lakshmi et al., 2013; Mishra, Retherford, & Smith, 2005; Patel et al., 2015). The use of kerosene lamp for lighting purposes in the household has a higher risk of stillbirth compared to when the electric bulb is used for lighting (Lakshmi et al., 2013).

2.9.2 Socio-Cultural Factors

Stillbirth is still concealed from society and parents who have suffered stillbirths hide their grief when they are in public places. Parents, especially women go through "individualized" grief after the death of their children since the grief is not seen as legitimate or acceptable by health professionals, their family members, or society (Hart, 1998). Stillbirths are not treated as real loss and they are separated from other types of child death to emphasis the view of stillbirth as an illegitimate loss (Cacciatore, Defrain, & Jones, 2008; Natasha, 2018). The communities in which the parents live trivialize stillbirths and "encourage" bereaved parents to forget about the stillborn baby, grief for a maximum of two weeks and focus on becoming pregnant / having another child as quickly as possible (Vanotoo & Adusei-Poku, 2010). The parents in such instances feel isolated; stigmatized, and not valued in the society. In some cases, such women suffer abuse and violence from the community members thus aggravating the trauma for families resulting in fatalism and greatly blocks the progression in stillbirth prevention (Hart, 1998; Reid, 2001).

There are various community perceptions and interpretations of causes of stillbirth as well as coping mechanisms and community responses to women who deliver stillbirths including biomedical, societal, and spiritual factors. The decision for a woman and/or the family to disclose or not to disclose stillbirth is dependent on whether the woman has experienced consecutive or multiple pregnancy losses; the possibility of exclusion from the community and whether she will be rejected by the family or not. The coping mechanisms for stillbirth are diverse as well as personalized because despite the fact that ritual burial practices are quite common, most of these practices are not done openly and they are usually relegated to the women who deliver the stillbirths: in contrast to public mourning for older children (Kiguli et al., 2015).

2.10 Funding for stillbirth activities

There are no data on direct costs for stillbirth prevention within the health sector but stillbirths need more resources than live births in managing the post-delivery period, maintain effective surveillance and during subsequent pregnancies. The family that suffers a stillbirth should not be unduly disadvantaged because the baby did not survive; the health sector must value the baby as a human being just as it would do for live birth and not burden the poor with the cost of care (Heazell et al., 2016). The health sector should include all possible costs when planning for prevention of stillbirths including prevention of post-partum morbidity such as depression since this will help to address the Sustainable Development Goal 3 target on Universal Health Coverage (UHC). A country's health sector plans should include fatalism prevention; reduction of stigma and compassionate bereavement care and support so that stillbirth would also feature on national priority health agenda (Flenady et al., 2016). Stillbirth contributes significantly towards the affected families' actual life experiences and insights but the health systems have not been well prepared to provide the support needed to families with stillbirths. Currently, there are limited documented health sector systems established to provide psychosocial support or care for families affected by stillbirths especially in LMICs (Kiguli et al., 2015; Vanotoo & Adusei-Poku, 2010).

2.11 The Ghanaian context

Ghana is in West Africa situated along the Gulf of Guinea with a population of about 27 million (Ghana Demographic and Health Survey, 2014); it has a relatively young population; 42% are below age 15 years. Women play a key role in the care of the household since they form 34% of heads of households. Ghana is a lower-middle-income country with a unilateral Government system governed through the 1992 Constitution of Ghana. There are currently

sixteen administrative regions in Ghana and these are sub-divided into 260 Metropolitan, Municipal and District Assemblies (during the period of this study there were ten administrative regions in Ghana with 216 Assemblies). Each region is somewhat autonomous, governed by the Regional Minister and the Assemblies are headed by Metropolitan, Municipal and District Chief Executives depending on the political area of jurisdiction of the Chief Executive.

Data from the Ghana Demographic and Health Survey (GDHS 2014) show that Ghana has a lot of ethnic groups but the Akans form the largest group representing about 48% of the population; the Mole-Dagbani form 17%, Ewes form 14%, Ga-Dangme form 7% and other groups form the rest of the people of Ghana. The literacy rate for people 15-49 years is 67% for women and 82% for men. Ghana's Service (52% of GDP) and Industry (27%) sectors have taken over from agriculture (22%) as the main drivers of the country's economy.

There are over 6,000 Health facilities in Ghana, the majority are located in urban areas. The fertility rate is 4.2; rural women have 1.7 more children than urban dwellers. According to the 2017 Ghana Maternal Health Survey, the coverage for antenatal care provided by skilled attendants is 98% and skilled birth attendance in health facilities is 79%. The maternal mortality ratio is 310/100,000 live births; the main direct causes of maternal deaths are obstetric haemorrhage (30%) and hypertensive disorders (14%). The infant mortality rate is 41/1000 live births; according to GDHS (2014) perinatal mortality for Ghana is 38/1000 pregnancies, however, it was reported as 43/1000 pregnancies by the Ghana Maternal Health Survey (GMHS 2017) (Ghana Statistical Service. & Ghana Health Service., 2017). The GMHS recorded 347 stillbirths out of 14,987 pregnancies giving a stillbirth rate of 2.3%. This is higher than the rate of 1.5% reported by GHS in the DHIMS 2 of the 2017 annual

report; both data sources did not provide the causes of death and they did not classify them into antepartum and intrapartum stillbirths.

Most of the doctors in Ghana (42%) are in GAR and the doctor to patient ratio for Ghana is 1: 8,026: it ranges from 1: 16,020 in Upper West Region to 1:3422 in the GAR. Ashanti Region has 1,267 midwives (19% of GHS midwives) the highest number in Ghana and GAR has 1,076 midwives (16% of GHS midwives). The midwife to WIFA ratio for Ghana is 1: 728 with a range of 1: 1,944 in Upper West Region (best) to 1: 6,323 in Northern Region (worse). The Caesarean Section rate for Ghana is 17.2%; this is above the WHO recommendation of 5% - 15%: it ranges from 7.8% in upper East Region to 26.3% in GAR. This huge difference could be due to the number and level of facilities in GAR (more, higher services, receives more referrals); the volume of work done (larger population in GAR) and a number of doctors with the expertise to perform C/S.

2.11.1 History of health in Ghana

The history of healthcare in Ghana dates back to the pre-colonial era; it has been shaped by international and national events and different players. These include the World Bank, the International Monetary Fund, Christian missionaries, Europeans who came to colonize the country as well as the political systems and the various democratic dispensations which the country has experienced over the years. The prevalence of communicable and non-communicable diseases has contributed to the various stages of the health reforms Ghana has gone through (Tagoe, 2012). The country has gone through a phase of no-fee services in the 1960s to out-of-pocket payment (called cash and carry) for services at the point of care in the 1980s. To ensure access to health service for all Ghanaians, the National Health Insurance Scheme (NHIS) was introduced in 2003, under the National Health Insurance Act.

This was a major intervention into the health sector since it removed some financial barriers especially to the poor and thus prevented avoidable deaths. Maternal and newborn health services have also seen phases of development culminating in the free maternal health service which was launched in 2008 as part of the NHIS (Dalinjong, Wang, & Homer, 2017). Under the free care, all pregnant women who register with the NHIS are entitled to free care throughout pregnancy, delivery and 3 months after delivery. One of the objectives of the free maternal care is to increase access to skilled birth attendance during delivery to reduce maternal and perinatal mortality (Asante, Chikwama, Daniels, & Armar-Klemesu, 2007; Dalinjong et al., 2017).

2.11.2 The Ministry of Health

The Health Sector is made up of the Ministry of Health (MoH) and its Agencies which include the Teaching Hospitals; the Ghana Health Service (GHS); Christian Health Association of Ghana (CHAG); the Mental Health Authority; the Traditional and Alternative Medicine; the National Ambulance Service; the National Health Insurance Authority; the Health Facility Regulatory Authority; the Food and Drugs Authority and Ghana Standards Authority. The MoH is accountable for every health-related issue in Ghana. However, since the enactment of ACT 525 in 1996 by the Parliament of Ghana, all direct service delivery functions under Clinical Care and Public Health have been handed over to the GHS and Teaching Hospitals. The MoH is currently responsible for policy formulation; monitoring and evaluation; resource mobilization and disbursement; pre-service training and regulation of health in Ghana. The Vision of the MoH is to have a healthy population for national development and the Mission is "to contribute to socio-economic development and the development of a local health industry by promoting health and vitality through access to quality health for all people living in Ghana using motivated personnel' (MOH., 2015).

2.11.3 The Ghana Health Service

The Ghana Health Service (GHS) is the largest implementing Agency under the MoH. The GHS has the mandate to (1) implement approved national policies for health care delivery; (2) increase access to improved health care services and prudently manage resources that are available for the provision of health care services (Ghana Health Service., 2017). The Mission of GHS is "To provide and prudently manage comprehensive and accessible quality health services with an emphasis on Primary Health Care in accordance with approved national policies" (Ghana Health Service., 2017). The total health workforce in the Public Health Sector in Ghana is about 112,000: these are employees on the Government payroll. Out of this number 75,000 (68%) are employed by GHS to provide services at different levels of care and it provides health care to over 60 % of the people living in Ghana.

Challenges encountered in service delivery include: (1) inequitable distribution of health staff; (2) logistics unavailability; (3) weak referrals and "no bed syndrome" this is a term used to describe lack of access to beds for admission, especially in GAR.

2.11.3.1 Structure for health service delivery

Service delivery within GHS is provided across different levels of care

The tertiary level of care (the apex) is made up of the teaching hospitals and other highly specialized hospitals. These hospitals are the major referral hospitals in Ghana and receive complicated cases that cannot be treated at the other levels of care.

The Regional hospitals are below the tertiary hospitals. They provide specialized clinical and diagnostic care including comprehensive obstetric care. the Regional Hospitals receive referrals from the lower levels of care and may refer to the tertiary hospitals.

The District Hospitals provide clinical and emergency services and receive referrals from the subdistrict levels. some district hospitals provide comprehensive obstetric care and also conduct training for staff at the subdistrict level.

The subdistrict level has health centres that provide basic curative, disease prevention and basic maternity care. Although delivery services take place at the subdistrict level, health centres are not equipped to perform caesarean section and blood transfusion.

At the community level health is provided by community health nurses using the Community based Health Planning and Services (CHPS) strategy. The services provided include outreach, child welfare services, post natal for women and children, immunization, nutrition and family planning.

2.11.4 Safe motherhood in Ghana

The safe motherhood programme in Ghana is committed to preserving the health of women and their newborns through pre-pregnancy; pregnancy; childbirth and the postpartum period. The components are pre-pregnancy care; antenatal care; labour and delivery care; postnatal care; family planning; comprehensive abortion care; health education and counselling (Family Health Division., 2015). The provision of care to women and their babies during delivery is multi-disciplinary with doctors, midwives, and other staff working together to provide care to women and their babies during labour and delivery. It is worthy to note that the 2016 safe motherhood document did not mention stillbirth as a separate component to be addressed as a priority issue.

The Ghana Maternal Health Survey (2017) was conducted to obtain data on maternal health outcomes in Ghana to complement findings from other surveys such as the Ghana Demographic and Health Survey (Ghana Demographic and Health Survey, 2014). Data from the GMHS (2017) show improvement compared to data in the GDHS (Ministry of Health). Data in both GDHS and GMHS indicate that GAR recorded the highest rates of skilled delivery in Ghana. In 2014 the stillbirth rate in Ghana was 2% of total deliveries, however, the rate of stillbirth in 2017 was not stated in the 2017 GMHS. The figure of 2% is higher than the rate of 1.5% reported by GHS in DHIMS 2 in the 2017 annual report. This difference may be due to the fact that the DHIMS 2 report only captures data from health facilities on the DHIMS platform and although data are from various stakeholders, there are other providers who are not on the platform so do not submit reports to the platform.

2.11.5 System for monitoring women during antenatal and labour

Antenatal coverage in Ghana is about 97% (Ghana Health Service., 2017a). Every pregnant woman is given a record book called the antenatal care book which is used to record the history and progress of pregnancy for both the mother and the fetus during ANC attendance. Routinely, pregnant women are seen by midwives but occasionally by doctors when the need arises. There is a well-established system for monitoring the wellbeing of pregnant women and their fetuses throughout the antenatal period using guidelines set out in the ANC book. The midwives use history taking, laboratory tests and physical examination to determine the wellbeing or otherwise of the women and their fetuses and provide education and health promotion activities. There are some challenges with the routine ANC such as the inability of women to ask questions during health talks, inability to engage in demonstrations of skills such as breastfeeding and partner involvement is almost non-existent because of lack of

space. The routine system also leaves very little room for follow up and interaction between the health staff and the pregnant women after ANC sessions.

2.11.5.1 The Pregnancy School

To address the gaps in the routine ANC system, the concept of "pregnancy school" was introduced in GAR in 2013 to provide an opportunity to improve partner involvement; communication between pregnant women and the midwives/doctors and enhance liaison with the pregnant women after clinic hours. The author has written a book titled "Pregnancy School: communicating with pregnant women and their families" to guide the setting up; running; monitoring and evaluation of the pregnancy school at the health facility and community levels. Currently, all Government-owned hospitals and polyclinics in GAR have established and are running pregnancy schools for pregnant women and their spouses. Selected districts within GAR have been supported by a development partner to establish community pregnancy schools to facilitate follow up of pregnant women within the communities. The pregnancy schools help the midwives to keep track of their activities through the monthly reporting of performance especially on pregnancy outcomes and this is a very good way of regular monitoring of stillbirths in GAR. The different topics discussed during the pregnancy school sessions and classes help to inform the women about pregnancy, complications in pregnancy and interventions to address them. The classes also empower women with the requisite knowledge to seek clarification and demand for service. Most of the schools take place once in a month and the time is selected in collaboration with the pregnant women and the midwives have introduced innovations to sustain the interest of the women including graduation ceremonies and presentation of certificates to women who successfully go through the classes until they deliver. GAR has a Regional coordinator for pregnancy school, trainers have been equipped to train others and each district has a

coordinator to ensure quality assurance in the establishment and functioning of the schools at all times. There is a monitoring team that visits the various schools to provide coaching and other support and also reviews the monthly reports and give feedback to the providers.

2.11.6 Traditional birth attendants in Ghana

Traditional Birth Attendants (TBAs) are mainly women who provide maternal care such as ANC and delivery to pregnant women, but they have not gone through formal training and Ghana does not recognize TBAs as qualified care providers therefore births performed by TBAs are not recorded as deliveries conducted by skilled birth attendants. Although pregnant women are encouraged to deliver with skilled birth attendants to reduce the incidence of maternal mortality, they still seek care from TBAs during ANC and delivery. Report of the GMHS 2017 report showed that despite the high ANC coverage, 16% of pregnant women deliver with TBAs when they get into labour (Ghana Statistical Service. & Ghana Health Service., 2017). It is important to assess the outcomes of deliveries conducted by TBAs because newborn health is linked to maternal health and thus any intervention that improves maternal health will improve newborn health. The policy on TBAs in Ghana is that births performed by TBAs are not considered as skilled deliveries and are reported as deliveries by unskilled birth attendants.

2.12. Ghana National Newborn Health Strategy and Action Plan

Ghana was not able to achieve MDG 4 despite the several interventions implemented to improve child survival; one of the main reasons was the high level of neonatal deaths which contributed 40% of under-five deaths (Ghana Health Service., 2017). The MoH/GHS and partners developed the newborn strategy and action plan:

- To contribute to the reduction of neonatal mortality rate from 32/1000 live births in 2011 to 21/1000 live births in 2018 (5% per year).
- To contribute to the reduction of institutional neonatal mortality rate by at least 35% by 2018 (Warfa et al., 2014)

The package of interventions includes the following:

- Basic essential newborn care
- Management of adverse intrapartum events (including birth asphyxia)
- Care of the preterm/low birth weight/growth-restricted baby
- Management of neonatal infections/sick newborn

The priority areas of implementation were as follows:

- Development/updating of policies, standards and guidelines with overall implementation under the oversight and coordination of the Sub-committee on Newborn Care (SCNC)
- Extra focus on labour, delivery, the first 24 hrs. and first post-natal week
- Improving the quality of services at all levels
- A holistic approach including facility services, community interventions and establishing/strengthening of links between them
- Addressing equity issues
- Promoting scale and sustainability
- Implementing a strong Monitoring and Evaluation ("Count every baby")

Despite the fact that intrapartum deaths contributed 28% of newborn deaths in 2012 (Warfa et al., 2014) with the exception of perinatal death auditing, the newborn strategy did not

outline any specific interventions to address intrapartum stillbirths as a way of contributing to the reduction of newborn deaths.

2.13 Stillbirth in Ghana

Stillbirth has not been prioritized in Ghana, there is no strategic plan in place for intrapartum stillbirth prevention and research specific to stillbirth is limited. There is currently no advocacy for stillbirth prevention because it is not part of the current Newborn Strategic Plan and there is no national agenda to address bereavement care for women and families who have suffered a stillbirth.

The stillbirth rate in Ghana has seen a reduction over the years from 18/1000 in 2014 to 15/1000 deliveries in 2017 (Ghana Health Service., 2017a). Despite the reduction, the causes of these stillbirths are poorly understood and therefore not well documented in the Ghana National Newborn Health Strategy Action Plan 2014 – 2018 (Ministry of Health, 2014). In rural Ghana, 33.0% of stillbirths occur in the antepartum period before the onset of labour but the highest risk periods for perinatal deaths are during the intrapartum period and the first day of life. Infections are the major cause of the antepartum and neonatal deaths while obstetric complications are the most important cause of intrapartum stillbirths (Edmond et al., 2008).

The births and deaths registry is responsible for documentation of individual births and deaths in Ghana and families are encouraged to ensure that births are registered. The Family Health Division of the GHS does not issue certificates for births but it keeps records of the number of births conducted in health facilities through the aggregation of data from the District Health Information Management Systems (DHIMS) and keeps track of

survival/deaths of these newborns. The DHIMS is the major source of data from all government hospitals and some private and quasi-government health facilities. Due to the relatively large number of reporting facilities, sometimes the DHIMS data on various indicators are quoted as a proxy for national performance and they contribute significantly to the development, implementation and tracking of the performance of national interventions.

2.13.1 Stillbirth in Greater Accra Region

The Greater Accra Region has been recording huge numbers of stillbirths over the past years and these deaths contribute significantly to newborn deaths in Ghana. Table 2.1 below shows data from DHIMS 2 for GAR over a five-year period.

Table 2.1: Stillbirths in Greater Accra Region: 2012 – 2016 showing proportion (%) intrapartum deaths

Item	2012	2013	2014	2015	2016
Total deliveries from DHIMS	99,564	103,183	112,633	119,414	111,098
Total stillbirths	1987	1891	2156	1830	1884
Intrapartum stillbirths (% of total stillbirths)	967 (48.7%)	780 (41.2%)	915 (42.4%)	757 (41.4%)	736 (38.1%)
Macerated stillbirths	1020	1111	1241	1073	1148

Source: Greater Accra Region, 2016 annual performance report: denominator is the total institutional reported deliveries

Majority of the deaths are recorded within the Accra Metropolitan Area where the large hospitals, such as Korle Bu Teaching Hospital and Greater Accra Regional Hospital, Ridge are sited and most of the doctors, specialists and midwives work within this area. Figure 2.2 below shows the distribution of stillbirths and the location of doctors and specialists within GAR. The stillbirths follow the same pattern as the distribution of doctors and midwives and this may be as a result of the referral of cases from the periphery to the bigger hospitals to access higher-level care.

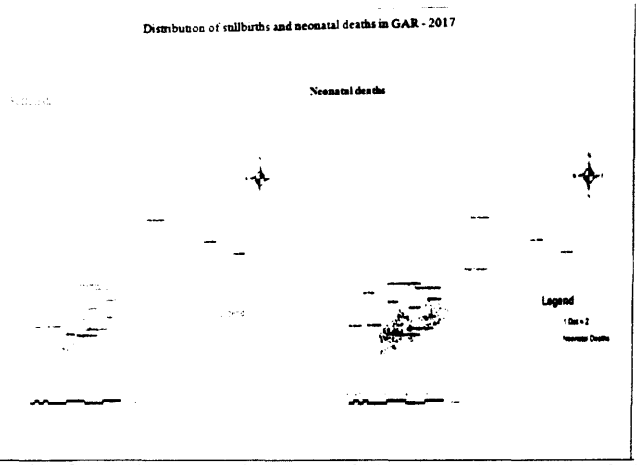

Figure 2.1: Comparison of the distribution of stillbirths and neonatal deaths in GAR

The Greater Accra Region introduced perinatal death auditing in 2014 to all health institutions where deliveries are conducted and analysis of stillbirths recorded in one of the districts in GAR showed that 32.4% of stillbirths occurred intrapartum. 70.6% of the stillbirths were delivered by midwives and 65.7% were by spontaneous vaginal delivery. Pre-eclampsia was recorded in 9.4% of the women and abruption placenta as a result of pre-eclampsia was recorded in 6.3% of the women who had stillbirth (Greater Accra Regional Health Directorate, 2015). This report is one of the few instances of in-depth analysis conducted as part of perinatal auditing; the author has not come across nor read about other reports generated in other regions or at the National level as part of perinatal auditing.

2.14 Interventions for reduction of stillbirths in Ghana

Interventions to prevent stillbirths in Ghana have been limited. Despite the fact that maternal mortality reduction has been on the agenda of the MoH / GHS for a long time, the same cannot be said for the prevention of stillbirths in general and specifically on intrapartum stillbirths. There is no document developed explicitly for the prevention of intrapartum

stillbirths, however, the Newborn Strategy which is under review has included other activities in addition to perinatal death auditing to address the issue of stillbirths (personal discussion).

2.14.1 Perinatal death audit

Perinatal death audit is the process of auditing stillbirths and babies who are born alive but die within one week, it was introduced in Ghana in 2014 with the aim of critically reviewing all perinatal deaths to identify the gaps in care and plan interventions to reduce future occurrences. Perinatal auditing was also to identify causes of death and use the findings to make recommendations; develop activities; implement them and evaluate the performance as a means of assessing care provided to pregnant women: since stillbirth is a reflection of the quality of care pregnant women receive during labour and delivery (Ghana Health Service., 2017a).

The perinatal death audit form used in Ghana is a combined tool for auditing stillbirths and neonatal deaths designed after the format of guidelines for auditing and reporting maternal deaths. Staff are trained in the use of the audit tool as well as the guidelines so that auditing would be done objectively and professionally. However, despite the introduction of the form and guidelines followed by the training of staff in all ten regions of Ghana, the rate of auditing of stillbirths and subsequent submission of reports to the GHS are very low. This is evident in the way stillbirths are presented in annual reports of the GHS compared to maternal deaths. The 2016 GHS annual report recorded 1,033 maternal deaths, the data were analyzed to show the trend, causes of death and the proportion of deaths that were audited as 872/1033 (84.4%). In the same report stillbirths recorded in 2016 were not analyzed for the cause of death or proportion that was audited, the report only gave the trend and rate thus showing that stillbirth auditing is not tracked in the National annual reports.

Rates of perinatal auditing in Ghana and GAR are very low at about 30 – 40% and some of the reasons for the low auditing are: (1) bulky nature of the perinatal death audit form which makes it laborious to complete; (2) the audit form is paper-based so health facilities have to print out anytime a perinatal death occurs; (3) lack of proper systems to collate and analyze the audit findings and monitor implementation of recommendations as is done for maternal deaths (personal discussion with staff). Apart from the perinatal death audit guidelines on how to conduct and document findings of the audit, there is no major budgeted plan developed by the health sector to be used as a blueprint by health facilities on issues related to stillbirth in general and intrapartum stillbirth specifically. The absence of such a national strategic plan; lack of dedicated funds and absence of an effective way of integrating intrapartum stillbirth into existing health delivery structures are disincentives for the frontline health workers to make stillbirth a priority and take steps to document them properly. The development of a model to predict intrapartum stillbirths in GAR would be a useful tool to be validated and used by frontline workers to identify and appropriately manage pregnant women whose reports show the likelihood of having an intrapartum stillbirth. The validated version could also serve as a reference tool for other LMICs.

2.15 Conclusion

This chapter reviewed published peer reviewed literature, relevant reports that were focused on global and country perspectives on stillbirth and factors that contributed to intrapartum stillbirths. The aim of the chapter was to critically review major maternal, fetal, health service delivery, socio-cultural, economic and environmental factors that significantly contributed to intrapartum stillbirths. The chapter contributed to the conceptualization of stillbirths based on what was already known as well as existing gaps regarding the phenomenon of intrapartum stillbirth. These factors formed the basis for the development of the conceptual framework of the study, the research objectives and the research questions.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

This chapter presents the methodology of the research. The chapter describes the study design: study sites; sampling procedure; procedures for data collection; analysis and the philosophical basis for the quantitative and qualitative paradigms. The chapter is divided into two main sections in line with the quantitative and qualitative components of the study. The major quantitative principles and qualitative approaches are discussed with justification for their use as the most appropriate approaches for the study. Data collection took place from May 1st to 30th September 2017.

3.2 Study design

The research employed a retrospective 1:2 case-control study design. A quantitative method with added exploratory sequential qualitative component was identified as the most appropriate approach to answer the research questions; provide more in-depth knowledge to elucidate the predictors of intrapartum stillbirth in singleton pregnancies and develop a model for predicting future stillbirths.

Quantitative and qualitative researches are usually portrayed as two basically diverse paradigms used in social science studies. Their use is determined by the type of epistemology and theoretical approaches used in particular research (Brannen, 2005). However, they should not be seen as two approaches that are far apart from each other but rather they should be considered as the ends of a range (W. J. Creswell, 2014). There have been long-standing debates about the use of these paradigms ("paradigm wars"). While the "purists" maintain that paradigms should stay separate the "situationists" argue that specific

situations demand definite methods. On the other hand, the pragmatists contend that the two paradigms can be combined and used efficiently. They discourage the creation of an artificial division between qualitative (postpositivist) and quantitative (positivist) research paradigms (Cameron, 2009). Each method has its own strengths and weaknesses. The weaknesses of quantitative approach include the possibility of a group of dissimilar cases; qualitative on the other hand works with few cases (Cameron, 2009). This study employed the quantitative method with a qualitative component to generate complementary evidence in understanding the phenomenon of intrapartum stillbirth.

Quantitative research can be descriptive or experimental and, in this study, the descriptive method was employed. Data in quantitative research are numeric, collected using structured questionnaires, interviews, observations and other research tools from a sample size that is representative of the population under study (Langkos, 2014). Quantitative studies have high reliability; they can be replicated or repeated. The processes are well structured from the start of study development before data collection start and the researcher is objectively separated from the subject under study. Results are presented as numbers and statistically, such as in tables, charts or other forms that are not textual. Quantitative results can be generalized; used to predict future outcomes or determine causal associations (Langkos, 2014). On the other hand, in qualitative research, the researcher is the major data collection tool and the design comes out as the study progresses. Qualitative data are in word, pictures or objects and, the results are subjective, they cannot be generalized and the researcher is subjectively involved in the topic under study (Langkos, 2015). Qualitative paradigm is used when the subject matter under study needs clarification and not just a simple yes or no answer. Qualitative research uses approaches such as focus group discussions; in-depth

interviews; case studies as well as open-ended questions to unearth answers from the persons or phenomenon being studied (Sullivan & Sargeant, 2011).

3.2.1 Rationale for choice of study design

A case control study was chosen because it is retrospective and the outcome of interest in this study which is intrapartum stillbirths has already happened. Case control studies help to determine whether an exposure is associated with the outcome of interest. The case control design was also found to be the best choice to be able to address the objectives of the study and answer the research questions. A prospective study design would not have been feasible during the study period because it is difficult to determine during labour which baby will come out as fresh stillbirth for the researcher to be present to collect data after delivery. A prospective study would require The best data to use in such instances is retrospective data and thus the choice of case control design.

In-depth interview (IDI) was selected as the means to assess the perceptions of women who had experienced stillbirth and staff involved in care of pregnant women because it provides the opportunity to access perceptions of affected people about stillbirths. information obtained from IDI is useful in providing context to data obtained from the quantitative study. The IDI provided information which could not be obtained from the secondary data used in the quantitative study.

The combination of quantitative and qualitative study designs helped to provide a complete picture of intrapartum stillbirths in the selected hospitals.

3.3 Quantitative and Qualitative Methods Approach

The mixed methodology is the bedrock of research in social sciences. It helps to bring together diverse approaches and permits the researcher to design the study questions within a specific context and parameters of the study (Bowen, Rose, & Pilkington, 2017). The entrance of mixed methodology has contributed to a massive increase in combined and ingenious research across various disciplines. The mixed-method also helps to deal with a wide range of questions and gives a far-reaching and innovative approach to research. Mixed methods approach contains various strategic stages including integrating a two-phase system in which quantitative research is initially conducted after which qualitative research is conducted in a well-planned manner (Bowen et al., 2017). In each instance there could be a dominance of the quantitative or qualitative component and the research may start with either the quantitative or qualitative and follow on with the other method. This gives rise to the types of the sequential mixed method (with quantitative or qualitative dominance) or concurrent mixed-method (with quantitative or qualitative dominance) (J. W. Creswell, Plano Clark, Gutmann, & Hanson, 2003). The results from qualitative data assist to contextualize and enrich research findings; enhance validity; contribute to deeper understanding and engender new knowledge of the subject under study. The results also contribute to increased confidence in research findings; generate more facts and minimize the weaknesses of individual research approaches (Bowen et al., 2017).

3.4 Quantitative method

3.4.1 Study area

The study was conducted in the Greater Accra Region of Ghana (Figure 3.1) within six public hospitals (Figure 3.2) that provide antenatal, delivery and post-natal services for pregnant women, both as primary and referred clients. These hospitals were purposively

selected because their distinctive characteristics made them the most appropriate study sites to answer the research questions. The major objective of purposive sampling is to pay attention to specific unique features of the study population which help the researcher to answer the research questions and not for generalization. One of the disadvantages of purposive sampling is a possible bias because of the researcher-led and the subjective nature of the selection of the study units. This disadvantage was minimized in this study because the facilities were selected based on well set out criteria.

In this study the homogenous purposive sampling technique was used because the six hospitals provide a similar range of out-patient and in-patient services; they have the expertise to conduct delivery and carry out interventions including caesarean sections in women with complications during labour. The hospitals have the highest number of Doctors, Specialists Obstetricians / Gynaecologists, Midwives, Nurses, Pharmacists, Anaesthesiologists and professional Health Service Administrators working within GHS in GAR. They also have well established functional governance/management structures and are major contributors to the huge numbers of stillbirths in GAR. The six hospitals were: Greater Accra Regional Hospital, Ridge; Tema General Hospital; La General Hospital; Ga South Municipal Hospital; Ledzekuku Krowu Municipal Assembly (LEKMA) Hospital and Achimota Hospital.

3.4.2 Background of the study sites

3.4.2.1 The Greater Accra Region

3.4.2.1.1 Regional Profile

The Greater Accra Region is one of the sixteen administrative regions of Ghana. It lies at the South-Eastern part of the country along the Gulf of Guinea and has miles of beautiful

coastline especially in the rural parts of the region. The shores in the capital city Accra are unfortunately mostly polluted. The Greater Accra region is challenged with problems of inequitable access to an acceptable quality of health service. The region currently has 16 local government administrative districts. The Accra metropolitan area is the largest among the administrative districts and it is further subdivided into five sub metros.

The GAR has a projected total population of 4,671,226 based on the 2010 national population census and this translates to 15.4% of Ghana's population making GAR the second most populous region in the country after Ashanti Region with 19.1% of Ghana's population (Ghana Demographic and Health Survey, 2014). GAR accommodates the capital city of Ghana, Accra with a rural: urban ratio of 20:80. Due to its small land area, GAR has the highest population density in Ghana. The location of the capital city of Ghana, Accra, and urbanization contribute to migration from different parts of the country and the high population.

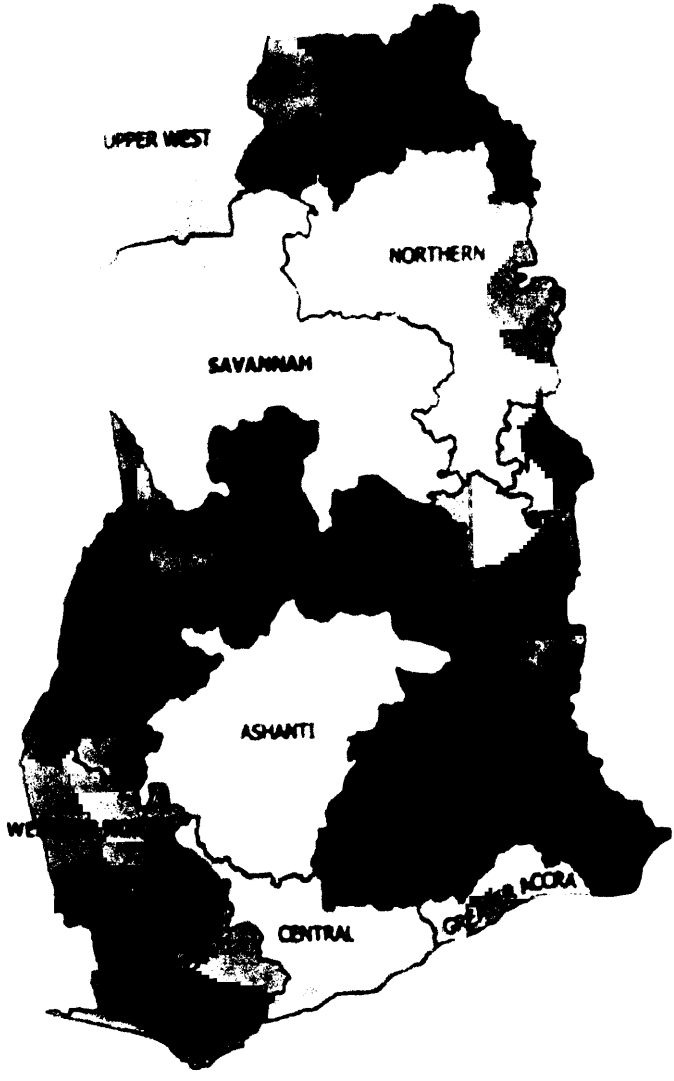

Figure 3.1: Map of Ghana showing the sixteen administrative regions

Figure 3.2: Map of Greater Accra Region showing the six study sites

3.4.3 Profile of La General Hospital

La General Hospital was established in 1963 and designated as a District Hospital in 2004. The hospital is situated in La Dadekotopon Municipality and serves the population of La, Osu, Teshie, Nungua and the surrounding communities. It is the only public hospital within the Municipality but works closely with both Private and quasi-government hospitals (37 Military Hospital). The hospital provides all the services of a district hospital including caesarean section, general surgery, out-patient and in-patient services and it also has mortuary facilities. The hospital is headed by a Medical Superintendent who manages the facility with the support of a management team. The hospital sees an average of 192 patients a day. About 3,800 babies are delivered in La General Hospital annually. In 2016, the hospital recorded 3,842 deliveries with 133 stillbirths out of which 47 (35.3%) occurred intrapartum.

3.4.4 Greater Accra Regional Hospital, Ridge

The old buildings of the Greater Accra Regional Hospital, Ridge (GARHR) date back to the period 1911-1923. It was opened by the British around 1928 to provide care to the general public. Ridge Hospital was designated as a Regional Hospital in 1997. A considerable amount of renovation works as well as new constructions have been carried out over the years and an extra-ordinary 420-bed new hospital has been built to augment the old structure. Politically, it falls within the Osu Klottey Sub Metro of the Accra Metropolitan Area which has a population of 1,695,136.

The hospital provides out-patient and in-patient care as well as specialized services which are not available in the district hospital. The hospital receives referrals from all over the Greater Accra Region; occasionally patients are referred from other regions to the GARHR. The hospital serves as a training centre for House Officers and Specialists Residents. It is also a site for collaborative research with institutions such as Kybele from the United States of America. There is also a School of Anaesthesia for the training of anaesthetists for the Health Sector. The hospital sees an average of 300 patients a day with over 8,000 deliveries conducted annually. In 2016 the hospital recorded 8,120 deliveries with 388 stillbirths out of which 139 (35.8%) occurred intrapartum.

3.4.5 Tema General Hospital

Tema General Hospital (TGH) was constructed in 1954 by J.W Harrow and Sons Limited and handed over to the Government of Ghana in 1962. It is located within the Tema Metropolis. The geographical location of TGH, road networks and commercial nature of the Metropolis makes the hospital a major referral point for all other Clinics and Hospitals in the Metropolis, Kpone Katamanso, Ashaiman Municipal Area and Ningo Prampram

Districts and the first point of call for most of the numerous Road Traffic and Industrial accidents.

The hospital has a bed complement of 326 and provides a 24-Hour Specialist and General Services on both Out-Patient and In-Patient basis. The hospital sees an average of 471 patients in a day and conducts about 6.800 deliveries annually. In 2016, TGH recorded 6,238 deliveries with 299 stillbirths out of which 131(43.8%) occurred intrapartum. One of the challenges the hospital faces is inadequate space to receive all the numerous clients, especially pregnant women, who use the facility on a daily basis.

3.4.6 LEKMA Hospital

The LEKMA Hospital is situated in Teshie and it has a catchment population of 263,631. It was built by the Chinese Government and inaugurated in 2010 as a China – Ghana Friendship Hospital. It has a bed capacity of 141 and sees on average 94,000 clients annually. The hospital provides a range of services including General OPD and in-patient care. LEKMA hospital also has complementary and alternative medicine such as herbal medicine; massage services; acupuncture and moxibustion (heat therapy for the skin using the moxa plant). In 2016 there were 2,740 deliveries with 61 stillbirths out of which 22 (36%) occurred intrapartum.

3.4.7 The Achimota Hospital

The Achimota Health zone forms part of the Okaikoi Sub-Metro within the Accra Metropolitan Health Area, the area has a population of about 65, 227. Achimota Hospital was established in 1927 by the Achimota School authorities ten years after the establishment of the school. It is situated within the Achimota School and was originally built to cater for

the health needs of the students, staff and other institutions within its catchment areas such as Accra Girls' and Presbyterian Boys' Secondary Schools. However, it was taken over by the Ministry of Health in 1973 and declared a District Hospital in 1985. It has since served beyond its immediate environment and expanded the range of services to include comprehensive obstetric care, family health, and lately Orthopaedic and accident and trauma care services. The hospital provides 24 hours of care for both out-patient and in-patient. In 2016, Achimota hospital recorded 3,281 deliveries with 22 stillbirths out of which 9 occurred intrapartum.

3.4.8 The Ga South Municipal Hospital

The Ga South Municipal Hospital, once known as the Communicable Disease Hospital currently has 66 beds and the only public hospital in the Ga South Municipality. It began as a leprosarium in the 1940s. With the outbreak of chickenpox, smallpox and later cholera; it became a sick bay for such patients. As the population in the catchment area began to increase, Reproductive Child Health (RCH) services were added. Due to the location as the only public health facility in the western end of Accra, the hospital attracted support from various NGOs and the Bank of Ghana. In 1996 and 1999 a maternity wing and an OPD block were built and the Hospital was upgraded to a Municipal status in 2008. It serves as a referral point to the numerous communities in the Municipality and adjourning districts. The hospital provides 24 hours service for both out-patients and in-patients. In 2016, the hospital recorded 3279 deliveries with 15 stillbirths out of which 14 occurred intrapartum.

Table 3.1: Allocation of cases and controls included in study

Name of hospital	Total deliveries	Total stillbirths	Fresh stillbirths	Fresh stillbirths folders retrieved/included in study	Controls selected
Greater Accra Regional	10, 518	388	139	37	74
Tema General	12,505	299	131	49	98
La General	3,839	133	47	8	16
Ga South	3,279	15	14	10	20
Achimota	3,281	22	9	4	8
LEKMA	2,746	61	22	17	34
Total	36,168	918	362	125	250

3.5 Study population

The study population was all women with singleton pregnancies at 28 weeks or more gestation, who delivered in the six selected public health facilities in 2016. The delivery and post-natal case-folders of these women formed the basis for the selection of cases and controls.

3.5.1 Inclusion criteria

The cases and controls were selected based on a set of criteria developed before data collection began. The criteria are:

- Women with singleton pregnancies of 28 or more weeks gestation;
- Women who delivered in any of the 6 selected public health facilities in 2016;
- Women with live births (controls) delivered at 28 or more weeks gestation in 2016
- Women who delivered intrapartum stillborn babies (babies with no signs of maceration or skin disintegration (cases) at 28 or more weeks gestation in 2016

3.5.2 Exclusion criteria

The following criteria were set to exclude potential participants.

- Selected women with live births whose folders could not be traced
- Selected women with fetal deaths whose folders could not be traced

3.6 Sampling Procedure

The study covered the period 1st January to 31st December 2016. To gain access to the client folders for the quantitative data collection, the researcher sought permission from the hospital management because they are the custodians of the data and had the power to release data. The hospital management provided the telephone numbers and made initial contact with the participants. The hospital management assisted with the selection of the health staff to be interviewed by the research team, based on the inclusion criteria set by the PI. Various steps were followed to obtain the sample size for the study as outlined below.

3.6.1 Selection of cases and controls

3.6.1.1 selection of cases

1. A census of all intrapartum stillbirths recorded between 1st January and 31st December 2016 in the six selected health facilities was carried out
2. A total number of 362 intrapartum stillbirths were reported in the six hospitals' documentation between 1st January to 31st December 2016. However, out of the 362 cases records were available for only 125 cases for the period 1st January to 31st December 2016. Some of the reasons for inability to trace the folders were relocation of the records department at the hospital and folders were given to clients to take home. All the 125 cases were therefore studied (Figure 3.3).

Although the census of all cases was conducted, an ex-post power analysis was conducted to determine whether the study design was powered enough to detect a significant effect of the predictors of interest. The estimated power was 82% based on 125 cases and 250 controls assuming a type I error of 5% and the approximate odds ratio of 2%.

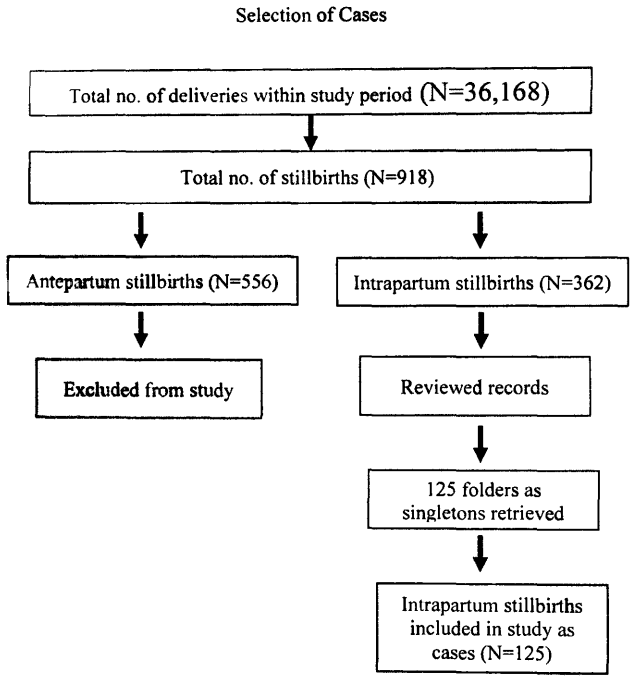

Figure 3.3: Selection of cases

3.6.1.2 Selection of controls

1. The study design was unmatched case-control where 2 controls were matched to 1 case. This resulted in the selection of total controls of 250.

2. These 250 controls were randomly sampled from the total number of live births, 35,250, recorded within 1st January to 31st December 2016 in the six facilities.
4 The number of controls selected per hospital was based on the number of cases selected from that hospital
5 The background characteristics of the cases and controls were obtained from the hospital records on the cases and controls.
6 Multivariable Poisson regression models were used to assess how they contributed to intrapartum stillbirth.

The inability to retrieve folders on all deliveries recorded as intrapartum stillbirths in the six health facilities led to 125 cases being studied. The study focused on 2016 and not earlier years because considering the challenge of retrieving client records for the study period (1st January to 31st December 2016) designing the study to cover earlier years would have created a huge difficulty in getting the data. This is one of the challenges of retrospective studies (Anthonisen, 2009). A retrospective study was conducted because a long period of time and lot of resources would be required to do a prospective study on a phenomenon such as intrapartum stillbirth to get enough cases to match with controls and make inferences of significant associations. This is because it would not be easy to identify which deliveries would end as intrapartum fetal deaths when women come in labour with live babies.

Procedure for selection of controls

- Controls – 250 unmatched systematic random sampling
- Number selected per hospital was based on number of intrapartum stillbirths retrieved for that hospital [see Table 3.1]

Example for Greater Accra Regional Hospital, Ridge in 2016

Total deliveries = 10.518;

Total live births 10,518 – 388 = 10,130

Total stillbirths = 388;

Number of intrapartum stillbirths = 37

Therefore number of controls required = 2 X 37 = 74

- Sampling interval = total live births / controls required = 10,130/74 = 136.9
- First control was randomly selected between 1st and 137th live birth recorded in delivery book
- Second control = 1st selected control + 137
- Subsequent controls were selected by adding 137 to the previous selected recorded live birth until 74 controls were obtained
- Similar procedure was used for the other five hospitals

The case-control study design was chosen because it compares patients who have a disease or outcome of interest (cases); in this study intrapartum fetal death; with patients who do not have the disease or outcome (controls); in this study live birth. Case-control was chosen also because it looks back retrospectively to compare how frequently the exposure to a risk factor is present in each group to determine the relationship between the risk factor and the disease. In this study intrapartum stillbirth as a birth outcome had already taken place and maternal; fetal and health service factors were assessed to determine how they contributed to intrapartum stillbirths in singleton pregnancies.

The design was chosen also because case-control studies are observational, no intervention is attempted and no attempt is made to alter the course of the disease. This study did not

include any intervention and did not alter the outcome of delivery. The goal of a case-control study is to retrospectively determine the exposure to the risk factor of interest from each of the two groups of individuals: cases and controls. This study was designed to retrospectively identify the maternal, fetal and health service factors that could predict future intrapartum fetal deaths. Case-control studies are designed to estimate odds of an outcome and this was one of the reasons for using this method for the study.

There were other advantages of case-control study design that made it the most appropriate for this research:

1. It is good for studying rare conditions or diseases: intrapartum fetal deaths are less common compared to live births
2. Less time is needed to conduct the study because the condition or disease has already occurred: the intrapartum fetal deaths and live births had already happened in 2016
3. The case-control allows the researcher to simultaneously look at multiple risk factors: this study was designed to look at maternal, fetal and health service factors at the same time
4. They are useful as initial studies to establish an association: very little work has been done in the Greater Accra Region on causes and risk factors associated with intrapartum fetal deaths. The findings from this study will serve as the basis for future work on intrapartum fetal deaths and stillbirths in general in the Greater Accra Region and Ghana and other countries
5. Case-control studies answer questions that could not be answered through other study designs: a prospective method would have been difficult in this study because one cannot determine which of the deliveries would end in intrapartum death and

the available time and other resources would not yield enough number of intrapartum fetal deaths to show significant associations.

6. The case-control study design was selected because the cases and controls are selected at the start of the study, the study is relatively quick to perform, compared to cohort studies, fewer subjects are required and multiple factors can be assessed for one outcome (Song & Chung, 2010).
7. A 1:2 case-control study was done to increase the power of the study.
8. Odds ratios were calculated because they determine the association between exposure and outcome

3.6.2 Selection of participants for the qualitative component

Participants were selected from the 125 cases whose folders were available from the records of intrapartum stillbirths recorded between 1st January and 31st December 2016. About 10% of the cases with varied socio-demographic characteristics were purposively selected from the available records. A total of 13 women with a history of intrapartum stillbirth were finally selected for the in-depth interview (IDI). Fourteen health professionals were purposively selected as participants for IDI from the two major hospitals: Tema General Hospital and Greater Accra Regional Hospital, Ridge.

The mode of selection ensured fair representation of the target population. Participants were purposively selected to give a fair representation in terms of religion, marital status, education, age and professional background. Thirteen participants were considered enough during the IDI to elicit the required responses to answer the research questions (Guest, Bunce, & Johnson, 2006).

The cadre of health professionals selected gave a fair representation of the staff required to ensure that pregnant women receive optimal care. They were made up of Directors of the hospitals and Administrators who are responsible for the provision of logistics and supplies at all times for smooth service provision. The Doctors and midwives were selected because they perform the actual clinical work including monitoring of labour and delivery including provision of interventions when needed.

The two hospitals were selected because they have the requisite trained staff and set up, including surgical theatres to receive referrals from lower levels. They have some of the most experienced Specialist Obstetrician Gynaecologists in the Greater Accra Region and they serve as resource persons for other regions in Ghana. The hospitals are equipped to provide emergency obstetric care including caesarean section and blood transfusion services. Greater Accra Regional Hospital has a modern intensive care unit for adults and children. The two hospitals serve as training centres for nurses, midwives, medical students and resident doctors. Among the six hospitals, the two hospitals recorded the highest number of deliveries, the highest numbers of stillbirths and the highest numbers of intrapartum stillbirths in 2016.

Table 3.2: 2016 deliveries and stillbirths in study sites

Name of hospital	Site	WIFA population	Annual delivery (2016)	Total number of live births	Total number of stillbirths in 2016	Number of fresh stillbirths (proportion of total fresh stillbirths)
Greater Accra Regional Hospital, Ridge	Osu Klottey	44,098	10,518	10,130	388	139 (38.39%)
Tema General	Tema	99,212	12,505	12,206	299	131(36.19%)
La General	La Tenashie	62,175	3,839	3,706	133	47 (12.98%)
LEKMA Hospital	Teshie	77,177	2,746	2,685	61	22 (6.08%)
Achimota Hospital	Achimota	108,542	3,281	3,259	22	9 (2.49%)
Ga South Municipal	Weija	136,907	3,279	3,264	15	14 (3.87%)
TOTAL			36,168	35,250	918	362 (100%)

Source: GAR DHIMS 2 annual report 2016

3.7 Data collection techniques and tools

Data abstraction form was used by the data collectors to abstract relevant data from clients' folders for cases and controls which had been selected based on the inclusion and exclusion criteria. Health information officers were contacted to retrieve the folders according to the criteria for inclusion and exclusion

1. Trained data collectors then visited the selected hospitals to collect the folders on cases and controls with support from the health information officers for the hospital
2. The data collectors entered the data from the folders onto the developed data collection tools for mothers and newborns
3. Antenatal; delivery; medical; post-natal records and monitoring charts for mothers were reviewed and relevant portions entered in the data collection tool
4. Delivery and immediate postnatal records on babies were reviewed and pertinent data for cases (fresh stillbirths) and controls (live births) were recorded on the appropriate data collection tools for fresh stillbirth and live births.

The data abstraction tool captured maternal data such as socio-demographic characteristics; previous obstetric history; ANC attendance; interventions received during ANC; labour; delivery and the immediate postpartum period. During the same period data were recorded for the baby. The time of delivery; sex of the baby; birth weight; physical appearance of the baby; characteristics of the placenta; characteristics of liquor and mode of delivery were recorded. Other relevant data such as the health staff who conducted the delivery, complications observed during the antenatal period, labour and delivery were also recorded. Samples of the data abstraction tools are attached in the appendix 2 and 3.

Antenatal, delivery, monitoring charts, medical and post-natal records of cases and controls were also reviewed for both mothers and babies for other relevant information. The variables

included in the administered questionnaires were selected based on work done by other researchers on similar topics through literature review as well as previous personal unpublished work done on contributors to stillbirth by the researcher.

3.7.1 Qualitative data collection

With reference to data collection for the qualitative arm of the study, two semi-structured interview guides with open-ended questions were interviewer-administered to women with histories of delivery of fresh stillbirths in 2016 and health workers. The data collection tool also captured the views of the women on the possible factors that contributed to the delivery of fresh stillbirths as well as their suggestions on how to reduce future occurrence. With reference to the health workers, the tool captured their views on contributors to stillbirths, priority given to the prevention of stillbirth, how stillbirth could be prevented, logistics and blood availability, their capacity in neonatal resuscitation, stillbirth auditing and motivation for health workers. The tools also captured the views of the participants on the role of other stakeholders in reducing stillbirth. A sample of the data collection form is attached in appendix 2.

3.8 Data Quality control

All selected folders were checked by the Regional Health Information Officer and another Health Information Officer. They reviewed the documentation in each folder. against the labour, ward records to confirm that the delivery took place within the same month that the stillbirth was recorded and the gestation was 28weeks or more. A one-day training was organized for the data entry officers to introduce them to the study, explain the various sessions of the tools and equip them with the skill of both quantitative and qualitative data collection skills. The tool was pretested in Adabraka Polyclinic, a GHS health facility which

provides out-patient and in-patient care, antenatal, delivery and post-natal care. This was done to ensure that the data collectors understood the questions; were able to identify the answers from the client folders and appropriately enter the details onto the questionnaires. Two officers entered the data independently and data cleaning was done as the data entry progressed by a senior health information officer. Participant folders that had large amount of missing data which could not be filled were excluded.

3.9 Data processing and analysis

3.9.1 Quantitative data

Data were entered into EPI info 7 using the double-entry technique. The data were cleaned, summarized and new variables created as necessary; an excel template was generated and exported to Stata 13 for bivariate and multiple logistic regression analysis. The Socio-demographic characteristics of the participants were obtained by cross tabulating birth outcome with age; weight; marital status; religion; place of residence (rural / urban); educational level; socioeconomic status; parity; history of previous stillbirth or perinatal death; presence of syphilis; malaria; HIV status; antepartum bleeding and alcohol use. For the babies, the birth outcome was tabulated with sex; gestational age; day of birth; time of birth; intrauterine growth restriction and physical abnormalities. For the service delivery factors, the birth outcome was tabulated against the mode of delivery, health personnel who conducted the delivery, logistics availability and accessibility, referral status of woman, use of partograph, adherence to protocol and completeness and quality of documentation.

3.9.2 Statistical methods

In determining the relationship between intrapartum stillbirth and each of the categorical covariates, bivariate analysis was done using Fisher's exact test and Pearson Chi-square test

of independence were used. Fisher's exact test was used when more than 5% of the expected frequencies in a two by two contingency table were less than five. In comparing quantitative continuous and discrete covariates between mothers who experienced stillbirth (cases) and those who did not (controls), the Welch t-test and the Wilcoxon Rank Sum test were used. In the case of the non-normally distributed covariate, the Wilcoxon rank sum test was used to compare the median of the covariate under investigation between the cases and the control groups. The Welch t-test was used to compare the mean of quantitative covariates between the cases and controls for normally distributed covariates.

The proportion of missing values on certain predictors was relatively high (Table 3.2). Twenty-one multiple imputations by chained equations (MICE) were used to impute missing values. The number of imputations was arrived at by comparing Markov Chain Monte Carlo error on the coefficients. The rule of thumb is that the number of multiple imputations should be increased until Markov Chain error is 10% or less with a p-value less than 0.01. The ability of fetal, maternal and service delivery characteristics to predict stillbirths were evaluated individually using Area under the Receiver Operating Characteristics Curve (AUROC) and the Brier score (BS). Since the sample size was small relative to the number of cases (intrapartum stillbirth), only predictors with higher AUROC and smaller BS were used in the multivariate analysis. The AUROC and BS measure the discrimination and calibration performance of each predictor variable. The F-test measures the overall significance of the model. Poisson regression models with the robust standard error were fitted to the imputed data sets to investigate the risk of fetal, maternal and service delivery risk factors that increase the likelihood of a pregnant woman having an intrapartum stillbirth. Sensitivity analysis was conducted using logistic regression analysis to determine the robustness of the study results to different outcome model specifications. The relative

risk estimates from the Modified Poisson model, odds ratio estimates from the logistic regression model, their respective standard errors and predictive performance indices were combined using Rubin's rule (Rubin, 1996). Per cent relative effect of the predictors was calculated as follows: % increase in the risk of intrapartum stillbirth = (RR - 1) x 100 when RR>1; % decrease in the risk of intrapartum stillbirth = (1 - RR) x 100 when RR<1. RR is the relative risk estimates from the Modified Poisson regression model.

The predicted probability of a woman having stillbirth was explored among the various categories of the predictors using box-whisker plots and scatter plots. Some variables were dropped in the multivariate analysis because of high covariate imbalance (low variability) between cases and control. These variables included admission during pregnancy, area of residence, history of previous stillbirth, history of neonatal death, evidence of abnormality, fever, syphilis and malaria status at the time of delivery. For instance, almost all the patients' folders reviewed showed about 98.0% of mothers (both cases and control) lived in the urban area indicating little variation in the area of residence and hence the decision to drop those variables from the multivariate model to increase the probability of model convergence.

Table 3.3: Proportion of missing values imputed using multiple imputations by chained equations (MICE).

Variables	Fully observed	Number missing	% missing	Number imputed
Age of mother in years	361	14	3.73	14
Sex of the child	354	21	5.60	21
Duration of labor	188	187	49.87	187
Age between the last child and current pregnancy	232	143	38.13	143
Birth weight in kg	349	26	6.93	26
Gestational age of the fetus in weeks	306	69	18.40	69
Parity	356	19	5.07	19
Antenatal care attendance	340	35	9.33	35
Admission during pregnancy	314	61	16.27	61
Antepartum Hemorrhage	361	14	3.73	14
Characteristics of the placenta	352	23	6.13	23
Health professional who delivered the child	336	39	10.40	39
Diabetes	346	29	7.73	29
Eclampsia	345	30	8.00	30
Evidence of abnormality	365	10	2.67	10
Fever	313	62	16.53	62
Gestational diabetes	347	28	7.47	28
History of previous stillbirth	360	15	4.00	15
History of neonatal death	350	25	6.67	25
Malaria	311	64	17.07	64
Marital status	351	24	6.40	24
Pregnancy-induced hypertension	348	27	7.20	27
Syphilis	311	64	17.07	64
Time of delivery	347	28	7.47	28
Mode of delivery	368	7	1.87	7
The educational level of mothers	237	138	36.80	138
Employment status	321	54	14.40	54
Hypertension	348	27	7.20	27
Area of residence	361	14	3.73	14
Position of the baby	356	19	5.07	19
Weight of mother at registration	31	344	91.73	344

N=375 women, 250 controls (women who did not have stillbirth), 125 cases (women who had stillbirth);

$\%\ missing = \left({}^{Number\ missing}/_{375}\right) \times 100\%$

3.10 Qualitative study

The qualitative arm of the study used in-depth interview (IDI) technique for data collection because it provided deeper insight into contextual issues from women who had experienced

fresh stillbirths; lapses in accessing care; perceptions on contributory factors and prevention of fresh stillbirths. The IDI would provide more elaborate data on health care providers' perspectives about contributory and preventive factors to intrapartum stillbirth.

3.10.1 Selection of sites

The Greater Accra Regional and Tema General Hospitals were purposively selected for the qualitative arm of the study because the two hospitals recorded almost 75% of the number of intrapartum stillbirths reported in the six study sites in 2016. The two hospitals are endowed with doctors; midwives and health service administrators. They are major referral centres for general clients and pregnant women from both public and private health facilities throughout the GAR. They are training sites for doctors, nurses and midwives and they also offer technical support to smaller health facilities; including telemedicine.

3.10.2 Inclusion Criteria – selection of participants

To qualify to be included in the study, the woman should have used Tema General or Greater Accra Regional Hospitals for antenatal and delivery services; she should have had an intrapartum stillbirth at or after 28 weeks gestation and willing to talk about her experience. These criteria were necessary because such women would have information about the type of services provided at the hospitals to pregnant women during antenatal and intrapartum. With reference to the health professional, he/she should be a permanent staff of the hospital and also have a role to play in the care of pregnant women.

3.10.2.1 Selection of participants for an in-depth interview

Thirteen women with a history of intrapartum stillbirths, six doctors, six midwives and two Health Service Administrators were selected as participants. The selected numbers of

participants are enough when conducting IDI during qualitative researches including studies about phenomena and also to reach data saturation (Sargeant, 2012).

The women among the cases were purposively selected to include those below 35 years and those above 35 years. Maternal age above 35 years has been associated with poor pregnancy outcomes including stillbirths. The Medical Director of the hospital, the head of the Obstetrics and Gynaecology department, the midwife in-charge of the labour ward, a midwife working in the labour ward and the Hospital Administrator were also purposively selected and interviewed. Per the criteria for selection of participants, the staff were permanent employees who had worked in the hospital for at least six months. This was to ensure that they were conversant with the operations of the hospitals and the services available for pregnant women, discuss issues in detail and contribute to a better understanding of factors associated with stillbirths. Doctors, midwives and hospital administrators were selected because per the governance structure of the Ghana Health Service they play important roles in ensuring continued availability of logistics; health commodities; supplies and human resource management for the smooth running of the hospitals to ensure safe delivery for both mother and baby. The senior managers of the hospitals are the immediate supervisors of frontline health staff, responsible for ensuring that national policies are explained and implemented appropriately by the hospitals. The Medical Directors have the responsibility of ensuring availability and adherence to protocols and standards of care for quality service provision at all times. The Hospital Administrators oversee procurement and human resource management so their inclusion in the study will help unearth health service factors that contribute to intrapartum stillbirth. Well trained skilled health workers, especially midwives, in contrast to numbers, contribute to the reduction of maternal mortality and newborn deaths because they are able to identify and

respond appropriately to complications (Fauveau, Sherratt, & de Bernis, 2008). The role mix of the selected health providers afforded the researcher a unique opportunity to explore contextual factors that lead to intrapartum stillbirths. The data will inform policy and interventions to prevent future occurrences.

3.11 Women with experience of fresh stillbirths

After selecting the folders of cases and controls, the PI requested the Medical Directors of the Tema General and Greater Accra Regional hospitals to make initial contact with the women and introduce the research team to them to facilitate discussions. Stillbirth is a sensitive issue which is hardly discussed. In Ghana, women are required to grieve for less than 2 weeks and move on with their lives (Vanotoo & Adusei-Poku, 2010). The PI envisaged that since the women used the facilities during the antenatal period and for delivery they were acquainted with the staff and would feel more comfortable to talk to the research team when they are introduced by the staff. After the initial contact was made by the hospital, the PI and her assistants followed up the women through phone calls and personal contact; explained the study into more detail and confirmed their willingness to participate. Each woman was allowed to select the most convenient time and venue and the research assistant followed up to complete the IDI. Each interview was conducted at a place away from interference from other people and as secure as possible so that others did not hear what was discussed to give the woman the space to share her experience.

3.12 The health workers

The PI worked directly with the hospital authorities because they have the power to release hospital data and allow their staff to be interviewed. She provided the category of staff required to the Medical Directors who linked the research team to a contact person to serve

as a liaison between the PI, research assistants and the Hospital system. The contact person provided the list and contact details of the categories of staff to be interviewed to the PI who contacted them. The PI explained the purpose of the study and requested the staff to confirm their willingness to participate after which the research assistants followed up and agreed on the time to conduct the IDI. The date, venue and the time were all scheduled to suit the convenience of the participants; taking into account their work schedules. The research team worked with the hospital management to identify appropriate venues for the IDIs such as the hospital's conference room which was located in a quiet, relatively private and free from distractions.

3.13 Arranging data collection tools and materials

All the necessary materials and equipment, including enrolment form, IDI guide, contact summary form, note-takers form and copies of the participant information sheet and signed consent form were made available. Equipment such as digital voice recorder, spare batteries, notepaper and pens were all readily available. The voice recorder was tested before the interview to make sure that it was working and the interviewer was confident in using it.

3.13.1 Carrying out the interview

In-depth interviews are usually conducted in a face-to-face manner with one participant at a time. They can be used inductively when studying a particular issue to stimulate new theories or hypotheses that can be tested in later researches. The IDI can also be used deductively to examine whether theory from a previous study can be applied to groups, individuals or any other phenomenon in the current study (Brounéus, 2011). In this study, IDI was used inductively since the research did not test any theory or hypothesis but was used to develop themes that can be tested in future research studies.

Interview guides were used and participants allowed to share their experiences and perspectives on specific issues (Brounéus, 2011). Thus, IDI was identified as the best technique to get women with a history of intrapartum stillbirth to share their experiences without truncating them. The use of a semi-structured interview guide allowed the interviewer to ensure that all participants answered the same questions without forcing them to follow the same order in responding to questions. The interview guide also helped the interviewer to ask all relevant questions without any omission.

Stillbirth is a sensitive phenomenon which has to be discussed in an environment that does not leave the parents worse off. Verbal and non-verbal interactions helped the interviewer to manage the process since the discussion could lead to a lasting effect on the mother (Ellis et al., 2016). The conservational nature of IDI created the right space for the interviewee to talk about the study subject while the interviewer listened carefully; asked for clarifications; interpreted the responses and moved efficiently from one topic to another to gain the smooth flow of the participant's experience. Use of IDI also offered the interviewer the extraordinary opportunity to observe and record non-verbal communication which other data collection methods do not provide. The interviewer recorded her own reflections immediately after the interview to aid in the data analysis (Brounéus, 2011).

In this study, the interviewer had a face-to-face interview with the participants using an interview guide to cover all the relevant questions but the interviewee was allowed to express his or her view without interruption. The interviewer also had the opportunity to record verbal and non-verbal gestures. The interview was conducted in Twi and English languages, based on what the participant was comfortable with, recorded on a recorder and transcribed verbatim.

The in-depth interviews were conducted by 3 trained research assistants who were Medical Doctors with Masters in Public Health after pre-testing the interview guide at Adabraka Polyclinic in the Greater Accra Region. The pre-test gave the PI the opportunity to assess: the research assistants' understanding of the questions; whether the questions were posed to get the desired response; whether the women were given the opportunity to express themselves without limiting them; the reaction of the women while talking about the stillborn baby and how the Clinical Psychologist would be called in if the need arose. The responses from the pretest also gave the PI the chance to review and modify questions to get the desired responses.

Face-to-face interviews were conducted by the interviewers with every selected participant who consented to participate in the research. The interviewer introduced herself to each participant and explained the purpose of the study at the start of each interview. The interview was recorded on a tape recorder. The interviews with the women were conducted in the Asante Twi and English languages, each interview took about 30 minutes. Ghana has 79 languages but Asante Twi language was used because it is the most widely used language for transactions including commerce and entertainment in Ghana: about 50% of the total population speak it as their first language and close to 80% as a first and second language (Sarpong, 2010). It was more appropriate to conduct the interview in Twi because it would be easier for the women to express themselves freely than to use the English language to discuss a sensitive health phenomenon. However, the interviews of the health staffs were conducted in English since that is the official language for Ghana and in a place free from distractions within the hospital environment for convenience and to minimize disruption of work. Each interview lasted between 30 minutes to 45 minutes.

The PI engaged a Clinical Psychologist and explained in detail the purpose of the study, her role of providing service to the women with a history of stillbirth in case they broke down during the interview. She gave her consent and the PI gave her the interview dates, times and venue for her to be within reach. The research assistants were trained to recognize and suspend the interview when a woman became too emotional to continue with the discussions or decided to withdraw in the course of the interview and call the Clinical Psychologist to provide counselling after seeking her consent.

3.13.2 Following the data collection guide

The interviewers followed the guide but allowed the pace to be set by the interviewee and recorded proceedings accordingly. Each page of the interview notes was labelled with the participant's study ID to prevent mix up of participants' identity and make it easier to track individual participants for possible follow up. The interviewer made brief notes on the topic guide to highlight the main issues discussed during the interview. The interviewers took notes of points of clarification; answered questions posed by the interviewees and also explained any points that were not clear to the participant.

The data collection guide was designed to answer the research questions while bringing out clear perceptions and emerging themes and it was structured around the four thematic areas:

- Maternal factors
- Fetal factors
- Service-related factors
- Mitigating factors against intrapartum stillbirths

Details of the guide are found in Appendix 5 and 6.

3.14 Debriefing meetings

The PI had daily debriefing sessions with all research assistants and minutes were recorded on Debriefing Forms. The objectives of the debriefing meetings were:

- To update and assess progress with data collection and assess progress made
- To discuss challenges and find solutions
- To check if any of the participants needed the services of the Clinical Psychologist

The debriefing minutes contributed to a review of the interview guide, participant recruitment and interview process to ensure quality assurance was maintained throughout the data collection phase.

3.15 Qualitative Data Analysis

3.15.1 Transcription and Translation

Audio recordings were done for all interviews; these were later listened to carefully and checked for voice file clarity. In two cases where the participants' voice recordings were not clear the research assistants contacted the participants and repeated the interviews with the same participants and these participants were health workers. All the repetitions were done before they were transcribed and exported to NVIVO 11 (QSR International, Cambridge. MA) qualitative data management software for coding and analysis. A standardised layout was applied to all transcripts to facilitate the comparison of data at the analysis stage. This included a summary of quantitative data to describe the participant's demographic characteristics, the location and other key information to situate the interview. Recorded audio data were transcribed verbatim into English. Verbatim transcription eliminated the tendency of losing respondent's contribution to interpretation or summary during transcribing.

The verbatim approach underpinning qualitative research helped to convey as fully as possible the experiences and representations of the participants who had experienced intrapartum fetal deaths. This included word-for-word transcription, recording all hesitations, pauses, utterances, cross-talking and incomplete sentences. An agreed set of notations were applied to indicate these. Major interruptions by other people or telephones were recorded to contextualise any breaks in speech or repetitions. However, minor interruptions were not recorded in order to ensure the flow of the transcript supports interpretation and analysis. The transcription was proof-read against the audio file by the transcriber and the Principal Investigator for accuracy, to identify any missed or misheard words and to clarify any areas of confusion or unclear terminology. An agreed cleaned version of the transcription was created and this was used for analysis.

Uploaded transcripts were coded inductively and deductively into basic themes based on the codebooks developed for the study. Deductive coding was guided by identified causes of intrapartum stillbirth in the literature review that preceded data collection. Similar quotes to research questions in two or more basic themes/level one nodes were grouped into organizing themes (level 2 child nodes/child nodes). Global themes (level 1 nodes) summarized all emerging inductive and deductive themes under each research question. NVIVO concept maps were used to construct thematic networks to present a visual summary of how themes spread out and connect in revealing results under each research question.

A data entry interface was created for all quantitative data such as demographic details, in Excel. Data were then imported into NVIVO as a new casebook. The relevant transcripts and audio files were linked to each case in the casebook. Field notes were coded on a daily

basis: this coding grouped the descriptions of observations and informal conversations into themes. Alongside this coding, a reflective analytical diary was kept, to draw out and justify emerging themes and lines of enquiry through the fieldwork process. Transcripts were coded line-by-line, and then later into developing themes and theoretical constructs by grouping the base coding together. The on-going analysis was characterised by frequently going back to the original transcripts to ensure that texts were coded within context. This analytical process situated the practices and perceptions of the findings in the wider networks in which they are embedded, giving attention to cultural, historical, political and economic contexts. Important quotes were written to create emphasis.

3.16 Quality Assurance

3.16.1 Training of Research Assistants

The research assistants were taken through one-day training on the objectives of the research study, the design of the questionnaires, the significance of the questions and how to elicit answers, piloting the questionnaires, ethical issues in data collection, how to ensure quality data collection and data entry. The training took place at the Greater Accra Regional Health Directorate. It was conducted by the PI, a Senior Public Health Specialist.

Standard operating procedures were developed as guidance to monitor the research team at all stages of the study, including recruitment, data collection and data analysis, and these were used as the basis for quality assurance assessment protocols. Three assessments of quality assurance were conducted during the data collection phase by a moderator (a senior Health Information Officer) who was external to the field team. The moderator discussed issues identified with the PI and immediate actions were taken to ensure the progress of the research.

3.16.2 Reflexivity

Reflexivity shapes the relationship between the researcher and the research and systematically deals with the context of knowledge construction in relation to the researcher and improves the integrity of the study (Palaganas, Sanchez, Molintas, & Caricativo, 2017) According to Bourke (2014) the researcher, through reflexivity, is able to do self-reflection and critically examine his or her role through the course of the research. The critical self-awareness looks at how the researcher's social position such as class, gender, race, ethnicity and kinship influence the study (Palaganas et al., 2017). Furthermore, reflexivity helps to focus attention on the researcher's emotions, biases and assumptions about the research (Berger, 2015) and enables the researcher to be accountable for the analysis and interpretation he or she makes of the research data (Deutsch, 2004).

Gilgun. (2010) posits that researchers should be reflexive in 1) the choice of the study topic, 2) the stakeholders involved, made up of study participants and other researchers, and 3) beneficiaries of the research findings. Jootun et al (2010) theorize that all research is shaped by the perspective or position of the researcher and they influence the understanding of the phenomenon under study and the researcher's role in the study. Therefore, as the researcher tries to be objective, he or she must still bear in mind that it is not possible to ignore the issue of subjectivity and its influence on the research process and output. According to Bourke (2014), positionality represents the place where subjectivism and objectivism meet.

In conducting this research, I recognize how my positionality may have affected the selection of the topic, data collection and analysis, presentation of results, interpretation of the findings, conclusions and recommendations. I start with my role as Regional Director of Health Service and how this was an advantage but also created a dilemma during data

collection and how I managed this dilemma to increase objectivity. I then address the issue of my personal experience of fetal loss leading to the emotional attachment to the phenomenon of stillbirth.

Although I have come to the understanding that it is not all pregnancies that will end in live births, as I thought about how to help babies survive, I had the strong desire to go into history and explore the perceptions of health workers and women about their experiences of stillbirths. According to Dwyer and Buckle (2009), the researcher does not occupy a neutral position but rather the dual role of insider and outsider during the study process. For this reason, I draw on the terms "insider" and "outsider" to refer to my dual role as someone who could have had an impact on the study through my profession, experiences, ethnicity, gender values or inexperience. A number of social scientists have discussed the role the researcher's position, person and background play in selecting the methodology and the entire process of a study and I believe my position as RDHS and personal experience of fetal loss affected the methodology of this study (Attia & Edge, 2017; Patnaik, 2013) However, to mitigate subjectivity I draw on the available literature on similar topics to minimize introduction of bias.

With my background as a medical doctor coupled with my role as the Regional Director of Health Service (RDHS) for the Greater Accra Region, I see myself as an insider. However, since I do not work directly in any of the hospitals where data collection took place, in that sense, I see myself as an outsider. The design of this study evolved from my basic training in Medicine, Paediatrics, Epidemiology and practice. Though my qualitative study was more of probing, firstly, I believe in the objective realism that although some stillbirth may occur from unpreventable causes, other cases are preventable. Secondly, since I want to

have an in-depth understanding of factors that contribute to intrapartum stillbirth, I used two methods (quantitative and qualitative) to explore the phenomenon of intrapartum stillbirth.

I derived several benefits from my dual role as an insider and an outsider. First, my position as RDHS gave me the advantage of easy access to the Hospital Management and staff, health information officers (HIOs), District Health Information Management System (DHIMS), and women who had experienced stillbirth. Furthermore, it was easy to select senior and junior HIOs and medical doctors as research assistants. They were easily accepted into the hospitals as peers for data collection and interviews. Secondly, it would have been difficult for me to explore my research topic with the hospital records, health professionals and women with history of stillbirth as a complete outsider, only playing the role of a researcher. I resolved this difficulty by giving due respect to the Medical Directors and sought permission before engaging the HIOs and other staff. My personal contact with the HIO, as someone who understood the importance of their work as well as the difficulty of retrieving old records, rather than "a boss instructing them" facilitated the retrieval of client folders. Thirdly, my position as RDHS gave me a deep understanding of how the hospitals should function as well as the challenges they encounter with data management. However, in this instance my role was a researcher and not a supervisor, thus, I saw myself as an outsider who did not pass judgment on the functionality of the hospital. Fourth, I recognized the fact that if I interviewed the health professionals, my position as RDHS would affect the responses either positively or negatively. To mitigate this bias, medical doctors were engaged as research assistants to interview all participants. The research assistants were trained not to pass professional judgment or give their own perspectives during the interviews. The female gender of the doctors (research assistants) was important. With the women participants, the issue of possible power play between a well-

educated woman (interviewer) talking to a not-so-well-educated woman (participant) cannot be ruled out but the use of local dialect, non-medical jargons and female interviewers reduced this risk as much as possible. With reference to the health professionals, the interviewers were peers and the English language was used since this is the official language in Ghana. They were familiar with the medical terms used during the interview and therefore, there was no ambiguity about answering the questions. I took on several responsibilities during the study: development of data collection tools, liaison between data collectors and study sites, trainer of data collectors, the interviewer (pretesting of the questionnaire), team leader of data collectors and reviewer of interview recordings and transcripts. In conducting this research, I do not remain an unconcerned passive outsider. My perspectives and experiences may have informed the processes involved in developing every aspect of the study. However, this does not imply that the study is filled with subjectivity and personal values. To ensure objectivity, I followed the due ethical processes in conducting research and obtained relevant ethical approval.

Choosing both quantitative and qualitative methods was informed by my desire to get in-depth information about intrapartum stillbirth. My personal experience with fetal loss makes me emotionally attached to women with similar experiences and my position as RDHS gave me the responsibility of identifying factors that contribute to stillbirth. I, therefore, take on the "emic" position as a woman who has experienced fetal loss and an "etic" position as a supervisor who does not attend to women in labour. In this case, I may not fully understand the difficulties midwives and doctors face as they provide care to women in labour, so I could easily judge their dedication or professional competence. To mitigate this possibility of bias I did not interview the participants myself. The interviewers, trained medical doctors, had insight into the issues of stillbirth and

understood all the variables in the interview guide. They have worked in the Ghana Health Service in various positions including middle-level management and were conversant with the professional duties of doctors, administrators and midwives. The selection of doctors, midwives and health administrators in the study was influenced by my understanding (as RDHS) of the role they play as frontline workers to ensure optimal care for pregnant women.

Though my dual role facilitated data collection, entry and analysis, I point out the problem I encountered with my positionality which prevented me from having face to face interview with participants. I envisioned that if I, as the RDHS (supervisor) interviewed the hospital staff, they may say that everything was going well or they may see it as an opportunity to share only the challenges confronting them and say that nothing was going well. To mitigate this, the interviewers were trained to guide the discussions without stopping a participant from expressing his or her view on a particular issue.

My position as RDHS and the strong desire to identify factors contributing to intrapartum stillbirth influenced the selection of study sites which are referral centres with relatively high numbers of trained staff but also the highest recorded numbers of stillbirths in GAR. Asking about emergency response had to be done carefully to avoid bias. The third delay (of the 3 Delays model) occurs at the health facility and contributes to poor birth outcomes including stillbirth. To mitigate this, the interviewers recorded the interview without giving their professional views.

Assessing health system factors had to be done cautiously to identify workers' professional level of adherence to policies in their work. My desire to understand how internally

generated funds (IGF) was utilized to improve the quality of care may have influenced the inclusion of logistics and supplies in the interview. This had to be done professionally to avoid the semblance of policing the hospitals. The interviewers were trained to document responses without giving any feedback on how IGF was used. Both senior and junior health staff were interviewed to give equal opportunity for them to express their views.

With the reflexive insight of being the RDHS and having a "superior position" over all the health workers, I deemed it prudent to engage research assistants and train them to conduct the face-to-face IDIs.

Not conducting the face-to-face IDIs (myself) might have led to the loss of some non-verbal cues portrayed by the participants which could have added more insights. However, it is also possible that if I had conducted the face-to-face interviews the health workers may have brought up other concerns for discussion which may not be relevant to the topic. I may have been distracted and discussed them as a way of showing respect or to compensate them for their time dedicated to answering the research questions. The interviewers were trained to identify such distractions and gradually bring the participant back on track. By listening to all the audio recordings, I checked for clarity of audio recordings and gave feedback to the interviewers. This also served as quality assurance. I reviewed all the transcripts and my background as a trained Medical Doctor, made it possible to correct all technical words. This improved the quality of the transcription and thus, made the coding and thematic analysis easier and more credible.

The willingness of the participants to talk about their experiences may have been influenced by the emotional nature of stillbirth as a birth outcome. My "fear" that the women may break

down led to the recruitment of a Clinical Psychologist. However, none of the participants needed such services. Although the research assistants were medical doctors, they did not give their opinions about why the babies died and so did not introduce bias.

My position as RDHS may have influenced the data entry, analysis and presentation of findings. The Regional Health Information Officer (RHIO) assisted to get two reliable HIOs to do the data entry. The RHIO supervised the data entry and was personally involved in data cleaning. To mitigate the introduction of his personal biases, I had daily meetings with him to review the progress of data entry and address any challenges encountered. Although I was his supervisor, I did not use the occasion to judge his work so he was comfortable talking about some of the lapses in information management identified during the data collection and entry. In this situation, my role was an outsider.

My strong desire to contribute to the reduction of preventable intrapartum stillbirth, and the lack of attention given to stillbirth in Ghana may have influenced the analysis of both the quantitative and qualitative data sets and proposal of a model to prospectively predict intrapartum stillbirths. The objectives and research questions and the choice of quantitative and qualitative methods may have influenced the findings and conclusions drawn. To mitigate biases, I followed due processes in the study design and implementation. It is possible that the findings from this study will contribute to the reduction of intrapartum stillbirths in future. I see this as my God-given assignment to help humanity.

3.17 Ethical considerations/issues confronting the research

Ethical approval was obtained from the Ghana Health Service Ethical Review Committee through the Health Research and Development Division (GHS, RDD). The requirements were duly met as stipulated on the website at

http://www.ghanahealthservice.org/publications. The ethical clearance certificate was GHSERC23 /06/17

3.17.1 Consent Process

Research Assistants always sought informed consent from all study participants for participation in the IDIs at convenient locations and in the English language or Twi language based on the participant's preference. Data collectors were trained on the sensitivity of the phenomenon of stillbirth and asked to stick to the questions as per the interview guide and not to divulge information to anyone else apart from the research team and to ensure privacy at all times. After providing information, answering any queries, the participants were asked to give their written consent using a consent form; those who could not write gave verbal consent. A logbook was provided in which all those eligible who consented to or refused to participate were recorded.

In addition to approval from the GHS, RDD, the PI obtained permission from the Greater Accra Regional Health Directorate and the management of the six selected facilities before data collection started. The interviewers obtained permission from the participants before discussions were recorded on tape and the tapes have been stored in a safe with security lock which is available to the PI. These tapes will be available for a period of five years and then be destroyed with technical assistance from computer experts.

When women were called on phone the interviewer's phone was not placed on the speaker: so people around did not hear the answers from the women. No payment was made to participants for their participation and this was communicated to them at the beginning of the interview that participation was voluntary. They were informed that they were free to

withdraw from the research at any time and that would not affect their use of services at the facilities in the future. The potential risk of someone breaking down during an interview (while talking about her stillborn baby) was also explained as well as access to the services of a trained Clinical Psychologist if the need arose at no financial cost to them. They were made aware that the data would be stored in a secured place under lock and key and the PI would be the only person to have access to the key and that the data will be destroyed after five years using the most modern form of destruction for the device used in recording the data.

Participants were also informed that the results of the research would be presented in tables, graphs and prose at different meetings both in and outside of the country and would contribute to the knowledge on stillbirths and development of possible preventive interventions but not for the financial benefit of the PI or any other person. They were informed that whenever presentations were made, their names will not be mentioned, to maintain confidentiality.

3.18 Summary

This chapter described the methodology of the study. The chapter was divided into the quantitative and qualitative arms of the study. The chapter described the study design; study sites; sampling procedure; procedures for data collection; analysis and the philosophical basis for the quantitative and qualitative paradigms as well as the reflexivity of the study. The chapter ended by discussing how consent was obtained from the participants; processes used to ensure quality and ethical issues associated with research.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the results of the study at three different levels using both quantitative and qualitative analytical techniques. Firstly, the chapter describes the socio-demographic, maternal and fetal characteristics of respondents in the quantitative data. The chapter presents the results of the quantitative data in two sections. The first section provides background characteristics of respondents engaged in the study while the second section investigates the association between the maternal, fetal, service delivery factors and intrapartum stillbirth.

Secondly, the chapter examines the maternal, fetal and service delivery predictors of intrapartum stillbirth using quantitative and qualitative techniques. Analysis of the predictors of intrapartum stillbirth was done in two ways. First, factors (including maternal, fetal and service delivery factors) that were significantly associated with intrapartum stillbirth in the previous chapter were modelled in the multivariate analysis. There were three different models. The significant predictors of intrapartum stillbirth in these three different models were then used in one model to account for the real predictors of intrapartum stillbirth.

Thirdly, the chapter explores the reasons accounting for the causes of intrapartum stillbirth among the participants in the qualitative study using thematic analysis technique. This chapter under this section is divided into two. The first section presents the demographic characteristics of participants of the qualitative data. The second section presents findings on the causes and suggestions on how intrapartum stillbirth could be prevented.

The aim of this analysis is to identify maternal, fetal and service delivery factors that participants perceive to be the causes of intrapartum stillbirth but may not have been captured in the quantitative data, as well as to clarify some of the findings from the quantitative analyses. The perceived causes of intrapartum stillbirth are classified into three organizing themes; (i) maternal factors (ii) fetal factors and (iii) service delivery factors.

Basic themes and quotes from the participants are presented to elaborate on these organizing themes. The participants are identified by numbers that correspond to their positioning in Tables 4.8a and 4.8b which provide detailed description of each of the participants in the qualitative study. The basic themes and quotes are presented in appendix 9.

4.2 Quantitative Study

4.2.1 Maternal and fetal characteristics

The number of deliveries recorded in all the six selected hospitals in the Greater Accra Region between 1st January 2016 and 31st December 2016 was 36,168. Out of this 35,250 (97.5%) were live births whilst 918 (2.5%) were stillborn. Also, 362 (39.4%) out of the stillbirths occurred intrapartum. Based on available data, a total of 125 cases (intrapartum stillbirths) and 250 controls (live births) were selected for the study (Table 3.1).

The mean ages of the women were 28.8 years for the cases and 28.9 years for the controls. About seventy eight percent (78.6%) of the cases and 84% of controls were below 35 years while 21.4% of cases and 16% of controls were above 35 years. With regards to educational background, 13.3% of cases had no education and 7.3% of controls had no education while 10% of cases had tertiary education compared to 11.9% of controls. With reference to marital status, 83.3% of cases and 86.9% of controls were married while 16.7% of cases and

13.1% of controls were single. With regards to employment, 10.9% of cases and 6.4% of controls were unemployed while 77.2% of cases and 81.8% of controls were in the informal sector (Table 4.1a).

With regards to antenatal attendance, 94.5% of cases and 97.4% of controls attended antenatal clinic. Pregnancy-induced hypertension was recorded in 27% of cases and 8.1% of controls. Antepartum haemorrhage was recorded in 24.8% of cases and 2.5% of controls (Table 4.1b).

Among the babies, 57.3% and 55.3% were males among the cases and controls respectively while 42.7% of cases and 44.7% of the controls were females. Evidence of abnormality was reported in 11.7% of cases and 1.2% of controls. Gestational age below 37 weeks was recorded in 51.5% of cases and 25.6% of controls while gestational age above 37 weeks was recorded in 48.5% of cases and 74.4% of controls. Birth weight below 2.5Kg was recorded in 37.6% of cases and 15.4% of controls while birth weight above 2.5Kg was recorded in 62.4% of cases and 84.6% of controls. In 50% of the cases, the liquor was meconium stained compared to 8% in the controls. The babies presentation at birth was cephalic in 81.7% of cases and 95% in the controls (Table 4.2).

4.2.2 Association between maternal factors and intrapartum stillbirth

This study investigated fourteen different maternal factors that could increase the risk of intrapartum stillbirth, based on a review of previous studies in the literature. The Pearson Chi-square test of independence showed that pregnancy-induced hypertension; premature rupture of membranes and ante partum haemorrhage were associated with an intrapartum stillbirth (Table 4.1a). Among mothers who delivered intrapartum stillbirth, 27.0% had

experienced pregnancy-induced hypertension compared to 8.1% (χ^2=21.9, p<0.001) in the control. Among the cases, 8.0% had experienced premature rupture of membranes compared to 4.0% in the controls (χ^2=77.4, p<0.001). With regards to antepartum haemorrhage, 24.8% of the cases had previously experienced intrapartum stillbirths compared to 2.5% among the controls (χ^2=79.0, p<0.001). From the above, it can be concluded that pregnancy-induced hypertension, premature rupture of membranes, antepartum haemorrhage and low haemoglobin at registration are key maternal factors associated with intrapartum stillbirth among women in the Greater Accra Region.

Table 4.1a: Bivariate analysis of maternal factors associated with intrapartum stillbirth in the Greater Accra Region in 2016.

	Control		Cases		
Maternal Characteristics	Number of mothers (n= 250)	n (%)	Number of mothers (n= 125)	n (%)	Pearson Chi square, p-value notation
Age in years (mean+SD)	244	28.88 ± 5.54	117	28.85 ± 6.05	0.05,ǂ0.957
Age categories: <35 years	244	205 (84.02)	117	92 (78.63)	1.57, 0.842
>=35 years		39 (15.98)		25 (21.37)	
Educational level: None	177	13 (7.34)	60	8 (13.33)	4.66, 0.198
Primary		53 (29.94)		11 (18.33)	
Secondary		90 (50.85)		35 (58.33)	
Tertiary		21 (11.86)		6 (10.00)	
Marital status: Married	237	206 (86.92)	114	95 (83.33)	0.81, 0.273
Single		31 (13.08)		19 (16.67)	
Area of residence: Urban	244	242 (99.18)	117	113 (96.58)	0.089,§ 0.071
Rural		2 (0.82)		4 (3.42)	
Employment: Unemployed	220	14 (6.36)	101	11 (10.89)	1.98, 0.160
Formal employment		26 (11.82)		12 (11.88)	
Informal employment		180 (81.82)		78 (77.23)	
Parity: median (LQ, UQ)	236	1.00 (1.00, 2.50)	120	2.00 (1.00,3.00)	-1.04, 0.299ǂ
Parity categorize : No child	236	55 (23.31)	120	29 (24.17)	0.31, 0.856
1 - 4		168 (71.19)		86 (71.67)	
4		13 (5.51)		5 (WHO)	
Weight at registration (mean ± SD)	6	75.01 ± 18.57	25	64.37 ± 14.62	1.31, 0.231ǂ
Hemoglobin at 1st registration (mean ± SD)	6	10.57 ± 1.36	29	10.71 ± 1.61	-0.22, 0.829ǂ
Hemoglobin: **median** (LQ, UQ)	2	6.88 (6.65,7.10)	15	6.05 (4.95,6.60)	1.95, 0.052ǂ
Age between last child and current Pregnancy: median (LQ, UQ)	154	2.00 (0.00,4.00)	78	2.00 (0.00,5.00)	-0.699, 0.485ǂ

P-values notation;*p<0.05,**p<0.01,***p<0.001 values were based on Pearson chi-square and Fisher's exact test for categorical variables, Mann-Whitney test and t-test. SD: Standard Deviation. UQ: Upper quartile, LQ: Lower quartile. (%) represent column percentage, ǂ estimated p-value from the Welch t-test, § p-value estimate from Fisher's exact test. ¥ p-value estimated from Mann-Whitney test, N: Total number of cases and controls that were actually used in the estimation of the test statistic.

Table 4.1b: Bivariate analysis of maternal factors associated with intrapartum stillbirth in the Greater Accra Region in 2016...

	Control		Cases		
Maternal Characteristics	Number of mothers (n= 250)	n (%)	Number of mothers (n= 125)	n (%)	Pearson Chi square, p-value
History previous stillbirth: Yes	245	3 (1.22)	115	4 (3.48)	2.09
No		242 (98.78)		111 (96.52)	
History of Neonatal deaths: Yes	239	5 (2.09)	111	4 (3.60)	0.47§
No		234 (97.91)		107 (96.40)	
ANC attendant: Yes	231	225 (97.40)	109	103 (94.50)	1.84
No		6 (2.60)		6 (5.50)	
Number of ANC Visits (mean ± SD)	7	5.57 ± 2.51	30	4.55 ± 2.09	1.01¶
Number of ANC Visits: 0 - 3 visits	7	2 (28.57)	38	13 (34.21)	1.00§
More 3 visits		5 (71.43)		25 (65.79)	
IPT doses (mean ± SD)	15	2.20 ± 1.08	34	2.24 ± 0.82	-0.11¶
Fever: Yes	246	6 (2.44)	67	3 (4.48)	0.41§
No		240 (97.56)		64 (95.52)	
Malaria: Yes	248	3 (1.21)	63	3 (4.76)	0.10§
No		245 (98.79)		60 (95.24)	
Diabetes: Yes	248	1 (0.40)	98	0	1.00§
No		247 (99.60)		98 (39.00)	
Hypertension: Yes	248	2 (0.81)	100	4 (4.00)	0.10§
No		246 (99.19)		96 (96.00)	
Pregnancy Induced Hypertension: Yes	248	20 (8.06)	100	27 (27.00)	21.87***
No		228 (91.94)		73 (73.00)	
Eclampsia: Yes	247	3 (1.21)	98	2 (2.04)	0.625§
No		244 (98.79)		96 (97.96)	
Admission in pregnancy: Yes	247	8 (3.24)	67	2 (2.99)	1.00§
No		239 (96.76)		65 (97.01)	
Premature rupture of Membrane: Yes		10 (4.13)		10 (8.00)	
No	242	232 (95.87)	125	81 (64.80)	77.41***
Antepartum Hemorrhage: Yes	236	6 (2.54)	125	31 (24.80)	
No	236	230 (97.46)	125	79 (63.20)	79.02***
Labor duration in hours : median (LQ, UQ)	129	8.40 (5.00,13.56)	59	7.30(3.35,15.00)	0.30¥

P-values notation; *p<0.05, **p<0.01, ***p<0.001 values were based on Pearson chi-square and Fisher's exact test for categorical variables, Mann-Whitney test and t-test. SD: Standard Deviation. IQR: interquartile range, n (%) represent frequency and column percentages respectively, ¶ estimated p-value from the Welch t-test, §: p-value estimate from Fisher's exact test, ¥: p-value estimated from Mann-Whitney test, N: Total number of cases and controls that were actually used in the estimation of the test statistic.

4.2.3 Association between fetal factors and intrapartum stillbirth

This study investigated seven fetal characteristics and how they could influence the risk of intrapartum stillbirth in the Greater Accra Region. The Welch t-test showed a statistically significant difference in the mean gestational age of fetuses between mothers that had previously experienced intrapartum stillbirth and those that have not had such experience. The mean gestational age of the fetus in weeks for mothers that have not experienced stillbirth was approximately 38.8 weeks compared to those that have experienced stillbirth,

which was 35.6 weeks (t=5.2, p<0.001). The sensitivity analysis based on the Chi-square test of independence when gestational age in weeks was re-categorized into preterm and term births also showed a significant relationship with intrapartum stillbirth (χ^2=20.2, p<0.001). Birth weight was statistically different between the cases and controls. The mean birth weight of stillbirths (cases) was generally lower compared to the birth weight of babies born alive (controls) (2.7kg versus 3.1kg, t=4.0, p<0.001). There was an association between birth weight and intrapartum stillbirth (χ^2=21.3, p<0.001). Among mothers who had an intrapartum stillbirth, 37.6% of them delivered babies with low birth weight while 15.4 % in the control delivered babies with low birth weight. Evidence of abnormality, characteristics of the liquor and placenta had a statistically significant relationship with intrapartum stillbirth (p<0.05) (Table 4.2). The results show that gestational age is one of the main fetal factors associated with an intrapartum stillbirth.

Table 4.2: Fetal factors associated with intrapartum stillbirth in six public hospitals in 2016.

	Control		Cases		
Fetal characteristics	Number of mothers (n= 250)	n (%)	Number of mothers (n= 125)	n (%)	Pearson Chi square, p-value notation
***Sex of child*: Male**	244	135 (55.33)	110	36 (57.27)	0.12
Female		109 (44.67)		47 (42.73)	
Gestational age (mean ± SD)	203	38.80 ± 2.69	103	36.54 ± 3.95	5.23***
Gestational Age categorized: Preterm **(Below 37week)**	203	52 (25.62)	103	53(51.46)	20.24***
Term (37 weeks and above)		151 (74.38)		50 (48.54)	
Birth Weight (Collins et al.) (mean ± SD)	240	3.08 ± 0.65	109	2.70 ± 0.92	3.96***
Birth Weight (Collins et al.): Low (<2.5kg)	240	37 (15.42)	109	41 (37.61)	21.28***
Normal (≥2.5kg)		203 (84.58)		68 (62.39)	
Position of the baby: Otherwise	241	12 (4.98)	115	21 (18.26)	16.33***
Cephalic		229 (95.02)		94 (81.74)	
Evidence of Abnormality: Yes	245	3 (1.22)	120	14 (11.67)	19.78***
No		242 (98.78)		106 (88.33)	
Characteristics of the placenta: Described	247	176 (71.26)	105	50 (47.62)	17.91***
Not Described		71 (28.74)		55 (52.38)	
Characteristics of Liquor: Clear	224	206 (91.96)	32	16 (50.00)	42.81***
Meconium Stained		18 (8.04)		16 (50.00)	

P-values in parentheses:*p<0.05,**p<0.01,***p<0.001 values were based on Pearson chi-square and Fisher's exact test for categorical variables, Mann-Whitney test and t-test. SD: Standard Deviation. IQR: interquartile range, (%) represent column percentage. ǂ estimated p-value from the Welch t-test, § p-value estimate from Fisher's exact test, ¥ p-value estimated from Mann-Whitney test; N: Total number of cases and controls that were actually used in the estimation of the test statistic.

4.2.4 Association between service delivery factors and intrapartum stillbirth

This study investigated three service delivery factors that can influence intrapartum stillbirth. These factors were the mode of delivery, category of a health professional who conducted the delivery and the time of delivery. The Pearson Chi-square test analysis showed that there is a relationship between the mode of delivery, health professional who conducted the delivery and intrapartum stillbirth ($p<0.05$) (Table 4.3). Among the cases, 51.2% of babies were delivered via caesarean section compared to 34.1% delivered by caesarean section among the controls ($\chi^2=10.1$, $p<0.001$). Approximately 55.2% of cases were delivered by medical doctors compared to 39.1% of deliveries by medical doctors among the controls ($\chi^2=8.0$, $p=0.005$). Time of delivery was not found to be statistically significant. Mode of delivery and the health professional who conducted the delivery could be associated with intrapartum stillbirth but caution must be taken in the interpretation of these results since this relationship was only observed during the bivariate analysis.

Table 4.3: Bivariate analysis of service delivery factors associated with intrapartum stillbirth in six public hospitals in 2016

	Control		Cases		
Service delivery factors	Number of mothers (n= 250)	n (%)	Number of mothers (n= 125)	n (%)	Pearson Chi square, p-value
Mode of Delivery: CS	247	84 (34.01)	121	62 (51.24)	10.08***
SVD		163 (65.99)		59 (48.76)	
Person conducted the Delivery: Medical Officer	220	86 (39.09)	116	64 (55.17)	7.95***
Midwife		134 (60.91)		52 (44.83)	
Time of delivery: Day shift	230	152 (66.09)	117	74 (63.25)	0.28
Night shift		78 (33.91)		43 (36.75)	

CS: Caesarian Section, SVD: spontaneous vaginal **delivery; P-values notation; ***p<0.05, **p<0.01, ***p<0.001 values were based on Pearson chi-square and Fisher's exact test for categorical variables, Mann-Whitney test and t-test. SD: Standard Deviation. IQR: interquartile range, **(%) represent column percentage,** ł estimated p-value from the Welch t-test, § p-value estimate from Fisher's exact test, **¥ p-value estimated from Mann-Whitney test,** N: Total number of cases and controls that were actually used in the estimation of the test statistic.

Table 4.4: Screening variables to be included in the multivariate analysis using the Area under receiver operating characteristics curve and the Brier score.

VARIABLES	AUROC [95% CI]	BRIER SCORE
Fetal Factors:		
Sex of child	0.50 [0.45, 0.56]	0.2220
Gestational age of child weeks	**0.67*** [0.61, 0.74]**	**0.1979**
Birthweight of child in kg	0.64 [0.57, 0.70]	0.2080
Intra uterine position	0.57 [0.53, 0.60]	0.2087
Maternal factors:		
ANC	0.54 [0.50-0.58]	0.2199
Age of mother	0.51 [0.44, 0.57]	0.2222
Marital status	0.53 [0.49-0.58]	0.1887
Mothers educational status	0.67 [0.61, 0.73]	0.2211
Parity of mother	0.53 [0.47, 0.60]	0.2216
Antepartum Haemorrhage	**0.64§ [0.60, 0.69]**	**0.1940**
Haemoglobin at registration	**0.81§ [0.76, 0.85]**	**0.2132**
Premature rupture of membrane	**0.64§ [0.60, 0.68]**	**0.1942**
Pregnancy induced hypertension	**0.71§[0.64-0.77]**	**0.1886**
Weight at Registration in kg	**0.71§[0.66, 0.76]**	**0.2076**
IPT doses	**0.81§ [0.76, 0.85]**	**0.2143**
Service delivery factors:		
Mode of Delivery	0.61 [0.56, 0.66]	0.2177
Time shift delivery	0.51 [0.46, 0.57]	0.2233
Delivered by:	0.58[0.52, 0.64]	0.2166

AUROC: Area under receiver operating curve. CI: confidence interval. § indicates variables included in the multivariable analysis

Table 4.5: Quantifying the effect of fetal and maternal factors on intrapartum stillbirth using multivariable logistic regression model with robust standard error

	A binary logistic regression model with robust standard error	
	aOR [95% CI]	aOR [95% CI]
Gestational age of child	0.86** [0.79-0.94]	0.83** [0.73-0.96]
Antepartum hemorrhage: *No*	ref	ref
Yes	2.85** [1.43-5.71]	3.28* [1.33-8.10]
Premature -rupture membrane	ref	ref
No		
Yes	3.28** [1.59-6.75]	3.36* [1.20-9.40]
Pregnancy induced	ref	ref
hypertension: No		
Yes	3.59*** [1.80-7.17]	3.72** [1.71-8.10]
Hemoglobin at first registration		1.13 [0.72-1.79]
Weight at first Registration		1.00 [0.97-1.02]
IPT doses		1.35 [0.66-2.75]
Model performance index:		
AUROC [95% CI]	**0.73*** [0.66, 0.80]**	**0.85***[0.81- 0.90]**
Brier score	**0.1566**	**0.1323**

ref: reference category. OR: Odds Ratio. P-value notation: ***: p<0.001, **: p<0.01, *p<0.05. CS: caesarian section. SVD: spontaneous vagina delivery. ##########: Not applicable. IPTp: Intermittent Preventive Treatment for pregnant women.

4.2.5 Analysis of the predictors of intrapartum stillbirth

Concerning the maternal factors, after the initial analysis, only six out of the 14 maternal factors investigated met the criteria for inclusion into the multivariable model; they had

relatively higher AUROC and smaller Brier Score as shown in Table 4.4. Controlling for gestational age of the fetus and other maternal characteristics in the Poisson regression model, among mothers who experienced pregnancy-induced hypertension, the odds of experiencing intrapartum stillbirth was approximately 3.7 times the odds of experiencing intrapartum stillbirth among women without a history of pregnancy-induced hypertension (aOR=3.7, 95%:1.71-8.1, p<0.01; Table 4.6). Among women who experienced antepartum haemorrhage, the odds of intrapartum stillbirth was approximately 3.3 times the odds of intrapartum stillbirth among women without antepartum haemorrhage (aOR=3.28, 95% CI:1.33-8.1, p<0.05; Table 4.6). Among women who had premature rupture of membranes, the odds of experiencing intrapartum stillbirth was approximately 3.4 times the odds of experiencing intrapartum stillbirth in women who did not experience premature rupture of membranes (aOR=3.36, 95% CI: 1.2-9.4, p<0.05; Table 4.6).

Concerning fetal factors, after the rigorous variable screening to determine fetal factors to be included in the multivariable analysis using AUROC and Brier Score, gestational age was the only fetal factor that met the criteria of inclusion into the multivariable Modified Poisson regression model (AUROC=67.0%, Brier score=0.1979) (Table 4.4). Controlling for key maternal characteristics, the results showed that a unit increase in gestational age in weeks is associated with approximately 17% reduction in intrapartum stillbirths (aOR=0.83, 95% CI: 0.73-0.96, p<0.01; Table 4.6).

Regarding health service delivery factors, the discriminating and calibration indices of these service delivery factors (mode of delivery, a health professional who conducted the delivery) did not meet the criteria for inclusion into the multivariable Modified Poisson

regression model. They were therefore excluded in the multivariable model to avoid a spurious relationship with intrapartum stillbirth and to improve the parsimony of the model.

Table 4.6: Quantifying the risk of fetal and maternal factors on intrapartum stillbirth using a Poisson regression model with robust standard error

	A Binary logistic regression model with robust standard error	
	aOR [95% CI]	aOR [95% CI]
Gestational age of child		0.83** [0.73-0.96]
< 37weeks	0.86** [0.79-0.94]	
>37 weeks	ref	
Antepartum haemorrhage:		
No	ref	
Yes	2.85** [1.43-5.71]	3.28* [1.33-8.10]
Premature -rupture membrane: No		ref
Yes	3.28** [1.59-6.75]	3.36* [1.20-9.40]
Pregnancy-induced hypertension:		ref
No	ref	
Yes	3.59*** [1.80-7.17]	3.72** [1.71-8.10]
Haemoglobin at first registration		1.13 [0.72-1.79]
Weight at first Registration		1.00 [0.97-1.02]
IPT doses		1.35 [0.66-2.75]
Model performance index:		
AUROC [95% CI]	0.73*** [0.66, 0.80]	0.85***[0.81- 0.90]
Brier score	0.1566	0.1323

ref: reference category. OR: Odds Ratio. P-value notation: ***: p<0.001. **: p<0.01. *p<0.05. CS: caesarian section. SVD: spontaneous vagina delivery; NA:: Not applicable. IPTp: Intermittent Preventive Treatment for pregnant women.

4.2.6 Combinations of key risk factors in predicting intrapartum stillbirth

To identify the combination of predictors (fetal, maternal and service delivery factors) that could discriminate between mothers who are likely to have a stillbirth and those who will not, calibration estimates from the Brier Score and the AUROC were used. AUROC is the probability that if you were to take a random pair of women, one who has experienced stillbirth and one without such experience, the woman who has had stillbirth will have a higher predicted risk than the other. The AUROC thus gives the probability that the model correctly ranks such pair of women. From the nine models compared (Figure 4.1 and Table 4.5), the model with fetal, maternal and service delivery factors had the highest AUROC

and the smallest Brier Score indicating that it is the best model to probably predict stillbirth (AUROC=95.0%, Brier score=0.0907), see appendix 8.

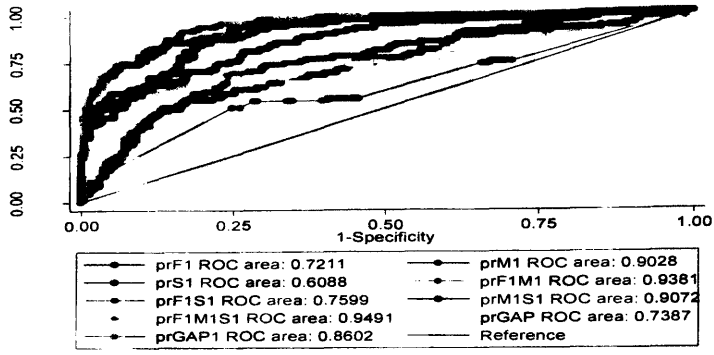

Figure 4.1: ***Assessing discrimination ability of nine different models on intrapartum stillbirth.***

Notations: ROC = Receiver Operating Characteristics Curve; prF1: Only Fetal factors; prM1: Only Maternal factors; prS1: Only Service factors; prF1M1: Fetal + Maternal factors; prM1S1: Maternal + Service factors; prF1M1S1: Fetal + Maternal + Service factors; prGAP: Gestational age + antepartum Hemorrhage + pregnancy induced hypertension + pre-rapture membrane; prGAP1: Gestational age + antepartum Hemorrhage + pregnancy induced hypertension + pre-rapture membrane + Hemoglobin at registration + Weight at registration + Intermittent Preventive Treatment for pregnant doses.

Table 4.7: Calibration and discrimination ability of nine different models on intrapartum stillbirth

Factors studied	AUROC	95% CI	Brier Score
Model 1: Unique selection 1: Gestational age + antepartum Hemorrhage + pregnancy induced hypertension + pre-rapture membrane	0.74	0.67-0.81	0.1566
Model 2: Unique selection 2: Gestational age + antepartum Hemorrhage + pregnancy induced hypertension + premature-rupture of membrane + Hemoglobin at registration +Weight at registration + Intermittent Preventive Treatment doses	0.86	0.82-0.90	0.1323
Model 3: Only Fetal factors	0.72	0.66-0.79	0.1887
Model 4: Only Maternal factors	**0.90**	**0.87-0.94**	**0.1239**
Model 5: Only Service delivery factors	0.61	0.54-0.68	0.2134
Model 6: Fetal + Maternal factors	**0.94**	**0.91-0.96**	**0.0976**
Model 7: Fetal + Service delivery factors	0.76	0.70-0.82	**0.1853**
Model 8: Maternal + Service delivery factors	**0.91**	**0.88-0.94**	**0.1177**
Model 9: Fetal + Maternal + Service factors	**0.95**	**0.93-0.97**	**0.0907**

AUROC: Area Under the receiver operating characteristics curve: Ranges from 0.5 (50%) to 1.0 (100%), the higher the better; Brier score measures the losses incurred in using the model to predict stillbirth, it ranges from 0 to 1, the smaller the better.

The Box and Whisker plots in Figure 4.2 shows how the median predicted the risk of intrapartum stillbirth varies across individual-specific factors from the three main categories

(maternal, fetal and service delivery factors). Figure 4.2 indicates that extremely high predicted risk of intrapartum stillbirth can be found among mothers who have experienced antepartum haemorrhage; pregnancy-induced hypertension (PIH), premature rupture of membranes (PROM), mothers with no malaria intermittent preventive treatment uptake (IPTp) and mothers who delivered preterm babies. Detailed variations in predicted risk of intrapartum stillbirth can be found in Figure 4.2 below.

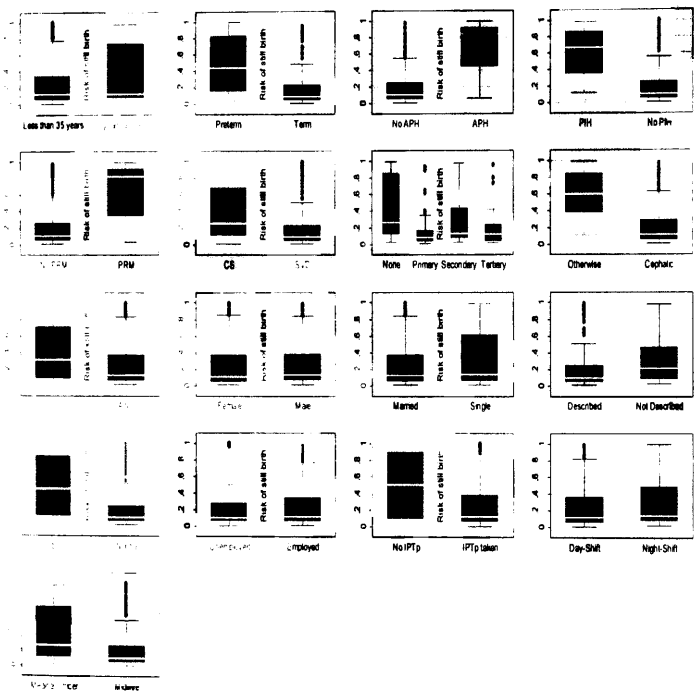

Figure 4.2: *Comparing the risk of intrapartum stillbirth among fetal, maternal and service delivery factors*

Notations: ANC: Antenatal Care Attendance, APH: Antepartum Hemorrhage, PIH: Pregnancy Induced Hypertension, PRM: Pre-Rupture Membrane

4.3 Results of the Qualitative Study

This section presents the qualitative findings of the study obtained from women who had delivered stillbirths; Midwives; Doctors and Health Service Administrators in Tema General Hospital and Greater Accra Regional Hospital, Ridge. Thirteen women who had experienced singleton intrapartum stillbirths and a total of 14 health professionals (6 midwives, 6 doctors and 2 health service administrators) were selected and interviewed using a semi-structured interview guide and audio recording. The results of the in-depth interviews (IDIs) are presented separately to identify their experiences and perceptions of intrapartum stillbirths.

In order to answer the research question: "Were there maternal factors that led to the delivery of intrapartum stillbirth?' the women who had experienced stillbirth were interviewed to identify maternal factors that could lead to the delivery of intrapartum stillbirth. Their responses were analyzed thematically. Thematic analysis was used to present findings in Global, Organizing and Basic themes using NVivo, a qualitative data management software. Global themes are the first level of themes that summarize all perspectives under the focus area of the research question. Organizing themes are the second level of themes that summarize underlining perspectives in two or more extracted responses revealing different views and lived experiences about the Global theme. Basic themes are the third level themes that are captured as quotes from transcripts.

The section is divided into two: responses from the women and health professionals. The first part begins with descriptive demographic characteristics of the participants (women). For a detailed description of the bio-data of participants see Tables 4.8a and 4.8b. This is followed by a presentation of findings on the organising and their corresponding basic

themes. The presentation of findings via the organising and basic themes are supported by verbatim quotations from the interviewees. The global theme analysed in the context of maternal health consists of seven organising themes, namely illness symptoms, pollution, illness conditions, maternal lifestyle, maternal history, ante-natal medications and knowledge gaps. There were twenty basic themes generated from the organising themes (Table 4.9). The analytical process of profiling, coding, thematic framing and thematic networking of results under each research question is presented.

4.3.1 Demographic characteristics of participants

A total of 13 women were interviewed, this was made up of six women from Tema General Hospital and seven women from Greater Accra Regional Hospital. The age range was 20 to 46 years. The average age for women in Tema General hospital was 32 years while the average for Greater Accra Regional hospital was 35 years. Out of the 13 women, six were married, four were cohabiting and three were single.

Educational background of respondents was generally low. Two out of the 13 women had no formal education, five had primary education, three had Junior High School education, one had Senior High School education and only two had tertiary education. Three of the women were unemployed, eight were working in the informal sector and only 2 worked in the formal sector. Charcoal was the main source of household fuel for cooking; only two women used liquefied petroleum gas (LPG) for cooking. All the women resided in an urban area. Eleven of the women were Christians and two were Muslims. Nine of the participants planned for the pregnancies that ended as stillbirth while four had unplanned pregnancies.

A total of 14 health professionals were interviewed: ten females and four males. Participants were six medical doctors, six midwives of various grades and two health service administrators evenly distributed between Tema General and Greater Accra Regional Hospitals. The number of years spent working with the Ghana Health Service ranged between 10 months and 40 years. The longest-serving staff is a midwife with the grade of a nursing officer and the youngest is a medical doctor. All the doctors interviewed have been trained to perform caesarean section surgeries.

4.3.2 Demographic characteristics of respondents

Table 4.8a: Detailed description of participants with postpartum stillbirth experience

ndent D	Age	Marital status	Educational background	Occupation	Setting	Religion	Birth planning	Main household fuel for cooking
.1	23	Cohabiting	Primary	Unemployed	Urban	Christian	Unplanned	Charcoal
.2	39	Cohabiting	Primary	Trading	Urban	Christian	Planned	Charcoal
.3	42	Cohabiting	None	Food vendor	Urban	Christian	Planned	Charcoal
.4	26	Single	Tertiary	Journalist	Urban	Christian	Unplanned	Charcoal
.5	35	Married	Junior High School	Unemployed	Urban	Christian	Unplanned	Charcoal
.6	32	Married	Primary	Hairdresser	Urban	Christian	Planned	LPG
.7	28	Married	Primary	Seamstress	Urban	Muslim	Planned	Charcoal
.8	46	Cohabiting	None	Food vendor	Urban	Christian	Unplanned	Charcoal
.9	36	Married	Junior High School	Unemployed	Urban	Muslim	Planned	LPG
.10	25	Single	Junior High School	Seamstress	Urban	Christian	Planned	Charcoal
.11	34	Single	Senior High	Bartender	Urban	Christian	Planned	Charcoal
.12	40	Married	Tertiary	Teacher	Urban	Christina	Planned	Charcoal
.13	31	Married	Primary	Seamstress	Urban	Christian	Planned	Charcoal

Source: Intrapartum stillbirth study, 2016

Table 4.8b: **Detailed description of health care providers**

Respondent I.D	Gender	Occupation	Institution	Rank	Year of Service
R.14	Female	Nursing Director	Tema General Hospital	DDNS	29 years
R.15	Female	Mid-wife	Tema General Hospital	Midwife	18 years
R.16	Female	Medical Doctor	Tema General Hospital	Medical Officer	10 months
R.17	Female	Mid-wife	Tema General Hospital	Principal Nursing Officer	16 years
R.18	Female	Medical Doctor	Tema General Hospital	O&G Consultant	30 years
R.19	Male	Health Service Administrator	Tema General Hospital	Deputy Chief Administrator	30 years
R.20	Male	Medical Doctor	Tema General Hospital	Medical Director	33 years
R.21	Male	Medical Doctor	Ridge Hospital	Senior Specialist	17 years
R.22	Female	Mid-wife	Ridge Hospital	Nursing Officer	40 years
R.23	Female	Mid-wife	Ridge Hospital	Principal Nursing Officer	29 years
R.24	Male	Medical Doctor	Ridge Hospital	Consultant Obstetrician Gynaecologist	14 years
R.25	Female	Mid-wife	Ridge Hospital	Senior Midwifery Officer	23 years
R.26	Female	Medical Doctor	Ridge Hospital	Medical Officer	4 years
R.27	Female	Health Service Administrator	Ridge Hospital	Principal Health Services Administrator	20 years

Interpretation: Each research question is presented as a Global theme, with subsequent organizing and basic themes under in the first column. Respondent IDs (as indicated in Table 4.9) are column headers from column two to the last column where the total numbers of row responses are indicated. (*) is indexed in the column where respondent ID intersects with basic themes. This shows the spread of basic themes and their contributions from respondents.

Table 4.9: Coding frequencies for maternal, fetal and service delivery factors causing intrapartum stillbirths

mmmmmmes	R. 1	R. 2	R. 3	R. 4	R. 5	R. 6	R. 7	R. 8	R. 9	R. 10	R. 11	R. 12	R. 13	R. 14	R. 15	R. 16	R. 17	R. 18	R. 19	R. 20	R. 21	R. 22	R. 23	R. 24	R. 25	R. 26
FFFFFFETERNAL TTTTTTCTORS																										
sssssssess weight gain	*	*	*	*	*	*	*		*			*														
lllllllllollen feet	*				*				*		*															
llllll h blood pressure	*				*	*			*		*	*														
ddddddadache	*			*			*	*		*	*		*													
rrrrrrrred vision	*		*						*		*	*														
DDDDDDominal pains	*				*							*														
aaaaaamature rupture of the membrane		*				*		*	*																	
Reduced fetal liquor volume				*		*			*	*		*														
Malaria medications		*		*			*		*		*															
Herbal medications					*			*				*				*			*							
Self-medications			*							*					*											
HIV	*																									
Diagnosed hypertension											*															
Alcohol intake		*																								
History of stillbirth		*	*			*			*		*															
The wide gap in years between the last child and stillbirth					*			*		*	*															
No knowledge on kick count			*		*	*	*			*			*													

KKKKKKKI knowledge of nnnnnnnnnancy																				
ı-t-t-t-t-t-t-use of ante-natal :ccccccvices																			*	
nnnnnnnnonsistent lddddddndance of ante-l																			*	
;ccccccarch reporting ccccccccede health itititititititlity reporting																				
yyyyyyyayed decision to :trtrtrtrtrt																	*			
AAAAAAAL FACTORS																				
Reduced fetal movement	*		*			*			*											
No fetal movement	*	*	*			*		*	*		*	*								
Irregular /no fetal heartbeat													*			*				
Excess fetal growth					*		*			*										
SERVICE DELIVERY FACTORS																				
Poor fetal growth	*		*					*			*									
Inadequate surgical tools																*				
The poor state of infrastructure													*	*	*	*		*		
Insufficient hospital beds	*										*									
Difficulty accessing needed technological devices and services			*						*											

dddddd-delivery testing s							
r r r r r r r post stillbirth a a a a a a a agement			*				
r o o o o o o o rofessional pre- e e e e e e e every care							
r o o o o o o o rofessional e e e e e e e every care	*		*	*			
r c c c c c c c rcations and r c c c c c c d rontations				*			
d d d d d d d d shortage						*	*
t a a a a a a a a rtage of Medicine							*

4.4 Maternal factors associated with intrapartum stillbirths

This global theme assessed the various existing maternal diseases before the index pregnancy; pregnancy-related diseases that developed during the index pregnancy and other conditions that predispose; increase the risk of developing intrapartum stillbirths or directly cause intrapartum stillbirths. The factors were generated based on published literature and formed the basis for the research questions.

4.4.1 Symptoms of maternal illness

This organizing theme was concerned with illness symptoms that predispose pregnant mothers to intrapartum stillbirths that were cited by pregnant women. This theme is composed of eight basic themes. The illness symptoms were cited by only women who have had intrapartum stillbirths since the health professionals were not assessed for their (personal) history of intrapartum stillbirths, their experiences did not matter in this instance. This could perhaps mean that these illness symptoms were not perceived as major complications in pregnancy that could affect the outcome of birth and were not reported to health care providers early enough for appropriate intervention.

4.4.1.1 Excess weight gain

Nine of the respondents who had intrapartum stillbirths in this study cited excess weight gain as one of the symptoms they experienced during pregnancy. Three of the participants illustrated this basic theme in the following responses:

> "*During the time of the pregnancy time, I put on weight*" (R.4; 26-year-old journalist)
>
> "*I gained weight, my hands and face became bigger*" (R.6; 32-year-old Hairdresser)
>
> "*I did, everyone was telling me that my weight has gone up*" (R.2; 39year-old trader)

4.4.1.2 Swollen feet

Five of the participants cited swollen feet as one of the symptoms they experienced during the pregnancy that ended as stillbirths. These participants indicated that during the prenatal period both legs were swollen to the extent that they found it difficult to walk or stand on their feet.

> *"My feet grew bigger; it became difficult for me to stand or walk for a long time"* (R.8; 46-year-old Food vendor)
>
> *"My weight also went up when I was pregnant and then at that time, too, my feet swelled"* (R.9; 36-year-old unemployed)

4.4.1.3 High blood pressure

High blood pressure emerged as one of the illness symptoms in women who experienced intrapartum stillbirths. Seven out of the thirteen participants with a history of intrapartum stillbirths (54%) mentioned that they had high blood pressure during the prenatal period.

> *"My pressure went high so they wrote it down and asked my sister to bring my medicines for them to see"* (R.11; 34-year-old bartender)
>
> *"The nurse told me that my blood pressure was going up"* (R.1; 23-year-old unemployed)

4.4.1.4 Headache

Headache was another symptom mentioned by the women who had intrapartum stillbirths. Seven of the thirteen participants experienced headache during the index pregnancy.

> *"...I was experiencing a lot of headaches..."* (R.7; 28year-old seamstress)
>
> *"...as for the headache it started a long time when I first realized that I was pregnant, sometimes it can be very sharp them I don't know what to do to myself..."* (R.13; 31year-old seamstress)
>
> *"... yes, I had severe headaches..."* (R.10; 25year-old seamstress)

Some of the participants had other symptoms in addition to the severe off and on headaches.

> "...*I remember that around the same time I was having the headache my feet started to swell, the headache will go and come back, severely...*" (R.8; 46-year-old food vendor)

4.4.1.5 Blurred vision

More than a third of the participants who had a history of intrapartum stillbirth reported that they had blurred vision during pregnancy before they delivered. This symptom was mentioned by five out of the thirteen women.

> "...*I was having blurred visions frequently...*" (R.3; 42-year-old food vendor)

For some of the women, the feeling was such that they had to sit or lie down before they felt better.

> "...*yes, I was having blurred visions, sometimes I have to sit or lie down for a while...*" (R.8; 46-year-old food vendor).

Other participants, experienced dizziness in addition to the blurred vision

> "...*I told the nurse that I needed to sit down because I was feeling dizzy and I could not see well...*" (R.1; 34-year-old bartender).

4.4.1.6 Abdominal pain

Abdominal pain was another symptom described by the participants who had intrapartum stillbirths. Three out of the thirteen participants experienced severe abdominal pains during the antenatal period before delivery of the fresh stillbirth

> "...*Yes, sometimes the pain in my abdomen will be sharp that I have to lie down...*" (R.1; 23-year-old unemployed)
>
> "...*I had abdominal pains a lot before I went to the hospital...*" (R.5; 35-year-old unemployed)

"...*I decided to call my sister when the abdominal pains started, it was very painful*..." (R12; 40-year-old Teacher)

4.4.1.7 Premature rupture of membranes

Premature rupture of membranes was another symptom mentioned by the participants with a history of intrapartum stillbirths. Four out of the thirteen women with a history of intrapartum stillbirth experienced this symptom during the prenatal period.

reporting to the hospital and others being admitted to the hospital

"... *I rushed to the hospital when I realized that the water broke*..." (R.2; 39year-old trader)

"...*at the hospital they were trying to get me a bed when the water broke so the nurse who checked my blood pressure told the midwife that my water has broken too early so they need to take me in* ... " (R.9; 36-year-old unemployed)

Some of the participants got scared when they had premature rupture of membranes and attributed the death of the fetus to the PROM.

"...*the nurse told me that it was not time for my water to break so that was part of the reasons why the baby did not survive*..." (R.6; 3year-old hairdresser)

"... *I started getting scared because I know if your water breaks too early it is not good*..." (R.8; 46-year-old food vendor).

4.4.1.8 Reduced fetal liquor volume

Five out of the 13 participants mentioned reduced liquor volume as one of the signs which was observed by health providers when they visited the hospital for antenatal care.

"...*the doctor told me that the water around the baby had gone down so they had to do something otherwise the baby would not survive*..." (R.4; 26-year-old Journalist)

"...*after the scan then they told me there was a problem, the baby needed water around it*..." (R.6; 32-year-old Hairdresser)

Some of the participants did not know what they or the health providers could have done about the reduced liquor volume

> "...*They told me the water around the baby was small and at that time I did not know what to do...*" (R.9; 36-year-old unemployed)
>
> "...*I do not know what they could have done about the water that they said was small around the baby because I don't know what can be done...*" (R.12; 40-year-old Teacher)

Some participants realized that the reduced liquor volume was not a good sign so they used prayer to help address the issue of reduced liquor volume

> "...*I told my mother to pray with me that the doctor says the baby's water was small, that time I knew things were getting serious...*" (R.10; 25-year-old Seamstress)

4.4.2 Pre-natal medications

This organizing theme is concerned with the medications that the pregnant women used during the prenatal period before delivery of the fresh stillbirth. Three basic themes were generated namely: malaria medication, herbal medication and self-medication

4.4.2.1 Malaria medication

Some participants took medications for malaria during the antenatal period; some did not know the name of the medication they took. Health professionals also mentioned that some of the pregnant women do self-medication while others took herbal preparations during pregnancy

> "...*yes, I took malaria medication during the pregnancy period, I do not remember the name...*" (R.2; 39-year-old Trader)
>
> "...*I had malaria so I was given the medicine as malaria treatment...*" (R.4; 26-year-old Journalist)

Some of the participants took medications for severe malaria which they believed was caused by the pregnancy

> "...*Yes, I got malaria some time and it was very serious so I took medicine and I got better; they say the pregnancy made malaria serious*..." (R.8; 46-year-old food vendor)

4.4.2.2 Herbal medication

The herbal medication was identified as a common practice among pregnant women. The use of herbal medicine during pregnancy was mentioned by both women with a history of intrapartum stillbirths and health providers. Some of the participants took herbal medicines given to them by other people without knowing the name of the medication and there was no indication of the reason for taking the herbal medicine

> "...*Yes, I took herbal medicine, I don't know the name, I collected it from someone" I bath with it*..." (R.5; 35-year-old unemployed)

Some of the participants drank herbal medicines to treat malaria "...*malaria medicine was the herbal medicine I drank* ... " (R.8; 46 -year-old food vendor)

Some of the participants took herbal medicines during the middle of the pregnancy for a short period

> "...*I once took some herbal medicine but it wasn't for a long time; pregnancy was like six months*..." (R.12; 40-year-old Teacher)

Some of the health providers believed that the pregnant women drank concoctions during pregnancy and that contributed to the fetal deaths

> "... *some also go in to take concoction before they come in and this also has an effect on the baby so sometimes the clients are also part of it*... " (R.15; Midwife)

4.4.2.3 Self-medication

Self-medication was common among pregnant women. Some of them reasoned that the demise of their babies was due to the negative effect of self-medication

> "*... If I had known earlier, I will not self-medicate and I stand by that point...*" (R.3; 42-year-old food vendor)
>
> "*...the medication I took at that time was not prescribed by a doctor...*" (R.10; 25-year-old Seamstress)

4.4.3 Prenatal illness

This organizing theme assessed the awareness of the presence of existing illness before the woman delivered. Two basic themes emerged from the organizing theme and only the women with a history of intrapartum fetal deaths mentioned these diseases.

4.4.3.1 HIV

HIV infection was not common among the women who had intrapartum stillbirths. The pregnant women were informed of the results after HIV testing/

4.4.3.2 Hypertension

Hypertension during the pregnancy which was diagnosed prenatally was not common among pregnant women. They got to know they had hypertension after their blood pressure had been checked and the results discussed with them

> "*...the doctor told me I had hypertension, so during the pregnancy, they were checking my blood pressure often...*" (R.11; 34-year-old Bartender)

4.4.4 Maternal lifestyle

This organizing theme assessed the social behaviour of women with a history of intrapartum stillbirths during pregnancy. One basic theme was generated and this was mentioned only by the women.

4.4.4.1 Alcohol intake

Pregnant women use alcohol during pregnancy for various reasons but alcohol use was not common among the women with a history of intrapartum stillbirths

> "... *I do not drink but occasionally; in-between*..." (R.2; 39-year-old Trader)
>
> "... *sometimes I did drink, but not all the time*..." (R.7; 28-year-old Seamstress)

4.4.5 Maternal obstetric history

This organizing theme is concerned with the past obstetric history of the women which predisposes her to risk of delivering stillbirths. Some past poor pregnancy outcomes have been identified as increasing the risk of having more poor pregnancy outcomes including stillbirths in future pregnancies. This organizing theme generated three subthemes.

4.4.5.1 History of previous stillbirth

Most of the participants (5/13) had a history of several pregnancies all of which ended as stillbirths. And most of the babies grew to term but they did not survive after delivery

> "... *after my child that is 6 years, I have had 4 pregnancies without anyone surviving; I will deliver but they will be dead*" (R.2; 39-year-old Trader)
>
> "... *Yes, 9 months. For the other stillbirth that I had was 26 weeks but this one took 40 weeks*...." (R.3; 42-year-old Food vendor)
>
> "... *the last time it happened it was about three weeks to delivery*" (R.6; 32-year-old Hairdresser)

4.4.5.2 Wide gaps between deliveries

The study looked at the number of years between the last pregnancy and the index pregnancy that ended as stillbirth. Some of the participants had a very wide duration between the last delivery and the index pregnancy that ended as fresh stillbirth as shown by the quotes below:

> "*...my last delivery was four years ago...*" (R.5; 35-year-old Unemployed)
>
> "*...The last time I got pregnant was seven years ago...*" (R.10; 25-year-old Seamstress)
>
> "*...my last pregnancy was eight years ago...* (R.11; 34-year-old Bartender)

Some of the women used the same hospital for their previous delivery which happened several years ago. They decided to use the same facility when they went into labour with the index pregnancy that ended as stillbirth. "*...I delivered in this same hospital during the last time, that was why I came here again: it has been six years now...*" (R.8; 46-year-old Food vendor)

4.4.6 Prenatal knowledge gaps

4.4.6.1 Knowledge about kick count

This organizing theme is concerned with the knowledge of the women with a history of intrapartum stillbirth about the state of the baby while in the uterus. Two basic themes were cited mainly by the women with a history of intrapartum stillbirths. Most of the women did not have any knowledge about kick count and some of them had never heard of it.

> "... *No, what is it (kick count) ...?*" (R.3; 42-year-old Food vendor)
>
> "... *I did not know (about kick count) ...*" (R.5; 35-year-old unemployed)
>
> "... *What do you mean by that? I do not know...* " (R.6; 32-year-old Hairdresser)
>
> "... *No, I have not (heard of kick count) ...*" (R.13; 31-year-old Seamstress)

4.4.6.2 Knowledge about pregnancy

Only a few of the participants with a history of intrapartum stillbirth did not know that they were pregnant. This probably affected the time the pregnant woman attended ANC. One participant did not plan for the index pregnancy and was not aware that she was pregnant

> "... *It was unplanned because I never knew there existed any baby...*" (R.3; 42-year-old Food vendor)

4.5 Fetal Factors causing intrapartum stillbirths

This global theme was to determine the contributory factors to intrapartum stillbirths related to the fetus while still in-utero. The theme assessed the growth and development of the fetus as well as the ability of the pregnant women to notice abnormalities and the actions taken to receive care.

4.5.1 Abnormal fetal development

This organizing theme was concerned with whether the growth of the baby was perceived to be normal or not. This was mentioned by only the women with a history of intrapartum stillbirths and it was not a common occurrence. The organizing theme had 2 basic themes and these are excess fetal growth and poor fetal growth

4.5.1.1 Excess fetal growth

This basic theme described how the participants reported the size of the baby before delivery, through their own observation or from what they were told at the hospital. Some of the participants used vivid illustrations to describe how big the baby grew inside the uterus. Excessive fetal growth was not common among the women who delivered fresh stillbirths (3/13).

"... during the 7th month the baby became very big and my child was like from here to the door..." (R.5; 35-year-old Unemployed).

"...I felt so much was unusual, and after the scan, they told me that the baby was bigger than usual..." (R.8; 46-year-old Food vendor)

"...the doctor said that the baby was too big so they wanted to do something about it..." (R 11; 34-year-old Bartender).

4.5.1.2 Poor fetal growth

This basic theme described how the participants were informed about the size of the babies before they were delivered. Many (5/13) of the participants had poor fetal growth before delivery

"... 7th month, the doctor said the baby was not growing well..." (R.1; 23-year-old Unemployed)

"...after the scan they said the baby is six months but it is not developing well..." (R.7; 28-year-old Seamstress)

"... she said the baby did not grow the way it should have grown ..." (R.10; 25-year-old Seamstress)

4.5.2 Abnormal Fetal movements

This organizing theme was concerned with abnormal fetal movements and the woman's perception of the baby's movement and her ability to detect changes in the fetal movement as well as actions taken. Two basic themes were generated namely reduced fetal movement and no fetal movement.

4.5.2.1 Reduced fetal movements

This basic theme showed how participants described the reduced movement of the baby before delivery; this was cited only by women with a history of intrapartum stillbirth. Most of the women experienced reduced fetal movement before delivery. It is possible that they

did not know the meaning of reduced fetal movement and delayed in reporting to the hospital

> *"... Initially, I was feeling the baby and along the line as well I was not feeling the baby properly..."* (R.1; 23-year-old Unemployed).
>
> *"... I have been feeling the kicks of the baby all throughout till the 8th month but during the 9th month it reduced..."* (R.3; 42-year-old Food vendor)
>
> *"...in the beginning the baby was very active like I was feeling the kicks a lot, then later I wasn't feeling the kick like before..."* (R.10; 25-year-old Seamstress)

4.5.2.2 No fetal movement

This basic theme shows how the participants described the period when they perceived there was no fetal movement. Majority of the participants did not feel any fetal movement at a point during their pregnancies and they felt that period of no fetal movement was the time the baby died before delivery.

> *"...the baby stopped moving, then I knew there was something wrong..."* (R.10; 25-year-old Seamstress)
>
> *"... the baby was already dead in my stomach upon delivery and that was why I wasn't feeling the baby move..."* (R.1; 23-year-old Unemployed).
>
> *"... getting to one week for my checkup date, I could not feel the baby kicking any more so I went to the health facility for a checkup and they told me that I was in labour..."* (R.2; 39-year-old Trader)

Some of the women did not recognize that the babies had stopped moving in the uterus until they were prompted at the hospital when they went for a checkup.

> *"... it was after the scan that the nurse asked me if I have been feeling the movement of the baby then I realized that I was not feeling the movement of the baby...."* (R.3; 42-year-old Food vendor)

Some of the women did not know what action to take when they did not feel the movement of the babies and so delayed in reporting to the hospital.

> "...*when I realized that the baby was not moving, I didn't know what to do so I told my sister*..." (R.9; 36-year-old Unemployed).
>
> "...*I believe that when I couldn't feel the baby move again, I should have gone to the hospital earlier at that time*..." (R.12; 40-year-old Teacher).

4.6 Service delivery factors causing stillbirth

The global theme on service delivery factors was to identify how the care provided during antenatal and delivery contributed to intrapartum stillbirths in the pregnant women who accessed care at the hospitals during pregnancy. The theme also assessed the availability and capacity of staff to provide quality care including management of complications in pregnancy, staff attitude, adherence to protocols and how the issue of stillbirths is managed at the hospital. It also assessed the gaps in service delivery and the perceptions of health professionals on how intrapartum stillbirths could be reduced.

4.6.1 Infrastructural and logistics challenges

This organizing theme was concerned with the ease of accessing needed logistics and how the infrastructure affected service delivery. The theme generated four subthemes and these were cited by the women who had intrapartum stillbirths and the health providers.

4.6.1.1 Inadequate surgical tools

This subtheme was cited by some health professionals but it was not a common occurrence as a reason for women experiencing intrapartum fetal deaths.

4.6.1.2 Poor state of infrastructure

This subtheme was concerned with the space available for providing care to women in labour. Most of the health staff cited the poor state of infrastructure as a factor that affected prompt access to care and contributed to the increased rate of intrapartum stillbirths.

> *"... if we 've gone to the facility you will realize that we have a lot of challenges like we create the space..."* (R.20; Health Service Administrator)
>
> *"... another issue we have is space, we don't have a lot of space in our ward..."* (R.16; Medical Officer)
>
> *"... Theatre is always ready but the spacing and the use of one theatre table for gynae cases that 's the challenge..."* (R15; Midwife)

4.6.1.3 Insufficient hospital beds

This subtheme depicted the challenge the participants faced in being allocated a bed when they arrived in labour. Some of the women had to wait for the staff to look round for available bed before they could be admitted

> *"...when I arrived, they made me sit down and wait, the nurse was looking for a bed for me ..."* (R.6; 32-year-old Hairdresser)
>
> *"... she made me wait for a bed, first I was lying on a mattress on the floor but later they got me a bed..."* (R.13; 31-year-old Seamstress)

4.6.1.4 Difficulty accessing needed technological devices and services

The subtheme was concerned with pregnant women's access to needed investigations during the antenatal period. It assessed the functionality of equipment and the presence of the personnel to provide the service at the appropriate time. Some of the women with a history of intrapartum stillbirth cited this as a contributory factor to the intrapartum stillbirth.

> *"...she said (a reference to medical officer) the scan showed that there is something wrong with the baby but they don't have the machine to see the actual problem so I should go and do it somewhere... that place too they said their machine was spoilt*

so we had to go and come later before taking the scan... " (R.3; 42-year-old Food vendor)

"... *If they have enough technological equipment, they could have allowed me to do a scan when they did not feel the baby kicking or if the breath has ceased so that they will immediately perform surgery to save my baby...* " (R.5; 35-year-old Unemployed)

4.6.2 Knowledge and management gaps

This organizing theme was concerned with gaps identified with reference to tests that pregnant women should benefit from during pregnancy to help reduce stillbirth rates and quality of care after delivery. Two subthemes were generated and these were cited by women who had intrapartum stillbirths.

4.6.2.1 Pre-delivery testing gaps

This basic theme described how some of the participants did not go through the routine tests prescribed for pregnant women.

"... *No, I did not do any syphilis test...* " (R.1; 23-year-old Unemployed)

"... *No, I did not do any syphilis test...* " (R.9; 36-year-old Unemployed)

4.6.2.2 Poor post stillbirth management

This basic theme described how participants perceived the quality of care provided by health providers after the delivery of stillborn babies. Most of the participants described the poor manner in which they were informed about the outcome of the delivery and how the stillborn babies were treated.

"...*they held the baby and they told me the baby is dead ...* " (R. 1; 23-year-old Unemployed)

"... *they just put the baby somewhere else inside a bowl; Oh, I saw the baby. It was a nice baby girl...* " (R. 5; 35-year-old Unemployed)

"...*immediately she assisted me to deliver then she informed me that the baby was dead upon arrival...* " (R.7; 28-year-old Seamstress)

"... *after delivery, they asked me to go and take my bath and go home. That is all...*" (R.13; 31-year-old Seamstress)

4.6.3 Unprofessional health practices

This organizing theme was concerned with the attitude of health personnel before, during and after delivery. Three subthemes were mentioned by some of the participants who had delivered intrapartum stillbirths.

4.6.3.1 Unprofessional pre-delivery care

This basic theme describes how some participants had to wait for long periods before they received care including the allocation of beds

"...*Yes. When I came here for the admission, I had to sit down from 7 o' clock to 12 before I had a bed*" (R. 5; 35-year-old Unemployed)

"... *when I was lying down, I realized they were angry. So, it was later that they attended to me...* " (R.12; 40-year-old Teacher)

4.6.3.2 Unprofessional delivery care

This subtheme was cited by the respondents with experience of intrapartum stillbirths and not by the health professionals. Most of the participants mentioned that the health personnel in charge of delivery withheld care during delivery

"... *on the bed, they asked me to push. They did not have time for me, they paid little attention to me...*" (R. 1; 23-year-old Unemployed)

"... *when it got to the time of delivery, I called them but no one came to my rescue. I started pushing single-handedly till the head of the baby started coming out then I called on a lady to assist me...*" (R.5; 35-year-old Unemployed).

"... *When the baby was coming, they did not help...* " (R.12; 40-year-old Teacher)

4.6.3.3 Altercations and confrontations

This subtheme was concerned with the kind of communication that went on between the health professionals and the women in labour as well as their relatives who accompanied them to the hospital during labour. Some of the women who delivered intrapartum stillbirths mentioned the poor attitude of the health professionals towards them and their relatives and how these confrontations negatively affected the care they received.

"...*the way the nurse spoke to me during the time of labour was not good even my sister and she exchanged harsh words. Me I was in pain so I couldn't say anything...*" (R.6; 32-year-old Hairdresser)

"... *my husband got angry with the nurse because of what I was going through. So, the nurses also got angry it was later that they attended to me and asked me to push but then I did not have the strength to push. Later, they told me the baby was dead...*" (R.,12; 40-year-old Teacher)

"...*other people complain about them, as for a certain woman her husband nearly fought with the nurses...*" (R. 13; 31-year-old Seamstress).

4.7 Factors amenable for interventions

This global theme was concerned with the factors that could be included in interventions for implementation to reduce intrapartum stillbirths. They were derived from the organizing and basic themes that emanated from the maternal, fetal and service delivery factors as well as recommendations made by all the participants. The amenable factors thus address service delivery, maternal and fetal contributory factors which were generated by the women who have had experiences of intrapartum stillbirths and the health professionals who provide

care to pregnant women during antenatal; labour; delivery and the immediate postpartum period.

4.7.1 Service delivery factors

This organizing theme was concerned with the factors within the health system for providing care to pregnant women and contribute to the delivery of intrapartum stillbirths but for which interventions can be developed and implemented for reduction of intrapartum stillbirths. Six subthemes were generated for this organizing theme.

4.7.1.1 Examination during the prenatal period

This basic theme described what the participants perceived could be done to reduce the rate of intrapartum stillbirths. The majority (7/13) of the women who experienced intrapartum stillbirths stated that improved examination of maternal and fetal development including the use of higher technological devices would reduce intrapartum stillbirths.

> *"...hospital with state-of-the-art equipment to foresee the future occurrence of stillbirth because if the medical facility that I attended had such equipment. I believe they could have saved the life of my baby..."* (R.1; 23-year-old Unemployed)
>
> *"...why is it that the hospital cannot get better machines to see if there is something wrong with the baby so that they can prevent the baby from dying...?"* (R.3; 42-year-old Food vendor)
>
> *"...maybe if the hospital had better machines to look at the baby in the womb then that one too can help..."* (R.5; 35-year-old Unemployed)
>
> *"...I still do not understand why I took a scan and they do not see that the cord was tied around the neck before the baby was delivered..."* (R.10; 25-year-old Seamstress)

Some of the participants also suggested that the availability of more staff would be helpful to reduce stillbirths.

"...They should look for a medical facility with enough nurses, midwives and doctors who can advise pregnant women on how to take proper good care of them..." R.8

4.7.1.2 Training sessions for medical personnel

This subtheme was mainly cited by the health professionals as what can be done within the hospitals to reduce intrapartum stillbirths. Almost all the health professional participants (14/15) cited training as an amenable factor to reduce intrapartum stillbirths.

"... they should be organizing workshops, educational sessions for our staff and on customer care and other professional things..." (R. 21; Medical Director)

"... there should be constant in-service training for staff on what they should know..."
(R.28; Health Service Administrator)

"... organize a workshop on neonatal resuscitation and the use of the partograph for the staff..." (R. 24; Midwife-Principal Nursing Officer)

4.7.1.3 Increase Staff numbers

This subtheme was cited as a major factor that could be amenable to intervention to reduce delivery of intrapartum stillbirths. Most (7/15) of the health professionals mentioned it as a factor for intervention to reduce the poor monitoring of labour that leads to intrapartum deaths.

"... we have two theatres we end up using only one because we don't have the staff and enough anaesthetists..." (R. 25; Consultant O & G)

"... we need more midwives in this facility..." (R.16; Medical Officer)

"... they have to see to it that there are enough staff to monitor the clients..." (R.24; Midwife, Principal Nursing Officer)

"... We need more staff here at the hospital for the monitoring and if we get more staff it will help with the monitoring and that could help prevent all these things..."(R. 23; Midwife, Nursing Officer)

4.7.1.4 Improved infrastructure

This basic theme describes some of the participants' perceptions about how improving infrastructure would affect stillbirths. Majority of the health providers cited improved infrastructure as a factor amenable to interventions to reduce intrapartum stillbirths.

> *"... So, I think if we have two theatres one for elective and one for an emergency then maybe our elective cases ...we would get our live babies; the emergency would be faster if we detect any fetal distress..."* (R.15; Midwife)
>
> *"...I think we need bigger bigger bigger facilities only in maternity services with a pediatric unit ..."* (R.17; Midwife, Principal Nursing Officer)
>
> *"... there should be a way of improvement by physical infrastructure ..."* (R. 21; Medical Director)
>
> *"... infrastructure is too poor, the working environment is not the best, the infrastructural challenges, today no water tomorrow no electricity situations..."* (R. 19; Consultant O&G)

4.7.1.5 Incentives

This basic theme described the perception of how incentives could affect the incidence of stillbirth. They were cited only by the health professionals and many of the midwives mentioned increasing the number of health professionals will achieve a better reduction of intrapartum stillbirths than giving other motivation or incentives to staff

> *"... so, the motivation is good you know but the numbers are equally very important to achieve success..."* (R. 17; Midwife, Principal Nursing Officer)

Some of the staff did not believe that midwives should be given incentives before they do their work

> *"... there is no incentives role here because why should you give a midwife something before doing her work?"* (R. 23; Midwife, Nursing Officer)
>
> *"... If you motivate people, they are able to do more but I don't think they need to be motivated to do their jobs..."* (R. 27, Medical Officer)

4.7.1.6 Improved attitude of service delivery personnel towards pregnant mothers

This basic theme described how some participants perceived that better attitude would help to reduce the occurrence of stillbirth. The basic theme also depicts how the participants described the midwives based on the responses they received when they called for help. Most of them were cited by the women who had intrapartum stillbirths.

> *"...when you are even in pain some of the nurses would tell you that don't you see that they are eating so you have to wait for them, it is not good at all. Sometimes I wonder if some of them have given birth before..."* (R.1; 23-year-old Unemployed)
>
> *"...Some of the nurses are wicked, they don't care when you tell them there is something wrong with you..."* (R. 6; 32-year-old Hairdresser)
>
> *"...some of them try their best to help, and others, too, they can allow you to suffer..."* (R. 9; 36-year-old Unemployed)

4.7.2 Maternal Factors

This organizing theme was concerned with maternal practices that contribute to intrapartum stillbirth and which could be amenable to interventions to reduce intrapartum stillbirths. Five basic themes were generated from this organizing theme.

4.7.2.1 Enhanced maternal medication practices

Some of the women who experienced stillbirth mentioned that self-medication, herbal medication and other medication malpractices lead to stillbirths. Therefore, intrapartum stillbirths would be averted if pregnant women desist from such practices during pregnancy.

> *"... I think it could be caused by the medicine that I have been taking..."* (R.2; 39-year-old Trader)
>
> *"... If I had known earlier, I will not self-medicate and I stand by that point..."* (R.5; 35-year-old Unemployed)
>
> *"...Later I heard that some herbal medications can also cause your baby to die..."* (R.12; 40-year-old Teacher).

4.7.2.2 Increased maternal care and pregnancy planning

This basic theme was concerned with how women planned for their pregnancies and the type of care received during pregnancy and how these would prevent intrapartum stillbirths. Majority of the participants (health professionals and women with intrapartum stillbirth) cited them as amenable factors to include in interventions to be implemented for prevention of intrapartum stillbirths. Some of the health staff believed that educating pregnant women about the need to attend ANC and getting the community to support them would be helpful in preventing intrapartum stillbirths.

> *".. the first suggestion is for the clients: they get pregnant so they should plan..."* (R.14; Deputy Director of Nursing Services)
>
> *"... The pregnant women will be educated to go to the hospital for care. The community should ensure that pregnant women go for antenatal clinics..."* (R24; Principal Nursing Officer)
>
> *"... community members can mobilize themselves to be educated on pregnancy; will realize that it is a problem that concerns them and they can play a role to reduce the problems..."* (R.25; Medical Director, O&G Consultant)

4.7.2.3 Spiritual exercises

This basic theme was concerned with the views of participants on how spiritual exercise could affect intrapartum stillbirths. Mainly the women who had intrapartum stillbirths cited that spiritual exercise such as praying could help prevent intrapartum stillbirths.

> *"... everything is about prayers so pregnant women should not relent in their effort when it comes to prayer that one too is very important..."* (R.1; 23-year-old Unemployed)
>
> *"...everything that happens to us physically has a spiritual aspect to it. So, the family of the woman should fast and pray to support..."* (R.12; 40-year-old Teacher).

4.7.2.4 Education of women in the community

This basic theme was concerned with building the knowledge of women within the communities and how that could lead to a reduction of intrapartum stillbirths. Some of the health professionals mentioned this as an amenable factor for which interventions could be developed to reduce intrapartum stillbirths.

> "... *we need to reorient the women to have a sense of priority to know what to do...* " (R. 22; Medical Doctor)
>
> "... *community members can mobilize themselves to be educated on pregnancy and the community members after education will realize that it is a problem that concerns them and they can play a role to reduce the problem...* " (R.25; Medical Doctor O&G Consultant)
>
> "... *education on the radio and TV as well and it will help to encourage women to come to the clinic early...* " (R. 23; Midwife, Nursing Officer)

4.7.2.5 Education and sensitization of women on maternal health

This basic theme describes the views of the majority of the health staffs about educating the pregnant women on pregnancy and how that could affect the delivery of stillbirths

> "...*they should be educated on the kick counts in the house... the drugs they take, the concoction that they take how it will affect the well -being of the baby...* " (R.17; Midwife, Principal Nursing Officer)
>
> "... *the clients need more education and even if they are educated, they should implement what they are educated on...* " (R.20; Health Service Administrator)
>
> "... *organize durbars to educate women on pregnancy and what to do when you are pregnant and all those things. And it all comes to education given to members in the community...* " (R. 27; Medical Officer)

4.8 Conclusion

This chapter presented the results of the study at three different levels using both quantitative and qualitative analytical techniques. The chapter described the socio-demographic,

maternal and fetal characteristics of respondents in the quantitative data. The chapter presented the results of the quantitative data in two sections. The first section provided background characteristics of respondents while the second section presented the results of the association between the maternal, fetal, service delivery factors and intrapartum stillbirth. The chapter examined the maternal, fetal and service delivery factors that could go into the model to predict intrapartum stillbirth using quantitative data analysis techniques. The results showed that PIH, APH, PROM and low gestational age were significantly associated with intrapartum stillbirths.

The chapter also explored the perceptions of participants in the qualitative study using thematic analysis technique. The first section of the qualitative study presented the demographic characteristics of participants. The second section presented findings on the causes and suggestions on how intrapartum stillbirth could be prevented.

The perceived causes of intrapartum stillbirth were classified into three organizing themes; (i) maternal factors (ii) fetal factors and (iii) service delivery factors. The qualitative study results showed that majority of the women had headache, high blood pressure, excess weight gain, blurred vision, and reduced fetal movement during the antenatal period. The women recommended modern equipment of health facilities to be able to detect complications during pregnancy as one of the ways to reduce preventable stillbirths. The health professionals mentioned lack of theatre space, inadequate number of trained health staff and poor knowledge of pregnant women about complications in pregnancy as some of the contributors to intrapartum stillbirths. They recommended increase in number of trained midwives, anaesthetists and number of operating theatres as some of the recommendations to reduce intrapartum stillbirths.

CHAPTER FIVE

DISCUSSIONS

5.1 Introduction

This study set out to examine the maternal, fetal, and health service factors that contribute to intrapartum stillbirths in singleton pregnancies and develop a model to predict future occurrences of intrapartum stillbirths in singleton pregnancies. The specific objectives of the study were to:

1. To examine maternal, fetal and service delivery factors that contribute to intrapartum stillbirths
2. To explore the perceptions of women with experience of stillbirth about causes and prevention of intrapartum stillbirths.
3. To assess the perceptions of health professionals about the causes and prevention of intrapartum stillbirths
4. To develop a model to predict intrapartum stillbirths

This chapter involves the integrated discussion of the major findings that evolved from the study based on the objectives listed above. The chapter also highlights the linkages of maternal; fetal and service delivery factors that contribute to intrapartum fetal deaths in singletons as depicted in the conceptual framework.

5.2 Maternal, fetal and service delivery factors

5.2.1 Maternal factors

This study investigated 14 different maternal factors that could increase the delivery of intrapartum stillbirth including maternal age, education, place of residence and occupation.

5.2.1.1 Maternal socio-economic and demographic characteristics

The study did not identify any significant association between maternal sociodemographic characteristics such as age, level of education, place of residence, occupation and intrapartum stillbirth. These results are contrary to findings from other studies that have investigated the effect of maternal socio-demographic characteristics on stillbirth and reported that low maternal education, age above 35 years, residing in rural areas; maternal illiteracy and unemployment were significant risk factors for delivery of intrapartum stillbirth (Ashish et al., 2016; Chuwa et al., 2017). Advanced maternal age (>35years) is associated with fetal anoxia resulting from poor placental blood flow and this may explain the association between older age and intrapartum fetal death (Pasupathy, Wood, Pell, Fleming, & Smith, 2011). Advanced maternal age has also been associated with the possibility of chronic diseases in the mother such as hypertension which affects uteroplacental blood flow (Huang, Sauve, Birkett, Fergusson, & van Walraven, 2008).

The lack of association between sociodemographic characteristics and intrapartum stillbirths in this study may be due to the position of GAR. It may be that since the Greater Accra Region is the Capital of Ghana, the effect of development and urbanization has influenced the living conditions of the subjects thus removing the influence of sociodemographic characteristics on intrapartum stillbirths. Ashanti Region has the largest population in Ghana and although Kumasi, the capital city of Ashanti Region is urbanized, Accra is more developed and the people are wealthier. According to the GDHS 2014, 52.2% of the population in GAR is in the wealthiest quintile compared to 27.1% in Ashanti Region. With reference to the population in the lowest quintile, the GDHS 2014 reported 2.6% in GAR and 6.5% in the Ashanti Region. The literacy rates for females in the two regions are different: the proportion of females with no education in GAR is 14.4% compared to 18.5%

in Ashanti Region while females who have completed secondary education is 10.5% and 6.6% respectively (Ghana Demographic and Health Survey, 2014).

The proportion of married women were similar between cases (83.3%) and controls (86.9%) and there was no significant association between marital status and intrapartum stillbirth. It was also observed that among the participants in the qualitative component of the study, 11 out of 13 women were either married or co-habiting compared to two who were single. It is important to note that 11 out of the 13 participants used charcoal for cooking and two used liquefied petroleum gas (LPG). Use of solid fuel for cooking is usually seen among people in the low wealth quintile. Solid fuel is linked to household air pollution (HAP) which is associated with poor pregnancy outcomes including low birth weight and stillbirth (Amegah et al., 2014; Lakshmi et al., 2013). It is possible that in these women the HAP contributed to the outcome of intrapartum stillbirth.

The lack of association between some sociodemographic characteristics and intrapartum stillbirth may be due to the Metropolitan nature of Accra, the numerous health facilities making access to care during pregnancy relatively easier and the relatively higher wealth of the inhabitants which contribute to better geographical and financial access and removes the protective effect of marriage for pregnant women.

In this study, 94.5% of cases and 97.4% of controls attended ANC and all of them delivered in a hospital with 51.2% of cases and 34 % of controls delivered through caesarean section. These further show that access to skilled birth attendants in the study sites was good.

5.2.1.2 Maternal disease

In this study, the quantitative component did not find a significant association between diabetes mellitus, syphilis, malaria and intrapartum stillbirth. Within the qualitative component, none of the 13 participants had a history of gestational diabetes or syphilis. These findings are contrary to reports from other studies that there is a significant association between maternal demographic characteristics and diseases including diabetes and incidence of stillbirth (Gardosi et al., 2013; Ha, Hurt, Tawiah-Agyemang, Kirkwood, & Edmond, 2012).

5.2.1.3 Maternal Parity

The average parity of the women in this study was 1.7 children making it a population of low parity. In the study, parity was not found to be a statistically significant predictor of intrapartum stillbirth although nulliparity and parity above 3 are associated with stillbirth (Gardosi et al., 2013). There are inconsistencies and controversies over the association between parity and pregnancy outcome. While some researches state a significant association between different parity levels and pregnancy outcomes including perinatal deaths, other research reports do not support such associations (M. H. Aliyu, Jolly, Ehiri, & Salihu, 2005; Bai, Wong, Bauman, & Mohsin, 2002; Dassah et al., 2014). The study by Gardosi et al was prospective and stillbirth was defined using gestational age 24 weeks unlike this study where stillbirth was defined at 28 weeks gestation. It may be that if they had increased the gestation to 28weeks, parity would have reduced (stillbirth at 24 weeks would not be counted) and this could have affected the significance of gestational age. In the study by Bai et al, their study population was grouped into nulliparity, low multiparity (parity 1,2 and 3) and grand multiparity (parity 4 to 8) and they found that stillbirth was associated with nulliparity and grand multiparity as was found by Gardosi et al. Both studies

studied singleton pregnancies and excluded confounders such as maternal smoking and congenital anomalies. The lack of significance of parity in this study may be due to the low parity (average parity 1.7 in the population) which falls within the parity 1 to 3 in their study.

5.2.1.4 Maternal Infections

Infections in pregnancy have been associated with poor birth outcomes including stillbirths. Malaria in pregnancy has a devastating effect on the growing fetus leading to intrauterine growth restriction, preterm delivery and stillbirth (Taylor & Feiko, 2017). In the quantitative component of the study, the analysis showed that 2.9% of the women had a fever. Although fever could signify an infection, this could not be confirmed and no reference was made in the medical notes to a specific infection causing the fever. In the analysis, fever was not found to be statistically significant.

Plasmodium falciparum infection which occurs predominantly in Africa is responsible for Malaria-associated maternal illness in pregnant women and low birth weight. The symptoms and complications of malaria in pregnancy vary according to malaria transmission intensity in the given geographical area, and the individual's level of acquired immunity (WHO, 2017). Malaria was not found to be statistically significant in this study: only 4.8% of cases and 1.2% of controls were reported to have had malaria despite the fact that *P. falciparum* is predominant in Ghana.

The low incidence of malaria in this study may be due to the malaria prevention interventions in place. Ghana has a policy on malaria prevention in pregnancy through free distribution of insecticide-treated bed nets (ITNs) and Intermittent Preventive Treatment for

pregnant women (IPTp) using Sulphadoxine Pyrimethamine (SP) given to pregnant women during ANC under direct supervision by the midwife. The study revealed high ANC coverage and this is consistent with the GDHS 2014 report that showed that 97.3% of pregnant women accessed ANC. The same GHDS (2014) report also showed that 87% had four or more ANC visits and 82.5% received IPTp. These figures mean that all these women probably received SP to prevent them from having malaria during the pregnancy. Only a few of the subjects in the current study had malaria possibly because of the interventions which are provided to pregnant women who attend ANC. Although ITN use was not assessed, all the interventions are given to every pregnant woman to prevent malaria in pregnancy. Five out of the 13 participants had malaria during the pregnancy that ended as stillbirth.

Syphilis infection during pregnancy is a risk factor for stillbirth (Menezes et al., 2009). Globally, over 1 million pregnant women are infected with syphilis and this infection contributes significantly to poor pregnancy outcomes including perinatal deaths (WHO, 2016). None of the study subjects had syphilis and this may be due to the policy in Ghana. One of the policies of the MOH in Ghana is that every pregnant woman should be screened for syphilis and those found to be infected are treated to prevent transmission to the fetus in the uterus. ANC coverage in GAR is very high, at 97% (Ghana Demographic and Health Survey, 2014) and this implies that almost all pregnant women have been screened and those found to be infected have been treated accordingly.

5.2.1.5 Antepartum haemorrhage

Antepartum haemorrhage is defined as bleeding from the genital tract after 24 weeks gestation and before the birth of the baby (Royal College of Obstetricians and

Gynaecologists, 2011). The anterior position of the placenta during pregnancy negatively affects pregnancy outcome more than when the placenta is placed in the posterior position. In this study 24.80% of the cases had APH compared to 2.54% in the controls; however, the records in the women's folders did not state whether they were due to placenta praevia or abruptio placentae. APH was found to be statistically significant factor associated with intrapartum stillbirth (aOR=3.28, 95% CI:1.33-8.1, $p<0.05$) implying that women who experienced APH were at 65% increased risk of having intrapartum fetal death compared to women who did not have APH. This finding is consistent with findings from other researches which have reported APH as a significant risk factor for intrapartum stillbirth (Ashish et al., 2016). Despite the statistical significance of APH within the quantitative arm of the study none of the women interviewed within the qualitative arm of the study reported a history of APH during the pregnancy that ended as intrapartum fetal death. This may not be as a result of recall bias because bleeding during pregnancy is not normal and may be frightening and so cannot easily be forgotten.

Placentation in the anterior position can go on to cover the cervix and this can lead to bleeding and poor perinatal outcomes such as intrauterine fetal growth restriction, preterm delivery and premature rupture of membranes (Ahn et al., 2018). It is one of the complications in pregnancy that is an important cause of perinatal mortality and maternal morbidity (Giordano, Cacciatore, Cignini, Vigna, & Romano, 2010). The two major causes of APH are placenta praevia and abruptio placentae and together they contribute about 50% of all cases of APH. In the other 50% of cases, the cause is difficult to identify even after investigations (Giordano et al., 2010). This is consistent with findings from other researches that 51.6% of pregnant women with placenta praevia develop APH (Fan et al., 2017). However, findings from other researchers found that about 9.8% of women with intrapartum

fetal deaths had placental abruption which was lower than what others have reported (McNamara, O'Donoghue, & Greene, 2018).

5.2.1.6 Pregnancy-induced hypertension, pre-eclampsia and eclampsia

Pregnancy-induced hypertension is the onset of hypertension after 20 weeks gestation in a woman who did not have hypertension before she became pregnant. Pre-eclampsia is the onset of a new episode of hypertension during pregnancy which is characterized by persistent hypertension (diastolic blood pressure ≥ 90 mm Hg) and substantial proteinuria (> 0.3 g/24 hours). Eclampsia, on the other hand, is diagnosed when there are generalized seizures in addition to the features presented when a woman has pre-eclampsia (WHO, 2014). Pregnancy-induced hypertension and eclampsia are associated with poor pregnancy outcomes for both the mother and the newborn. In the newborn, they contribute significantly to stillbirth as a significant proportion of perinatal deaths. For instance, in a study on women diagnosed with pre-eclampsia, the researchers reported as much as 84.5% of the perinatal deaths were stillbirths (Nathan et al., 2018).

In the quantitative arm of this study, pregnancy-induced hypertension was found in 13.5% of the total study population and this was higher than 7.5% reported in a prospective cohort study on pregnant women in two antenatal clinics in Accra (Browne et al., 2015). In this current study, among the cases, 27.0% experienced pregnancy-induced hypertension compared to 8.1% in the control group and this was statistically significant as a predictor of intrapartum stillbirth (χ^2=21.9, p<0.001). After controlling for gestational age of the fetus and other maternal characteristics in the Modified Poisson regression model, women with pregnancy induced hypertension had 85.0% increase risk of intrapartum still birth compared to those who did not experience pregnancy induced hypertension (RR=1.85, 95%:1.36-2.47,

$p<0.001$). This finding of significance is consistent with what was reported in other studies in Accra (aRR, 1.77; 95% CI, 1.32-2.36) (Dassah et al., 2014). The significant findings are also consistent with other research findings in Africa. A study in Zimbabwe found that women who developed PIH during pregnancy were 4.3 times more likely to have stillbirth as a pregnancy outcome (OR 4.34, $p = 0.0517$) compared to women who did not develop PIH (Muti et al., 2015).

PIH is characterized by symptoms such as excessive weight gain; headache; oedema; blurred vision and pain in the right upper abdomen in addition to the raised blood pressure. The qualitative component of the study assessed some of these characteristics to make an impression of PIH since the women may not be aware of the diagnosis and therefore cannot confirm or deny the fact that they had PIH during their pregnancies. The results of the study showed that nine out of the 13 participants reported excessive weight gain; six out of the 13 participants had hypertension; five developed swollen feet; seven experienced headache; three of them had abdominal pain and five out of the 13 had blurred vision. It is worthy to note that ten out of the participants had more than one symptom implying that PIH was prevalent in the women who had intrapartum stillbirths. Although the women experienced symptoms suggestive of pre-eclampsia they did not report immediately to the hospital suggesting that they did not have adequate knowledge about the magnitude of the symptoms. This is consistent with findings from other researchers who found that although women knew about hypertension and fits outside pregnancy, they lacked knowledge about pre-eclampsia and eclampsia during pregnancy. These women gave different explanations for the presence of these symptoms during pregnancy and there were no specific local names for eclampsia and pre-eclampsia (Akeju et al., 2016; Boene et al., 2016; Khowaja et al., 2016; Vidler et al., 2016).

5.2.1.7 Previous history of stillbirth or neonatal death

Recurrence of stillbirth is uncommon; it refers to the situation when a woman delivers another stillbirth after she has had a previous stillbirth. In this study, the previous stillbirth is defined as stillbirth in any previous pregnancy after 28 weeks gestation. Currently, the definition is unclear; there is a paucity of literature on stillbirth recurrence and most of the studies were done in developed countries and reports from different studies are divergent in their conclusions. While some researchers report up to ten-fold increased risk others report no increased risk at all (Ha et al., 2012). In their work, Lamont et al, (2015) reported that women with previous stillbirth were almost five times more likely to experience a stillbirth in their second pregnancy (odds ratio 4.77, 95% confidence interval 3.70 to 6.15) compared to women with no history of stillbirth.

In this study, 3.5% of the cases had previous history of intrapartum stillbirth compared to 1.2% of the controls, however, this was not statistically significant. In the qualitative component of the study, five out of the 13 women had a history of previous stillbirth. Work done by other researchers in Ghana on stillbirths, in general, found that 5.4 % of women who reported a past history of stillbirth delivered another stillbirth compared to 1.5 % of those with no past history of stillbirth (Afulani, 2016).

5.2.2 Fetal predictors of intrapartum fetal deaths

This study investigated seven fetal characteristics to document how they influenced the risk of intrapartum stillbirth. These were the sex of the baby; mean gestational age; birth weight; the position of the baby in utero; evidence of abnormality, characteristics of the liquor and characteristics of the placenta.

5.2.2.1 Gestational age

Preterm is defined according to the ICD -10 version 26, as a baby born at or after 28 completed weeks but before 37 completed weeks (196 completed days but less than 259 completed days) of gestation (WHO, 2016). Within the total study population, 34.0% of the babies were delivered preterm. The mean gestational age of the fetus (in weeks) for mothers with live births (controls) was approximately 38.8 weeks compared to those that experienced intrapartum stillbirths (controls); which was 35.6 weeks ($t=5.2$, $p<0.001$). The sensitivity analysis based on the Chi-square test of independence when gestational age in weeks was re-categorized into preterm and term births also showed a significant relationship with intrapartum stillbirth ($\chi^2=20.2$, $p<0.001$). Controlling for key maternal characteristics, the results showed that a unit increase in gestational age reduced the risk of intrapartum still birth by approximately 8.0% (RR=0.92, 95% CI: 0.88-0.96, $p<0.001$).

These findings are consistent with reports from Dassah et al. (2014) whose work was also done in Accra, that preterm delivery, hypertensive disorders in pregnancy, breech delivery and vacuum extraction were significant risk factors for stillbirths delivery (aRR, 5.15; 95% CI, 4.18-6.35). The findings are also consistent with reports from India, which globally has the highest absolute number of stillbirths that preterm delivery is one of the significant risk factors for stillbirth (Newtonraj, Kaur, Gupta, & Kumar, 2017).

5.2.2.2 Birth weight

Birth weight is one of the important factors of newborn survival: according to ICD – 10 version in the assessment of disorders of short gestation and low birth weight, even when data are available for both indicators, preference should be given to use of birth weight over gestation (WHO, 2016a). The median birth weight of the babies in this study population was

3.1kg. Birth weight was statistically significantly different between cases and controls. The mean birth weight of children born to mothers who had stillbirth (cases) was generally lower compared to the controls (2.7kg versus 3.1kg, t=4.0, p<0.001). There was enough statistical evidence to suggest an association between birth weight (Low versus normal) and stillbirth (χ^2=21.3, p<0.001). Among the cases, 37.6% of them delivered babies with low birth weight while 15.4 % in the controls delivered babies with low birth weight. Low birth weight contributes to poor newborn outcome because of the possibility of placental malfunction which leads to poor oxygen supply to the fetus leading to birth asphyxia and death.

It is worthy to note that some of the women interviewed in the qualitative arm of the study reported that their babies were bigger than normal. This is consistent with findings from studies that have reported that there is an increased risk of stillbirth in babies with low birth weight and large babies especially after 37 weeks (Contag, Brown, Crimmins, & Goetzinger, 2016). Although the study did not test the function of the placentae in the pregnancies that resulted in intrapartum stillbirths, these findings are consistent with what was reported by Lawn et al, (The Global Strategy for Women's Children's and Adolescents' Health), that the underlying mechanisms that lead to stillbirth normally involve decreased placental function, either with fetal growth restriction or preterm labour, or both. The same causal pathway may explain some of the findings reported in the qualitative arm of the study. Five out of the 13 women reported that there was poor fetal growth during the antenatal period for the pregnancies that ended as stillborn babies.

5.2.2.3 Other fetal characteristics

Initial analysis of the results showed that fetal abnormality, characteristics of the liquor and placenta had a statistically significant relationship with intrapartum stillbirth ($p<0.05$) as shown in Table 2. However, after the rigorous variable screening to determine fetal factors to be included in the multivariable analysis using AUROC and Brier score, these characteristics were not found to be statistically significant. These findings are consistent with what has been presented by other researchers. The Lancet series reported that congenital abnormalities accounted for a median of only 7·4% of stillbirths when available data were reviewed for 1.1 million stillbirths (J. E. Lawn et al., 2009). The lack of significance of the placenta in this study is contrary to reports from other studies that placental abnormalities are the second major cause of fetal deaths contributing to 11% to 65% of these deaths and placental abruption is the specific cause of the fetal deaths (Man et al., 2016). This lack of association may be due to the fact that the placentae in this study did not go through histological examination so abnormalities could not have been recorded in the clients' folders.

In this study, 11.7% of cases and 1.2% of controls had congenital abnormalities. However, a congenital abnormality was not found to be a significant contributor to intrapartum stillbirth. Advanced maternal age is associated with congenital abnormalities and subsequently stillbirth but in the antepartum period (Walker, Bradshaw, Bugg, & Thornton, 2016). This study did not find congenital abnormality significant probably due to the relatively young age of the participants (mean age of cases was 28.8 years and that for controls was 28.9 years) and the fact that the study looked at intrapartum stillbirths.

Position of the baby in-utero which was significant during bivariate analysis was not found to be significant after multivariate analysis of fetal factors contributing to intrapartum stillbirths. This is contrary to what was stated by Dassah et al. (2014) who reported in their study in Accra that stillbirth was significantly associated with breech delivery during the multivariate analysis (aRR, 2.70; 95% CI, 2.04-3.57). This difference in findings may be due to improved skills of health providers in conducting breech delivery as well as better access to interventions such as caesarean section.

Within the qualitative component of the study, three out of 13 women reported that their babies were very big but there were no descriptions of abnormalities. It is worthy to note that none of the women was diagnosed with diabetes during their pregnancies that ended in stillbirths. Five out of 13 women had reduced fetal movements before they delivered and eight out of 13 did not feel any movement before delivery. All five women who had reduced fetal movement later did not feel any fetal movement before delivery. The reduced fetal movements are signs that fetal survival was compromised at a point during the pregnancy and they would have benefitted from an intervention but those women did not take immediate action to seek care. These fetal deaths following reduced fetal movement may be linked to poor placental performance which is a major cause for stillbirth (Lawn et al., 2016).

5.2.3 Health service factors

The rate of intrapartum fetal death of a country is a reflection of the quality of care received by women and babies during labour and delivery. Focusing on the analysis of these deaths can bring out good aspects of the care women and babies receive intrapartum, as well as help to identify areas that need improvement to ensure optimal quality of care and survival of women and newborns (McNamara et al., 2018).

This study investigated three service delivery factors which can contribute to stillbirth and these were the mode of delivery; health professional who conducted the delivery and the time of delivery.

5.2.3.1 Mode of delivery and service provider at delivery

The mode through which the baby was delivered and the health professional who conducted the delivery were assessed as part of health service factors that can contribute to intrapartum stillbirths. Within the quantitative component of the study, among the cases, 51.2% of babies were delivered through cesarean section compared to 34.1% among the controls (χ^2=10.1, p<0.001). With reference to professional who conducted the delivery, 55.2% of cases were delivered by medical doctors compared to 39.1% among the controls (χ^2=8.0, p=0.005). Although these factors were not statistically significant during the multivariate analysis they are consistent with what was reported by Afulani (2016). She found that stillbirths were higher for births assisted by doctors (5.1 %) compared to those assisted by nurses (1.6 %) and 1% for deliveries assisted by other health professionals. She concluded that "having some intervention during pregnancy is positively associated with having a stillbirth". In their study, also in Accra, Dassah et al. (2014) reported that at the multivariate level vacuum extraction was significantly associated with stillbirth (aRR, 2.67; 95% CI, 1.50-4.76). Similar findings were reported by McClure et al (2011), who analyzed data from seven countries that deliveries conducted by Physicians had a higher rate of stillbirths compared to deliveries by nurses and traditional birth attendants. They opined that this finding could be due to the nature of pregnant women (with complications) who sought care from physicians and the absence of equipment at the health facilities. Deliveries in Ghana are usually conducted by midwives and Doctors are called in to assist when there are complications that interventions such as C/S and vacuum extraction which are performed

by Medical Doctors are required. The facilities within the study sites receive referrals from smaller facilities; including emergencies. It is possible that the babies delivered by Doctors were already compromised and so the poor birth outcomes were due to issues such as poor oxygen supply to the babies and not necessarily that Doctors lack the skills to perform deliveries thus recording higher stillbirths as birth outcomes.

Other researchers have identified that intrapartum asphyxia is a cause of intrapartum stillbirth (McNamara et al., 2018) and that training in neonatal resuscitation for physicians and other health workers could prevent many of the neonatal deaths currently misclassified as stillbirths (Zulfiqar A. Bhutta et al., 2009). Some of the health staff indicated that there was lack of capacity to conduct neonatal resuscitation and this could be contributing to the persistence of the huge numbers of reported intrapartum fetal deaths (since some of the babies may have been born alive). However, this could not be confirmed because the study was focused on delivery outcomes reported as intrapartum fetal deaths and therefore could not assess the contribution of lack of this capacity to neonenatl deaths within the hospitals.

5.2.3.2 Delay in receiving care

Delay in seeking care is common in developing countries for several reasons and the three delays model which looks at 1) delay in the client deciding to go to the hospital; 2) delay in reaching the hospital when decision has been made to go to the health facility and 3) delay in receiving care when the client gets to the health facility have been studied largely. Although the delays have been in connection with how they contribute separately or collectively to maternal mortality, they can equally contribute to neonatal morbidity and mortality including intrapartum fetal death (Martins et al., 2019). This is because newborn health and survival are very closely linked to maternal health and survival.

Findings from the qualitative component of the study showed evidence of the three delays during the pregnancies that ended as stillbirths. In this study, some of the participants who experienced symptoms of complications during the pregnancy did not report promptly to the hospital for care and this is consistent with Delay 1. This is consistent with what was reported by Calvello et al. (2015) that a client's inability to quickly recognize an emergency may lengthen the delay in the decision to seek timely and appropriate care. In some other instances, when the women got to the hospital, there were delays in receiving needed care such as investigations, allocation of beds and access to the theatre. These were cited by both the women and the health professionals and this is consistent with the third Delay in the three delays model. None of the participants cited non-availability of transport or money as a reason for the delay in going to the hospital. Thus, the second delay did not come to play in this study. This may be due to the cosmopolitan nature of Accra where vehicles are always available and the wealth status of the population did not hinder the women from affording transportation cost to the hospital.

5.3 Perceptions of women with history of stillbirths

The women participants with histories of stillbirths gave their perceptions about the possible reasons why their pregnancies ended as stillbirth and made suggestions for prevention.

5.3.1 Maternal factors

The participants mentioned lack of knowledge about complications which led to delay in accessing care as a possible reason for the fetal death. This was also mentioned by the health professionals as a possible contributor to intrapartum stillbirth. The use of unprescribed, medications including herbs was also mentioned as a possible contributor to stillbirth. They

suggested that health professionals should educate pregnant women on how they should take care of themselves during pregnancy to ensure the survival of their babies.

5.3.2 Fetal factors

The participants mentioned that the reduced fetal movement sometime during the pregnancy was missed as an early warning sign that there was a problem with the fetus. Since they were not aware of the significance of reduced fetal movement, they delayed in reporting to the hospital and they believed that this delay contributed to the fetal demise.

5.3.3 Health Service factors

The participants mentioned a number of health service factors which they believe contributed to the death of their babies. These were to do with human resource, lack of infrastructure and equipment and poor staff attitude. The participants suggested that there should be more trained staff to attend to pregnant women and there should be an improvement in the way mothers and babies are examined during ANC. They also suggested the procurement of modern equipment to facilitate improved care of pregnant women and their babies. There were reports of poor staff attitude and the participants believed that such incidents affected the care they received. They, therefore, suggested that staff should be educated to be gentle with women when they report in labour.

5.4 Health workers perceptions of intrapartum stillbirths

Part of the qualitative component of the study involved an in-depth interview of a health professional who worked in the two major hospitals: Greater Accra Regional Hospital, Ridge and Tema General Hospital to explore their perceptions on maternal; fetal and service

delivery factors that contribute to intrapartum stillbirths and how these deaths could be reduced.

5.4.1 Maternal factors

Quality antenatal care contributes to early identification of complications in pregnancy, early reporting and referral to the hospital for appropriate interventions leading to a reduction in stillbirths (Afulani, 2016). In discussing maternal factors in this study, the health workers expressed their views about the women's lack of knowledge on danger signs in pregnancy and therefore a poor response to complications leading to delay in seeking care and poor birth outcome including intrapartum stillbirth.

This finding may be due to the nature of the current system for providing ANC services: health education talks are given during the early sessions and they are not repeated before the end of the clinics. This means that only pregnant women who are present during the talks benefit from the day's educational session. Any pregnant woman who comes after the day's session misses everything that was taught. Currently, during ANC within GHS hospitals, women are not routinely given handouts on what is discussed at the ANC for the day and so they go home without any materials to refer to as a guide to help them prepare adequately for complications. The maternal health record book has been modified and contains some information and photographs on the common complications in pregnancy to inform the pregnant women on danger signs and when to report to the hospital.

Another factor which the health professionals mentioned was the delay in seeking care. They expressed the view that the use of alternate care such as from religious leaders could be a contributory factor to late reporting at the health facility leading to intrapartum stillbirth.

The health professionals mentioned the use of unprescribed medications including herbs as contributors to intrapartum stillbirth. The health staff proposed improved education of pregnant women during the antenatal period, especially about complications in pregnancy as well as public education within the communities to facilitate support from their families and community leaders. This is consistent with reports from Goldenberg and McClure (2009) that mobilizing the community and assigning them specific responsibilities helps to link pregnant women to the health system and improves pregnancy outcomes.

5.4.2 Fetal factors

The health staff interviewed did not have much to say about fetal factors and how they contribute to the delivery of intrapartum stillbirths. The lack of perceptions about fetal factors may be due to non-auditing of intrapartum fetal deaths due to lack of capacity to conduct perinatal death auditing. The other reason for lack of information on fetal factors may be due to the absence of autopsy services for intrapartum deaths leading to no records of fetal-specific causes of intrapartum deaths. This is consistent with reports from studies in Nigeria in which it was observed that the cause of stillbirth could not be ascertained for the huge numbers reported in a tertiary hospital because of lack of autopsy (Agbata, Eze, Ukaegbe, & Odio, 2017) The only comment made in relation to fetal factors was about mothers complaining of irregular heart rate during pregnancy but there was no indication of the actual interpretation of this and the health professionals did not give details of what is done for the mothers when they report with such complaints. This complaint from the women may be an indication of placental malfunction which impairs blood supply to the fetus in-utero and lead to fetal demise. The health workers proposed training in perinatal death auditing for all staff to improve the proportion of perinatal deaths that are audited to

identify possible causes of death and develop appropriate interventions to address any systemic gaps.

5.4.3 Health service factors

Intrapartum stillbirth is said to be a reflection of the quality of care pregnant women receive during labour and delivery. The health professionals expressed their views about the existing system for providing care to pregnant women and how some of the gaps could contribute to intrapartum stillbirth. They were emphatic about the role adequate numbers of trained staff could play in reducing stillbirth. Almost all the health staff were concerned that the number of staff who provide service were inadequate leading to poor intrapartum management and subsequently to intrapartum stillbirth. They linked the non-use of partograph to the inadequate number of midwives on duty at a particular time versus the number of women who may be in labour at that time. The use of partograph is linked to the identification of the alert point when an intervention may be needed and this helps to improve birth outcome (Ashish et al., 2016). They opined that more midwives, anaesthetists and Doctors should be recruited to augment the current numbers to improve access for pregnant women, adherence to protocols and improve intrapartum care to reduce the incidence of intrapartum stillbirth. This is because more staff will reduce the number of clients one staff would be responsible for and give the staff more time to attend to women in labour following existing protocols. The current situation where there are a few midwives attending to several women in labour makes it difficult for them to spend a lot of time on one woman.

The health staff mentioned poor infrastructure; lack of logistics; lack of staff and delayed referral as some of the contributory factors to stillbirth. These factors lead to delay in

providing care, poor quality of care and ineffective and delayed response to fetal asphyxia leading to intrapartum stillbirth.

These findings are consistent with factors contributing to the third delay in the three delays model of maternal mortality which looks at the delay in receiving care at the hospital as well as the length of the delay that has been described under the third delay (Thaddeus, 1994). The observations made by the health workers showed that the hospitals delayed in the provision of needed services although the women made their way to the hospital, and this could contribute significantly to the intrapartum stillbirths. This finding is consistent with the findings reported by Musafili (2015) that the third delay contributed to 37% of stillbirths in his study. The other factor they said contributed to intrapartum stillbirth was the lack of infrastructure and equipment. Specifically, they mentioned the inadequate number of beds which lead to delay in admitting pregnant women and lack of theatre space which also delayed the provision of interventions such as caesarean section resulting in intrapartum stillbirths. They suggested that there should be an addition of more theatres and beds to facilitate access and thus minimize the third delay.

Other factors they believed contributed to intrapartum stillbirths included the lack of staff capacity to perform neonatal resuscitation. They believed that babies who were born alive but needed resuscitation but did not get resuscitated due to lack of expertise were recorded as fresh stillbirth thus bloating the actual number of intrapartum stillbirths. They proposed that building the capacity of staff to do neonatal resuscitation will minimize the falsely classified intrapartum stillbirths since some of the babies would survive after the resuscitation because they were born alive. This assertion by the health staff is consistent with reports from perinatal death auditing conducted in health facilities using the form

developed by MoH (appendix 16). The GHS has adopted perinatal death auditing as one of the major interventions to identify causes of stillbirths in the effort to improve newborn survival. It is indeed the only intervention mentioned in the Ghana Newborn Strategy and action plan that specifically addresses stillbirth reduction (Ministry of Health, 2014). This single intervention requires that all staff involved in the delivery of pregnant women should be trained in stillbirth auditing to reduce stillbirth. However, the reports from the health staff revealed that these critical cadres of staff have not been trained to do the stillbirth auditing. This means that no context-specific strategies and activities can be developed to address significant causes contributing to the huge numbers of stillbirths recorded in these major facilities.

5.5 Model to predict future intrapartum stillbirth

Intrapartum fetal deaths are due to the multiplicity of factors as depicted in the conceptual framework and the findings from this study. After rigorous analysis of data in the quantitative component of the study, it was observed that the best model that could predict intrapartum stillbirths is made up of a combination of maternal, fetal and health system factors. Review of Table 4.6 and appendix 12 show that although maternal and health system factors can predict intrapartum stillbirths, the best model to be used to make an impact in the reduction of intrapartum stillbirths is the model that addresses all three factors: maternal; fetal and service delivery at the same time. This is consistent with *The Lancet* Executive Summary's stand that the major risk factors for stillbirth are well known and often overlap. Factors such as maternal age >35 years; maternal infections; fetal growth restriction; preterm labour and suboptimum care combine to increase the rate of stillbirths (Frøen et al., 2016).

5.6 Strengths of the study

This study is one of the few studies that have examined the contributors to intrapartum stillbirths in GAR. The unique feature of this study is that it examined maternal, fetal and service delivery factors that contributed to intrapartum stillbirths in the GAR. Another strength is that the study used census of available records on intrapartum stillbirths to ascertain the possible contributors to intrapartum stillbirths in GAR. It is the first study that explored and documented the perceptions of women who have experienced intrapartum stillbirths and perceptions of health professionals about contributors to stillbirth and how intrapartum stillbirths could be prevented (in the same study). The study is also the first to develop a model to predict intrapartum stillbirth in GAR. One of the unintended findings was the lack of capacity of the staff to conduct perinatal death auditing. This finding will inform remedial action to improve the auditing of perinatal deaths.

5.7 Limitations of the study

The major limitation of the study was the challenge of retrieving stored data for both the cases and controls. This is a limitation of retrospective studies and an example of poor data management practices that occur in health facilities especially in developing countries. To address this shortcoming, the study employed multiple imputations by chained equations (MICE) to input missing data before the multivariable analysis was done; thus increasing the validity of the findings. Another limitation is that autopsy for stillbirths is not a routine practice in Ghana therefore, this study did not have access to fetal predictors that can only be obtained through autopsy reports. The study utilized records on physical findings of the baby at birth to determine whether a baby had congenital abnormalities or not in the absence of autopsy reports. The same assessment was used for live babies, thus there was no discrimination between determining abnormalities in stillbirths and livebirths. Midwives

and doctors have the capacity to examine babies at birth and determine and document whether babies are born with congenital abnormalities or not. Therefore, the reports on abnormalities reported in both the cases and controls can be said to be professionally plausible. Fetal autopsy is not regularly performed in developing countries.

Agbata et al (2017) reported that although fetal autopsy examination remains the best tool for understanding and classifying the causes of stillbirth it has not been used extensively in developing countries. Since the study examined several contributory factors including congenital abnormality and used robust statistics to identify significant factors that contribute to intrapartum fetal deaths, the absence of reports on autopsy would not invalidate the findings of the study. Another limitation could be recall bias from the women who have had stillbirths, however, one year may not be such a long time to forget important events that occurred during their pregnancies that ended in stillbirth.

To overcome recall bias, interviewers were trained to guide the discussions, request for clarifications where there were inconsistencies in the participant's responses and also use reinforcement to validate what the women said during the indepth interviews. The interviewers were medical doctors so they had a good understanding of the issue of stillbirth and could easily pick any inconsistencies and ask further questions to clarify such issues. Each participant was given enough time to discuss in detail a point before the interviewer moved on to another point. Therefore, responses recorded could be taken as a fair report of what a participant experienced during the particular pregnancy that ended as stillbirth.

5.8 Conclusion

This chapter discussed the findings of the study based on the objectives and the research questions and integrated the major findings that evolved from the quantitative and qualitative studies. The chapter also highlighted the linkages between maternal; fetal and service delivery factors that contributed to intrapartum fetal deaths in singletons as depicted in the conceptual framework. The chapter also discussed the findings of the study in relation to relevant published research and sought to explain areas of convergence and divergence. The chapter discussed the strengths and how these contributed to knowledge on intrapartum stillbirths. Identified weaknesses of the study have also been discussed and the effect on the study outlined appropriately to show that the weaknesses did not affect the validity of the findings of the study.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter summarises the whole study and makes recommendations for consideration by the Ministry of Health, Ghana Health Service- Headquarters, the Greater Accra Regional Health Directorate and the six hospitals study sites. The chapter also highlights the contribution of the study to the body of knowledge on stillbirths.

6.2 Conclusions

The study identified maternal, fetal and health service factors that contribute to intrapartum stillbirths and developed a model to predict future intrapartum stillbirths. Pregnancy-induced hypertension (PIH), antepartum haemorrhage (APH), premature rupture of membranes (PROM) were key maternal factors identified as contributors to intrapartum stillbirths in singletons. Gestational age of the fetus at birth was the key fetal factor which contributed significantly to intrapartum stillbirths. Health service delivery factors such as mode of delivery and health professional who conducted the delivery were not found to be statistically significant during the .multivariate analysis.

Health professionals and women with a history of stillbirth identified poor maternal knowledge about pregnancy and complications, inadequate number of trained health personnel, poor infrastructure and lack of equipment as contributory factors to intrapartum stillbirths. The study also identified poor intrapartum monitoring and non-use of partograph for women during labour as some of the factors which contribute to intrapartum stillbirth. Lack of bed and theatre space were identified as factors that led to delay in receiving care from the hospitals and contributed to intrapartum stillbirths. Non-auditing of perinatal

deaths was also identified as a contributory factor to intrapartum stillbirth. The perinatal deaths were not audited because the health professionals lacked the requisite capacity to conduct the audits thus denying them the opportunity to identify factors which were contributing to the deaths and developing remedial interventions to reduce the occurrence of intrapartum stillbirths.

The best model to predict intrapartum stillbirth was the model which combined maternal, fetal and service delivery factors compared to models which had individual contributory factors or models with combinations of two contributory factors.

Women who had history of stillbirth and health professionals recommended capacity building for health staff as a remedial activity to reduce intrapartum stillbirths. They also recommended increase in the number of trained personnel and modern equipment as some of the remedial factors to reduce intrapartum stillbirth.

6.3 Contribution to body of knowledge on intrapartum stillbirths

This study has contributed significantly to the body of knowledge on intrapartum stillbirth in Ghana; currently, there is no model which serves as a guide for health providers in developing strategies to reduce stillbirths. The findings have shown that a model to predict intrapartum stillbirths in singletons at/after 28 weeks gestation should combine maternal, fetal and health system factors. Currently, Ghana's main strategy for reducing stillbirth is auditing of perinatal deaths. However, there has not been any study to assess the level and quality of the perinatal death audits within GHS hospitals since it was introduced over five years ago. This study has shown that the capacity to do thorough auditing is weak and perinatal death audits are not carried out routinely: therefore, maintaining auditing as the

major means of preventing intrapartum fetal deaths will not be an effective method of reducing stillbirths in Ghana. Implementing the model developed in this study would help to identify pregnancies at high risk of intrapartum stillbirths so that health providers can intervene at the appropriate time to reduce the occurrence. The study has also shown that although GHS stresses on pregnant women attending ANC with close to 100% coverage, pregnant women lack knowledge and awareness about symptoms of complications in pregnancy leading to delay in seeking care leading to intrapartum stillbirths. This brings out the question about the quality of services provided during regular ANC and the communication skills employed to educate pregnant women on danger signs in pregnancy and actions to be taken to avert maternal and fetal morbidity and mortality. PIH and APH are usually associated with maternal deaths and efforts at addressing them have been focused on reduction of maternal deaths. However, this study has shown that addressing PIH and APH will have a positive effect on intrapartum stillbirths thus contributing to the body of knowledge on prevention of intrapartum stillbirths.

6.4 Recommendations

Based on the findings from the study, the following recommendations are made:

6.4.1 Practice

1. The GHS should review ANC education provided to pregnant women to emphasise on identification and prompt response to complications in pregnancy
2. All doctors, midwives and nurses who care for pregnant women should be trained in proper management of pregnancy-induced hypertension (PIH); antepartum haemorrhage (APH) and premature rupture of membranes (PROM) to improve quality of care and birth outcome

3. The GHS should develop SOPs on proper management of preterm labour and delivery, train health care providers to use the standards and regularly monitor adherence to improve quality of care and birth outcomes.
4. The GHS should enforce the policy on partograph use for monitoring of labour to ensure that every woman who uses the hospital during labour and delivery is duly monitored and appropriate action taken at the right time to improve birth outcomes
5. Labour ward managers should monitor quality of intrapartum care of women during labour, document gaps in quality of care, make recommendations and design activities for redress to improve birth outcomes
6. The GHS should build the capacity of health staff who conduct deliveries in auditing of intrapartum stillbirths and use the findings for decision making to inform practice
7. GHS should sponsor interested health professionals to be trained in fetal autopsy to build the requisite capacity in Ghana to provide such services when needed

6.4.2 Policy

8. As a matter of urgency, the Ministry of Health should review the curriculum of health training institutions to give priority attention to management of PIH, APH, PROM and prematurity to ensure that staff enter the Service with the requisite knowledge to improve quality of care of pregnant women
9. The Ghana Health Service should develop a policy on fetal autopsy and include it as part of perinatal death auditing

6.4.3 Further Research

10. The GHS should conduct research on the model for predicting intrapartum stillbirths developed in this study and use the findings to inform further action on prevention of intrapartum stillbirths.

6.5 Summary

This chapter gave a summary of the research, the findings contribution to knowledge and how the findings could be applied to reduce preventable intrapartum stillbirths. The chapter made recommendations for consideration by relevant institutions and suggested timeframe for their implementation.

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APPENDICES

Appendix 1: Information Sheet for Heads of Study Site Hospitals

ID No.

Study title: PREDICTORS OF INTRAPARTUM STILLBIRTHS IN SINGLETONS IN SIX PUBLIC HOSPITALS IN THE GREATER ACCRA REGION

Name of Principal investigator: Dr. Linda Amarkai Vanotoo
Tel. +233243714095
Email: linda.vanotoo@ghsmail.com
Institution: School of Public Health, University of Ghana

Information sheet for interviewees
Qualitative:

My name is ..... I am a Doctor working with the Ghana Health Service in the Greater Accra Region and I am undertaking a study into a research project as part of my PhD in Public Health Degree.

One of the devastating outcomes of pregnancy is stillbirth. Stillbirth is defined as a fetus born after 28 weeks gestation without signs of life with/without skin disintegration. This could be intrauterine (macerated; dying more than 12 hours before delivery) or intrapartum fetal (fresh; dying within 12 hours of delivery) death. Globally about 3 million stillbirths are recorded annually: over 98% occur in developing countries. Ghana records over 11 thousand stillbirths annually; about 2000 (17%) occur in the Greater Accra Region (over 40% are fresh stillbirths). Stillbirths do not feature prominently in international agenda as other public health priorities and there is very little funding for stillbirth activities.

In Ghana, there has not been much research on stillbirth and there is no contextualized structured system for its prevention. This gap must be addressed since thousands of women and families require answers for their losses. Stillbirth is associated with severe psychological challenges such as depression and post-traumatic syndrome.

The aim of this study is to determine maternal, fetal and service delivery factors associated with fresh stillbirth in six Public Health facilities and identify predictors of fresh stillbirth in singleton pregnancies in the Greater Accra Region.

The study design is a (1) quantitative case-control study and (2) Qualitative study using in-depth interviews. For the case-control study, the study population is all women who delivered in the six selected public hospitals in 2016 at or after 28 weeks gestation. For the qualitative part of the study, a total of 13 women (who had stillbirths), 6 doctors, 6 midwives and 2 Health Service Administrators have been purposively selected from 2 hospitals (Tema General Hospital and Ridge Regional Hospital) to be interviewed.

Ethical approval to conduct this study has been obtained from the Ethics Review Committee of the Ghana Health Service (GHS).

Possible risk/benefits: All research assistants have been trained to keep every discussion in confidence. Hence this study will not pose any significant risk. This information will help improve health services for people in the country.

Right to refuse: Participating in this study is voluntary and participants can choose not to answer any individual question or all the questions. Participants will not be paid for their

participation. They are however encouraged to fully participate since their opinions are important.

Anonymity and Confidentiality: You are assured that whatever information you provide will be taken with strict confidentially and will be purely for research purpose. Your responses will not be shared with anybody who is not part of the study team. Data analysis will be done from one level to another level so that those at a higher level will not know you.

If you would like to know more about the project, I would be very happy to chat with you. If you wish to do this, please feel free to contact:

Contact person: Miss Hannah Frimpong
Administrator, Ghana Health Service Ethical Review Committee.
Tel: 0243235225
Dr. Linda Amarkai Vanotoo
Tel. +233243714095
Email: linda.vanotoo@ghsmail.com
Institution: School of Public Health, University of Ghana

Appendix 2: Quantitative Study - Data extraction form

Maternal Factors - from delivery records

1.0 Demography	
1. Age in years at last birthday	[ ]
2. Educational Background:	none [ ]; primary [ ]; secondary [ ]; tertiary [ ]; Vocational [ ]
3. Marital status	Married [ ] Single [ ] Divorced [ ] Co-habitation [ ]
4. Place of residence : state name of community and district	urban [ ] rural [ ]
5. Occupation	
2.0 Obstetric History	
2.10 Antenatal	
6. Parity	[ ]
7. Weight at Registration	[ ] Kg.
8. Hb at Registration	[ ]
9. Hb at 36 weeks	[ ]
10. Age between the last child and the current pregnancy (SB) in years	[ ]
11. History of previous stillbirth	Yes [ ] No [ ]
12. If yes: please state how many and year of occurrence	[ ]
13. History of previous neonatal death(s)	Yes [ ] No[ ]
14. If yes: please state how many and year of occurrence	[ ]
15. Antenatal Clinic Attendant	Yes [ ] No [ ]
16. If Yes: Number of ANC Visits before delivery	[ ]
17. Number. of IPTp Doses taken by Mother	[ ]
18. **Evidence of infection (From Laboratory tests results)**	
18.1 Fever	Yes [ ] No [ ]
18.2 Syphilis	Yes [ ] No [ ]
18.3 Malaria	Yes [ ] No [ ]
18.4 Other: please specify	Yes [ ] No [ ]
19. **Presence of disease**	
19.1 Existing Diabetes Mellitus	Yes [ ] No [ ]
19.2 Gestational diabetes	Yes [ ] No [ ]

19.3 Existing Hypertension	Yes [ ] No [ ]
19.4 Pregnancy Induced Hypertension	Yes [ ] No [ ]
19.5 Eclampsia	Yes [ ] No [ ]
19.6 History of admission during the antenatal period (probe for cause)	Yes [ ] No [ ]
19.7 Other: please specify	Yes [ ] No [ ]
20. **Complications**	
20.1Premature Rupture Of Membranes	Yes [ ] No [ ] Unknown [ ]
20.2Ante partum haemorrhage	Yes [ ] No [ ] Unknown [ ]
21 Labour and Delivery	
21.1 Duration of labour	[ ] Hrs
21.2 Place of delivery	[ ]
21.3Mode of delivery	SVD [ ] Assisted vaginal delivery [ ] Caesarean Section [ ] Others Please specify .....
21.4Delivery conducted by	Midwife [ ] Medical Officer [ ] General Nurse [ ] Comm. Health Nurse[ ] Enrolled nurse [ ]
21.5Any other comment from a review of records	

Appendix 3: Quantitative study – Data extraction form

Fetal Factors - From Mothers Delivery Records

1.0 Demography	
1.1 Sex	Male [ ] Female [ ] Not Stated [ ] Ambiguous [ ]
1.2 Gestational Age (weeks)	[ ]
1.3 Birth weight	[ ] Not Stated [ ]
2.0 Delivery records	
2.1 Date of delivery:	[ ] Not Stated [ ]
2.2 Day of the week:	Weekday [ ] Weekend [ ] Not Stated [ ]
2.3 Time of delivery (use AM or PM example: 9:20 AM or 9:20 PM	[ ]
2.4 Position/Presentation of Baby (Pls Tick all that apply)	Cephalic [ ] Breech [ ] Transverse [ ] Footling [ ] Arm prolapse [ ] Cord prolapse [ ] Cord around neck [ ] Other: please state
2.5 Mode of delivery	SVD [ ] Vacuum [ ] Forceps [ ] C/S [ ] Other [ ]
3.0 Complications	
3.1 Evidence of visible abnormality?	Yes [ ] No [ ]
3.2 If yes: please describe the abnormality	
3.3 Characteristics of Liquor (Pls tick all that apply)	Clear [ ] Meconium stained [ ] Offensive [ ] Unknown [ ]

3.4 Other characteristics of the baby (Pls describe)	
3.5 Characteristics of the placenta If described please document what was written	Described [ ] Not described [ ]
4.0 Delivery comments	
Document all remarks made by Doctor or midwife concerning this baby	

Appendix 4: Indepth Interview Consent Form for Participants – Women and Health Workers

Purpose: Good morning/afternoon and thank you for agreeing to talk with me today. My name is----------.we are currently conducting a study that would contribute to the award of PhD degree. We are gathering information on stillbirths from Doctors, midwives as well as individuals who have had such experiences to help understand the reason why some babies, unfortunately, are born without any signs of life. The findings from this study will help us to understand the unfortunate occurrence of stillbirth and develop interventions to reduce the numbers of stillbirths. You have been identified as one of such people who we can talk to in order to gather the needed information which can be analyzed to arrive at the conclusions that would help us achieve the goal of the study. You are among the 20 women who have been selected to be interviewed through the administration of a questionnaire for this study.

The experiences and concerns you share with us will contribute significant information towards the outcome of the study and will help to develop an implementable program for the reduction of stillbirths.

You are not under any obligation you can choose to participate or not. If you choose to be part, you can decide not to answer any question that makes you uncomfortable. You are free to change your decision at any point in the interview or discussion.

Procedure: Questions you will be asked (if you agree to be part of this study), will be about yourself, the pregnancy and the baby. We would like to ask for the consent of all the 20 participants, including you, to audiotape our conversation.

Confidentiality: We audiotape and take notes to be able to remember everything we discussed in our conversation, and make reference to when needed. Any information you are giving today will be confidential, and no one apart from the team conducting this study will have access to it. Though your name will be asked for a probable follow-up, it will not be attached to the information you are sharing, and no one will know what you have shared. Your name will only be on the informed consent that you will sign. There is no right or wrong answer to any of the questions. The recordings and notes will be kept in a safe place and locked by the principal investigator of this study only. Your name will not appear on any of the reports without your consent.

Risk and Benefits: The information you give us will help us understand better the issue of stillbirth and factors that contribute to the delivery of babies without any signs of life at birth. Also because of your experiences and how we can support women in such times, you may become uncomfortable with some questions, but remember you can decide to or not answer any question you are uncomfortable with.

Voluntary Participation: Kindly remember that your participation is out of your free will, if any of the questions make you uncomfortable feel free to stop at any time, your opinion and experiences are very important to us and there are no consequences for not participating in any of the interviews.

Reimbursement: kindly note that you will not be paid for participating,

Who Reviewed the Study? The Ghana Health Service Ethical Review Committee has reviewed the study to make sure all participants will be fairly treated in this study.

Do you have any questions? Yes No

Question: ----------

Participant's statement: I certify that the study and the process of the interview have been explained to me / I have read and understood the study, and I am willing to participate in the study. All my questions have been answered to my satisfaction and I understand that I am free to discontinue participation at any point of the interview if I so choose. I voluntarily agree to participate and I understand that I will not receive any payment for participating.

Date ---------- **Participant signature** ---------- **Mark**/thumbprint ----------

Declaration by Interviewer
I have explained the study and procedure of the interview to the best of my knowledge to the participant's understanding.

Date ---------- Interviewer's Name ---------- Sign ----------

Contact information
If you have any question about the study, suggestions or any information to help the study, please contact:
Dr. Linda Vanotoo: Study Principal Investigator
School of Public Health, Legon
Mobile: +233-243-714-095
Email: lavanotoo@yahoo.com

Appendix 5: Qualitative study - In-depth Interview with Participants (Mothers)

1.0 Demography Details	
1.1 Age in years at last birthday	[ ]
1.2 Educational Back ground:	None [ ] Primary [ ] Secondary [ ] Tertiary [ ] Vocational [ ]
1.3 Marital status	Married [ ] Single [ ] Divorced [ ] Co-habitation [ ]
1.4 Place of residence: state community and District	Urban [ ] Rural [ ]
1.5 Occupation	
1.6 Religion	Christian [ ] Traditionalist [ ] Islam [ ] Others Specify [ ]
2.0 Social History	
2.1 Alcohol intake during Pregnancy	Yes [ ] No [ ]
2.2 Mother Smoking	Yes [ ] No [ ]
2.3 Smoking husband	Yes [ ] No [ ]
2.4 Source of cooking fuel	Wood [ ] LPG [ ] Charcoal [ ]
2.5 Source of Drinking Water	Tap [ ] Well [ ] River [ ]
3.0 Antenatal Care	
3.1 Are you Antenatal Clinic attendant? Please explain If yes Where Number of times she attended Gestation when she started Please explain	
3.2 Did she attend pregnancy school? Please explain If yes how many times?	

3.3 what is the Age between the last child and Stillbirth?	
3.4 Did you take medicines for malaria prevention whilst pregnant? If Yes How many Doses	
3.5 Did you use Folic Acid and Haematinics? If Yes how often?	
3.5 Did you Use herbs whilst pregnant? Please explain When did she start What is the Name In What form: drink; enema; bitters; chewed How long did she use it	
3.6 Any bleeding from the vaginum?	
4.0 Complications in Pregnancy	
4.1 Was there any fever during pregnancy?	
4.2 Was there a History of admission If yes: kindly explain	
4.3 Did you experience reduced fetal movement? Please explain	
4.4 (When you realised reduced fetal movement what did you do Went to the Hospital (If Yes) Is the hospital where you attend ANC? What were you told to do? What was done for you Took some Medicine Please specify who prescribed it Informed an Elderly Woman Did not do anything	
4.5 If she did not do anything: Probe to find out why	
4.6 If Yes to 4.3 how long before Labour started	
4.7 Are you aware of Kick Counts?	
4.8 (if yes to 4.6) Do you know how to count? If Yes let her explain what she knows If Yes let her demonstrate	Yes [ ] No [ ]
4.9 Ask about symptoms of PIH excessive weight gain headache blurred vision raised blood pressure swollen feet Diabetes	

Malaria Cough Painful micturition	
4.10 Did she lose liquor	
4.11 When was the last time you felt the baby's movement? How many minutes or hours before you delivered	[ ]
4.12 When did you realize that the baby was not alive?	
4.13 Did the staff explain what could have caused the stillbirth?	
5.0 Labour and Delivery	
5.1 How old was the pregnancy when you went into labour?	
5.2 What time did the Labour start?	
5.3 Describe what happened when you went into Labour Went straight to the hospital Gave me an enema before going to the hospital Called my Husband and waited for him before going to Hospital Called my Mother / Mother in Law Waited at home till the Pains become stronger	
5.4 How long did it take you to get to the Hospital	
5.5 What means of transport did you use to the Hospital?	
5.6 Who accompanied you to the Hospital	
5.7 Who conducted the delivery?	
5.8 How long did the labour last?	
5.9 How will you describe the reception at the hospital? - the way the staff talked to you; - the waiting time before you were seen; - how you were treated when you were put in position; - how the news of stillbirth was broken to you; - the care you received after delivery - how the baby was treated - etc).	
6.0 Referral	
6.1 Was Mother referred from another facility	
6.2 At what stage during the pregnancy	
6.3 Reason for a referral. - Probe to find out if she was informed about the reason for referral and if she understood the reason for the referral. - What did she think about the referral? - Did she comply? Did she report immediately?	

- If she did not report as suggested by the referring facility; probe to find out why. - How long did she stay at home before going to the hospital after the referral?	
6.4 Do you have any comments on your experience: from the referral facility to where you were referred to?	
7.0 Care of Newborn	
Immediate care of Newborn What was done? Probe to solicit efforts at resuscitation 7.1 Midwife pressed baby's chest 7.2 Rubbed baby's feet with something 7.3 Beat the baby's buttock 7.4 Put something over the baby's mouth and pressed on a ball 7.5 Put a tube in baby's mouth and sucked something out 7.6 Wrapped and put baby aside 7.7 Said she was taking the baby to the incubator 7.8 Baby was taken away immediately 7.9 Left Baby in the Cot and did not do anything 7 10 I did not look at what was done to the baby (probe to find out why)	
8.0 Post Partum of mother	
8.1 Perception of postpartum care. Who informed her that her baby did not survive?	
8.2 How was the news broken to her?	
8.3 Did she see the baby?	
8.4 Did she hold the baby?	
8.5 Were you involved in the burial of the baby?	
9.0 Mother's Desire for Child	
9.1 Was this birth planned?	
9.2 Did you use any Family Planning before pregnancy?	
9.3 If Yes State the method used injectable condom pill Others please state	.....
9.4 How long did you use it before the current pregnancy?	[ ]

10.0 Mother's Perception of Stillbirths	
10.1 What does she think caused the stillbirth?	
10.2 Could it have been prevented	
10.3 If yes, how? What should have been done By herself By the family By the health workers	

11.0 Mother's suggestions to reduce Stillbirths	
11.1 Kindly share any suggestions you have to help reduce stillbirths in Ghana	
11.2 Any other comments	

Thank you

Appendix 6: Qualitative study- Indepth Interview for participants (Health Providers)

Section A: Staff	
1.0 Demographic Details	
1.1 Sex	Male [ ] Female [ ]
1.2 Rank	
1.3 Number of years worked at this facility	[ ] years
1.4 Number of years worked in the Ghana Health Service	[ ] years
1.5 Are you skilled to conduct a caesarean section? only for Doctors	Yes [ ] No [ ]
2.0 Staff Capacity	
2.1 Has the facility conducted training in partograph use	Yes [ ] No [ ] Don't know [ ]
2.2 Have you been trained to administer partograph to women in labour?	Yes [ ] No [ ]
2.3 How will you assess your capacity to administer and interpret recordings during labour? Probe for an explanation of answer selected	Very good [ ] Average [ ] Poor [ ]
2.4 Are all women in labour monitored on partograph?: Probe to get more on the selected answer	Yes [ ] No [ ] Don't know [ ]
2.5 Has the facility conducted training on helping babies breath?	Yes [ ] No [ ] Don't know [ ]
2.6 Have you been trained in helping babies breath?	Yes [ ] No [ ]
2.7 If yes: have you performed one on a baby before?	Yes [ ] No [ ]
2.8 If no (though trained) probe to find out why	Haven't had the opportunity[ ] No resources available [ ] Not sure I can do it [ ]
2.9 How will you assess your skill/capacity?	Very good [ ] Average [ ] Poor (will need help) [ ]
2.10 If she has not been trained: a probe to find out why (irrespective of answer selected)	Not selected [ ] Don't know [ ] Bias in selection [ ] Other: specify [ ]
2.11 Have you been trained in stillbirth auditing?	Yes [ ] No [ ]
2.12 If yes. have you conducted a stillbirth audit before?	Yes [ ] No [ ]
2.13 If she has NOT conducted one before, ask why	Not trained [ ] Not required [ ]

	It is not part of my job [ ] Workload [ ] Not sure of benefit [ ] Other: specify
2.4 Have you been trained in neonatal resuscitation?]	Yes [ ] No [ ]
2.5 If yes: when were you trained?	<1 year [ ] 1-5 years [ ] > 5 years [ ]
2.6 How will you assess your capacity to conduct neonatal resuscitation? - - - - - -	
3.0 Section B: The Facility and Access to Midwives	
3.1 How many midwives work in this facility?	[ ]
3.2 How many midwives conduct deliveries in this Facility?	[ ]
3.3 How many midwives are on duty during a shift:	Morning [ ] Afternoon [ ] Night [ ]
3.4 Apart from what the midwives, do other cadres of staff conduct delivery in this Facility? If yes please state the cadre of staff	Yes [ ] No [ ] .....
3.5 Any Comments on how pregnant women can get prompt Access to midwives?	....
4.0 Screening Of Pregnant Women	
4.1 What tests are conducted for pregnant women in this facility? Please list them	
4.2 Does this Facility Screen for and Treat syphilis in all pregnant women? What treatment is given for those who test positive?	Yes [ ] No [ ] Don't know [ ]
4.3 Does this Facility Screen for HIV in all pregnant women?	Yes [ ] No [ ] Don't know [ ]

4.4 What is done for pregnant women who test positive for HIV? Please list all that you know	Put on ART [ ] referred to another facility [ ] Don't know [ ] Other: Specify
4.5 What is done for the babies of HIV positive pregnant women after delivery? Please tick all you know	Referred to other facilities [ ] Put on treatment immediately after delivery [ ] Wait until 6 weeks and start treatment [ ] Don't know [ ]
5.0 Access to Caesarean Section	
5.1 How many doctors perform a caesarean section in the Facility?	[ ]
5.2 What is usually the time between decision to perform caesarean section and when caesarean section is performed	< 1 hour [ ] 1-3 hours [ ] 3- 5 hours [ ] > 5 hours [ ]
5.3 How many Anaesthetists are in this facility?	[ ]
5.4 How many anaesthetists are on duty per shift?	Morning [ ] Afternoon [ ] Night [ ]
5.5 Does the facility always have theatre sets ready for emergency C/S? If NO: probe for more details/reasons	Yes [ ] No [ ] Don't know [ ]
5.6 Any Comments on how pregnant women can get prompt Access to Caesarean Section.	
6.0 Availability And Access To Protocols and Guidelines	
6.1 Are there any guidelines on procedures for admitting women in labour?	Yes [ ] No [ ] Don't know [ ]
6.2 If yes: a probe for what is done and describe	
6.3 Are there guidelines on managing newborn babies?	Yes [ ] No [ ] Don't know [ ]
6.4 Are there protocols on - Helping Babies Breath (HBB)	Yes [ ] No [ ] Don't know [ ]

- Neonatal resuscitation	Yes [ ] No [ ] Don't know [ ]
6.5 Have all staff working in labour wards been trained in - HBB	Yes [ ] No [ ] Don't know [ ]
- Neonatal resuscitation	Yes [ ] No [ ] Don't know [ ]
6.6 Is there a Protocol for managing PIH in this facility?	Yes [ ] No [ ] Don't Know [ ]
6.7 If yes: have you been trained to use it?	Yes [ ] No [ ]
6.8 Has the protocol been pasted on the labour, delivery and postnatal wards?	Yes [ ] No [ ] Don't know [ ]
6.9 Is there a Protocol for managing Diabetes Mellitus in pregnant women in the facility?	Yes [ ] No [ ] Don't know [ ]
6.10 If yes: have you been trained to use it?	Yes [ ] No [ ]
6.11 Has the protocol been pasted on the labour, delivery and postnatal wards?	Yes [ ] No [ ] Don't know [ ]
6.12 Are there protocols for managing antepartum haemorrhage (APH)?	Yes [ ] No [ ] Don't know [ ]
6.13 Have you been trained in the management of APH?	Yes [ ] No [ ]
7.0 Blood and blood products transfusion services	
7.1 Are there Blood transfusion services in this Facility?	Yes [ ] No [ ] Don't know [ ]
7.2 Does the facility always have blood available?	Yes [ ] No [ ] Don't know [ ]
7.3 Does the facility have fresh frozen plasma (FFP)?	Yes [ ] No [ ] Don't know [ ]
7.4 Is the FFP always available?	Yes [ ] No [ ] Don't know
8.0 Medications	
8.1 Does the Pharmacy run a 24 Hr service? If No why?	Yes [ ] No [ ]

Probe for possible reasons	
8.2 Does the facility have medications when you need them? If NO: probe for possible reasons	Yes [ ] No [ ] Sometimes [ ]
9.0 Availability and Access to Logistics	
9.1 Does the facility have the following?	
Infusions	Yes [ ] No [ ] Sometimes [ ]
Syringes and needles	Yes [ ] No [ ] Sometimes [ ]
Gloves	Yes [ ] No [ ] Sometimes [ ]
Dressings	Yes [ ] No [ ] Sometimes [ ]
Bag and mask	Yes [ ] No [ ] Sometimes [ ]
Sphygmomanometers	Yes [ ] No [ ] Sometimes [ ]
List other things you need but are not available when needed?	
10.0 Visibility of Stillbirth	
10.1 Has the facility conducted training in auditing of stillbirths?	Yes [ ] No [ ] Don't know [ ]
10.2 If Yes: How long ago?	< 1year [ ] 1-3 years ago [ ]
10.3 Does the facility audit all stillbirths? If it does not audit all: a probe for the reasons why some are not audited	Yes [ ] No [ ] Don't know [ ]
10.4 Is there a standing team for auditing stillbirth?	Yes [ ] No [ ] Don't know [ ]
10.5 If yes: who are the members?	
10.6 How often is the auditing done?	
10.7 What does the facility do with the reports of the audit meetings?	
10.8 Is there a staff assigned to follow up on recommendations of the audit team?	Yes [ ] No [ ] Don't know [ ]
10.9 Was stillbirth prevention part of 2016 plans for the facility?	Yes [ ] No [ ] Don't know [ ]
10.10 Was there a budget for stillbirth prevention in 2016?	Yes [ ] No [ ] Don't know [ ]
10.11 Is stillbirth prevention part of 2017 plans	Yes [ ] No [ ] Don't know [ ]

10.12 Has it been budgeted for in 2017	Yes [ ] No [ ] Don't know [ ]
10.13 Is stillbirth discussed at facility meetings?	Yes [ ] No [ ] Don't know [ ]
10.14 What are your impressions about the facility's priority for stillbirth prevention?	
10.15 What are the Challenges faced in providing Obstetric and newborn care in this facility?	
10.16 What are your Perceptions of stillbirths?	
10.17 What in your opinion are the contributory factors to Stillbirths in general?	
10.18 What in your opinion are the contributory factors to Stillbirths in this facility	
10.19 Suggestions for prevention or reduction under the following	
Role of Management	
Role of Staff	
Logistics and Resources	
Clients and Family	
Motivation/Incentives	
10.20 What Recommendations will you give to help in the reduction of stillbirths?	

Appendix 7: Qualitative Study - Consent Form for telephone interview

Woman

I.....,

declare that the purpose, procedure including risks and benefits of this study have been thoroughly explained to me in English/Ga/Ewe/Twi language and I have understood.
I hereby agree to engage in the telephone interview.

Initial of woman:.....date...../.../...

Interviewer

I.....

read and translated the purpose, procedure including risks and benefits of this study from English and thoroughly explained in Ga/Ewe/Twi language to the above respondent. All questions were answered and the respondent voluntarily agreed to engage in the telephone interview.

Signature:..... date...../...../.....

Contact number:.....

Appendix 8: Content of Specific Models

Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Unique selection1	Unique selection 2	Fetal characteristics	Maternal factors	Service delivery factors	Fetal & maternal characteristics	Fetal & service characteristics	Maternal & service delivery factors	Fetal, maternal and service characteristics
Gestational age of child	Gestational age of child	Sex	Age of mother at the time of delivery	Delivery mode	Sex	Sex	Age of mother at the time of delivery	Sex
Antepartum haemorrhage	Antepartum haemorrhage	Gestational age of child	Marital status	Timeshift delivery	Gestational age of child	Gestational age of child	Marital status	Gestational age of child
Pre-rupture membrane	Pre-rupture membrane	Birthweight of child	Educational status of the mother	Personnel in charge at the time of delivery	Birthweight of child	Birthweight of child	Educational status of the mother	Birthweight of child
Pregnancy-induced hypertension	Pregnancy-induced hypertension	Intrauterine position	Parity of mother		Intra uterine position	Intra uterine position	Parity of mother	Intra uterine position
	Haemoglobin at first registration		ANC attendance		Age of mother at the time of delivery	Delivery mode	ANC attendance	Age of mother at the time of delivery
	Weight at first Registration		Antepartum haemorrhage		Marital status	Timeshift delivery	Antepartum haemorrhage	Marital status
	IPT doses		Pre-rupture membrane		Educational status of the mother	Personnel in charge at the time of delivery	Pre-rupture membrane	Educational status of the mother
			Pregnancy-induced hypertension		Pregnancy-induced hypertension		Pregnancy-induced hypertension	Pregnancy-induced hypertension
			Haemoglobin at first registration		Parity of mother		Haemoglobin at first registration	Parity of mother
			Weight at first Registration		ANC attendance		Weight at first Registration	ANC attendance
			IPT doses		Antepartum haemorrhage		IPT doses	Antepartum haemorrhage
					Pre-rupture membrane		Delivery mode	Pre-rupture membrane
					Haemoglobin at first registration		Timeshift delivery	Haemoglobin at first registration
					Weight at first Registration		Personnel in charge at the time of delivery	Weight at first Registration
					IPT doses			IPT doses
								Delivery mode
								Timeshift delivery
								Personnel in charge at the time of delivery

Appendix 9: Thematic framework for service delivery factors associated with intrapartum stillbirth

Global theme	Organizing theme	Basic theme	Definition	Frequency	Quotes
Service delivery factors associated with intrapartum stillbirth	Material and logistical challenges	Insufficient delivery beds	Respondents reported difficulty in being allocated beds due to insufficient beds at the hospital	3	*"...So I told them that I did not bring anything. So they ask me to go and lie down because they had to look for a bed for me so my husband got angry with them..."* R.1 *"...when I arrived they made me sit down and wait, the nurse was looking for a bed for me and the other nurse was went for my folder..."* R.6 *"...the first nurse asked my sister to get me provisions, but she made me wait for a bed, first I was laying on a mattress on the floor but later they got me a bed..."* R. 13
		Difficulty accessing needed technological devices and services	Respondents shared scenarios when devices for required examinations and qualified personnel were not available at health facilities	2	*"...she said (a reference to medical officer) the scan showed that there is something wrong with the baby but they don't have the machine to see the actual problem so I should go and it somewhere* *Interviewer: So did you go?* *Respondent: Yes I went but that place too they said their machine was spoilt so we had to go and come later before taking the scan..."*R. 3 *"...Respondent: If they have enough technological equipment they could have allowed me to do a scan when they did not feel the baby kicking or if the breath has ceased so that they will immediately perform surgery to save my baby. They told me*

Global theme	Organizing theme	Basic theme	Definition	Frequency	Quotes
					the officer who conducts the scan does not work in the evening so throughout the night they did not examine it properly (I: Oh okay). So by then, they would not have referred me. So all those while they transferred me and the delay could have been used to do another thing to help the baby survive" R. 5 *"...we got there around five and they said they can do the test but the person who does it has gone home he was not around...."* R.10

Appendix 10: Plan for implementation of recommendations

Area to address	Gaps	Recommendations	Target audience	Stakeholders	Suggested time frame
PRACTICE					
Antenatal education	Poor knowledge of complications in pregnancy Late reporting / response to complications	Review antenatal education provided to pregnant women to emphasis on identification and prompt response to complications in pregnancy	Pregnant women	Ghana Health Service	First half of year 2020
Care during labour	Poor management of labour	Build capacity in management of PIH, APH, PROM and	All doctors, midwives and nurses	MoH Ghana Health Service	First half of year 2020
Management of preterm labour	- Poor management of preterm labour - Poor capacity in neonatal resuscitation	Develop SOPs for management of preterm labour build capacity of staff in neonatal resuscitation	Drs and midwives who conduct deliveries	Ghana Health Service -Partners	3rd quarter of 2020
Monitoring of quality of intrapartum care	Lack of monitoring of quality of intrapartum care	-Develop SOPs for intrapartum care -Train labour ward managers to monitor care using SOPs	Ward managers	Ghana Health Service -Partners	3rd quarter of 2020
Death Auditing	Non auditing of perinatal deaths Lack of capacity to conduct auditing	Train midwives and doctors in perinatal death auditing	Midwives Doctors working in maternity department	Ghana Health Service - Partners	3rd quarter of 2020
Death auditing	Nonperformance of fetal autopsy	-Identify interested Doctors -sponsor training of Drs to conduct fetal autopsy	Doctors	-MoH -GHS -Partners	-3rd quarter 2020 - 2021 - 2015
POLICY					
Death auditing	Absence of fetal autopsy in perinatal death audit form	Include autopsy in perinatal death auditing	Doctors Midwives	MoH Agencies	2021

Curriculum review	Significance of PIH, APH, PROM in causes of stillbirths	Make PIH, APH, PROM, management of preterm labour priority subjects in Health Training Institutions	-Trainees in health training institutions	MoH -Nursing and -Midwifery-- Ghana Council Medical and Dental Council	1st quarter 2020 -
RESEARCH					
Research	Non availability of predictor model for intrapartum fetal deaths	Conduct research to validate model on intrapartum stillbirths	Researchers Doctors Midwives	-Ghana Health Service - Academicians -Partners	4th quarter 2020 - 2021

Appendix 11: Colour Coded Tool for Monitoring Pregnancy Induced Hypertension

Title: Pilot study on the Colour Coded Blood Pressure Chart as a Primary Care Antenatal Blood Pressure (BP) Monitoring tool in the Ga South Municipality, Greater Accra, Ghana

Dr Linda Amarkai Vanotoo[1], Dr Bernard Bright Davies Teye[2], Dr Akosua Sika Ayisi[2], Stella Tsar[2]

Greater Accra Regional Health Directorate[1], Ga South Municipality[2]

Introduction

Hypertensive disorders in pregnancy are a significant cause of morbidity and mortality for both mothers and neonates. The prevalence of Hypertensive disorders in Pregnancy ranges from 1.8- 16.7% across studies in developing countries (Kayode and Olusimbo,2011).

In the Greater Accra Region of Ghana, Hypertensive disorders in Pregnancy was the leading cause of maternal deaths in 2015 accounting for 33% of maternal deaths. A review of institutional audits of maternal mortality and near-miss data in the region also showed that there was late detection of rising blood pressure levels of pregnant women as well as delays in referring cases, especially in primary care facilities.

Currently, there is a paucity of work on simple monitoring tools that can be used at the primary care level to monitor blood pressures amongst antenatal clients and to inform decision making. There is, therefore, the need to develop simple, easy to use monitoring tools to help health providers at the primary level to effectively identify and refer appropriately to all clients with hypertension in pregnancy.

A colour-coded blood pressure monitoring chart was developed by the lead researcher (LAV) to be used as a monitoring tool for charting blood pressure measurements during the antenatal clinic and to inform prompt decision making based on the measured blood pressure. Blood pressure readings from 210+ to140 mmHg were coded as red; readings between 140 to 70mmmHg were coded as yellow and readings from 70 to less than 50 mmHg were coded as green. The chart had guidelines on what actions to take based on which colour zone the blood pressure was charted in.

This study was therefore aimed at piloting the use of this colour coded BP chart by midwives who conduct antenatal clinics in primary health care facilities.

Objectives

- To assess the use of the colour coded BP chart for early detection and prompt management and referral of hypertensive disorders by midwives in three primary care facilities in Ga South Municipality.
- To assess the acceptability of the colour coded BP chart to midwives in the primary care facilities in monitoring the blood pressure of antenatal clients.

Methods

Ethical clearance was obtained from the Greater Accra Regional Health Directorate and permission was also sought from the Ga South Municipal Health Directorate and the management of the participating facilities. Informed consent was obtained from all clients enrolled in the study. All new registrants attending antenatal clinics for the first time in three sub-districts in Ga South Municipality between 20th April and 12th May 2016 had the colour coded charts inserted in their maternal health records booklets.

A total of 189 registrants were enrolled during the period of the pilot study and followed up until delivery to determine the outcome of the pregnancy at the primary level.

The outcome of the pregnancy was classified:

- Prompt Referral to a higher level based on blood pressure readings in the red and yellow zones and as per chart protocol.
- Delivery at the facility under the supervision of a medical officer.
- Referral on account of other complications.

Booking Blood pressure was recorded on the colour coded chart and all blood pressure readings during subsequent antenatal clinic visits were recorded on the chart.

Clients with blood pressure in the Red and yellow zones were to be immediately referred to Medical Officers and Obstetrics and Gynecology specialists where available after initial treatment had been given.

A focused group discussion was also conducted with 24 midwives to assess their experiences on the use of the chart.

Quantitative data obtained were entered using Epi Info and Stata 12 was used for the statistical analysis. Qualitative data were coded and analyzed using NVivo 8.

Findings

Data on 165 out of the 189 (87.3%) were analyzed and 24 (12.7%) of the participants were lost to follow-up.

Mean age of participants at booking visit was 28years (Standard deviation 4.6)

Median Gestational age at booking was 18 weeks (Min 4 weeks, Max 38 weeks). The prevalence of Hypertension in Pregnancy at booking was 6%. The overall prevalence of Hypertension (patients in yellow and red zones) across all trimesters was 18%.

There was a significant relationship between the interpretation of blood pressure measurement as charted on the colour coded BP chart and referral patterns of the study participants at the primary level as shown in Table 1 (Pearson Chi-square- 45, P-value <0.001).

Referral patterns of study participants by midwives in Ga South municipality

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	12	4	16
[redacted]	17	108	122

Referred on account of other complications in pregnancy.	2	22	24
Total	31	134	165
Pearson Chi square 45 P value <0.001			

Analysis of the qualitative data revealed some key findings. The tool was said to be very helpful in identifying a hypertensive patient since their blood pressure when charted fell in the yellow or red zone. The accompanying guidelines also helped to prompt midwives on what management to give and on the need for urgent referral to see a physician.

One midwife said "*the colours prompt me to recognize a hypertensive client and intervene because sometimes under the pressure of work we fail to interpret the BP readings correctly when using the figures*"

The colour-coded BP chart was also said to be a useful tool for assessing control for patients on treatment. Some midwives also used it in client education on treatment compliance. During labour, it was found to provide a quick pictorial summary of the BP control over the antenatal period as summarized by a midwife in the words:

"It gives a clear picture at first glance of what the client's blood pressure control is".

It was also said to make risk categorization easier. The key fear of most of the participants was how to sustain such an initiative in the post-pilot era. The question, who was to bear the cost of the provision of the tool; the patient or the health care provider, generated a big debate.

Conclusion

The colour-coded BP chart is a useful chart in monitoring the blood pressure of antenatal clients and is significantly associated with a prompt referral by midwives to a higher level or to a medical officer within the same facility for further care.

It can serve as a tool to monitor compliance to treatment and it is also useful in adherence counselling to motivate clients on treatment. During labour, it provides a pictorial summary of the BP control.

Its implementation may, however, encounter some sustainability challenges since it is currently not part of the existing maternal health records book.

Recommendations

There is a need for a large-scale study across different regions to assess its use in multiple settings with varied socio-cultural dynamics.

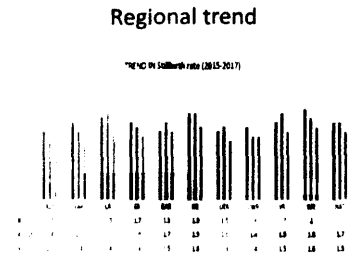
There is the need for greater sensitization and the developments of tools which will make the management of Hypertensive disease easier both for clinicians and clients especially at the primary levels of the health system.

Appendix 12: Policy brief Reducing Preventable Intrapartum Stillbirths in Greater Accra Region

From: Linda Amarkai Vanotoo (Dr.)
To: The Honourable Minister for Health
Thro: The Director-General, Ghana Health Service
Thro: The Regional Director of Health Service: Greater Accra Region

Introduction

Stillbirth is a devastating and unexpected pregnancy outcome that affects about 2.65 million births worldwide annually; 98% of stillbirths occur in developing countries and about 1.3 million occur during labour (intrapartum) however, most stillbirths are preventable. About 1.7% of total deliveries in Ghana end as stillbirths (figure 1) and this translates to almost 11 thousand stillbirths annually; 40% occur intrapartum and Greater Accra Region contributes almost 2 thousand stillbirths annually with 40% occurring intrapartum. In Ghana, the rate of reduction of stillbirths is slower than the rate of reduction of mortality in children less than 5 years old. Although neonatal deaths have been reducing in Ghana, the same cannot be said for stillbirth as shown in figure 2. The main strategy for reducing stillbirths in Ghana is perinatal death auditing for which guidelines were developed in 2015 followed by training of health staffs in 2016. All hospitals within Ghana Health Service were expected to start auditing all stillbirths by 2017: however, nationally only 30% of stillbirths are audited and there is poor evidence of the follow-up activities after the auditing. There is a paucity of evidence of studies on contributors to these huge numbers of stillbirths in Ghana and GAR and currently there is no documented strategic plan developed specifically for prevention and reduction of intrapartum stillbirths in Ghana. This study sought to identify and document contributors and predictors of intrapartum stillbirths with the goal of developing a model to predict intrapartum stillbirths to guide the development of contextual interventions for the reduction of preventable intrapartum stillbirths. The development and implementation of specific strategies will contribute to the attainment of SDG 3.2 target of reducing preventable newborn and under-five deaths.



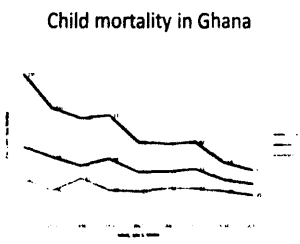


Fig 1: Trend of stillbirth in Ghana

Fig 2: Trend of child mortality in Ghana

Method

Study design

This was a descriptive quantitative and qualitative methods study conducted in six public hospitals purposively selected because they recorded the highest number of intrapartum stillbirths in Greater Accra Region between January 1st and December 31st 2016, figure 3.

Fig 3: Map of Greater Accra showing the study sites

Study population

The study population was records of all deliveries, at or after 28 weeks gestation, conducted in the six selected hospitals. 125 cases were selected by census from records of birth outcomes reported as fresh stillbirths and 250 controls were randomly selected from birth outcomes reported as live births. For the qualitative study, 13 women within the cases group and 14 health professionals who provide maternity care were purposively selected.

Data collection

A structured questionnaire was developed and used for the extraction of data on cases and controls from delivery records. A semi-structured interview guide was used to conduct in-depth interviews of the women with histories of intrapartum stillbirth and the health professionals who provide antenatal and delivery services to pregnant women.

Key study findings

Results

Among the total study population for the quantitative study, the mean age of the women was 28.8 years (range of 13 – 43 years) and mean gestational age was 28 weeks (range 28.0-45.4 weeks). 96.5% of the women attended antenatal clinic at least once. None of the women had gestational diabetes., 2.9% had fever, 0.3% had a previous history of diabetes; 1.9% had previous history of intrapartum stillbirth, 2.6% had previous history of neonatal death, malaria cases were found in 1.9%; pregnancy-induced hypertension was found in 13.5%, 1.4% had eclampsia; premature rupture of membranes was experienced by 6.0% and 10.7% had antepartum haemorrhage.

Among mothers who delivered intrapartum stillbirth (cases), 27.0% experienced pregnancy-induced hypertension compared to 8.1 % in the control group and those mothers who experienced pregnancy-induced hypertension had 85.0% increase risk of intrapartum stillbirth compared to those who did not experience pregnancy-induced hypertension. In 8.0% of the cases, the women experienced premature rupture of membranes compared to 4.0% in the controls and mothers who had premature rupture of membranes had 83.0% increase risk of intrapartum stillbirth compared to mothers who did not experience premature rupture of membranes. With regards to antepartum haemorrhage, 24.8% of the cases had previous history of intrapartum stillbirths compared to 2.5% of controls and mothers who experienced antepartum haemorrhage had 65.0% increase risk of intrapartum stillbirth compared to those who did not have antepartum haemorrhage. The study also found that significantly more stillbirths were delivered by Medical Officers and through Caesarean Section than live births.

The mean gestational age of the fetuses for mothers who did not experience stillbirth was approximately 38.8 weeks compared to 35.6 weeks for those who experienced stillbirth. The median birth weight of all the babies was 3.1 kg, however, the mean birth weight of stillborn babies was lower (2.7kg) compared to the birth weight of live births (3.1kg). Evidence of physical congenital abnormalities was seen in only 4.7% of the babies but this was not statistically significant.

Within the qualitative study, it was found that all the women lived in urban communities and most of them were Christians; the majority had none or primary education; majority used charcoal as cooking fuel and the majority were either married or co-habiting. With reference to complications in pregnancy, the majority gained excessive weight; experienced headache and had high blood pressure. Some of the women had blurred vision; swollen feet and reduced fetal movement during the antenatal period as stated in the quotes below:

"*...yes during my pregnancy, I gained a lot of weight...*" R.1

"*...I was experiencing a lot of headaches...*" R.7

"*...I remember that around the same time I was having the headache my feet started to swell, the headache will go and come back, severely...*" R. 8

Majority of the health workers believed that building staff capacity through training is one of the important factors that would lead to a reduction of intrapartum stillbirths. Most of the staff talked about the poor infrastructure and lack of space as some of the contributory factors while others suggested that education of pregnant women about pregnancy would lead to a reduction of intrapartum stillbirth. The study revealed that perinatal death auditing was hardly done in the health facilities; in some instances, the staff did not have the requisite

capacity to conduct the auditing. The study also found that some of the staff lacked the capacity to conduct neonatal resuscitation thus denying newborn babies who were asphyxiated at birth the needed care at birth. Another key finding was that referrals from peripheral hospitals were poorly done; the receiving hospitals delayed in providing care due to high workload and intrapartum monitoring was poor.

Interviewer: "What do you think contributes to stillbirth in this hospital?
Respondent: "The cases are not monitored here well because we don't have the staff numbers" [IDI- PNO]

Conclusion

Intrapartum stillbirth contributes significantly towards neonatal deaths in GAR. Maternal, fetal and health system factors combine to cause the huge number of intrapartum stillbirths recorded annually. Maternal predictors of intrapartum stillbirth are pregnancy-induced hypertension (PIH), antepartum haemorrhage (APH); premature rupture of membranes (PROM) and anaemia in pregnancy. The main fetal predictor is gestational age and service delivery predictors include mode of delivery and skilled attendant at delivery. Based on the model, interventions to reduce preventable intrapartum stillbirths should combine maternal, fetal and health system factors to achieve the greatest impact. Ghana should not depend on perinatal death auditing as the main strategy for reducing stillbirths since that would not yield the desired results.

Next steps and Policy implications of findings

1. A National Stakeholder Consultative meeting held after the dissemination of the findings of this study will place stillbirth on the national platform and help to identify policy actions and priority interventions to reduce avoidable fetal deaths.
2. Stillbirth is a national issue and the outcome of the consultative meeting will lead to the development of a strategic plan for policy direction; implementation of priority actions; monitoring and evaluation to reduce preventable intrapartum stillbirths
3. Placing stillbirth on the national agenda will contribute to the attainment of SDG 3.2 which states that *"by 2030 end preventable deaths of newborns and under-five children"*

Potential interventions to reduce preventable intrapartum stillbirths

Preventable intrapartum stillbirths can be reduced through the quality improvement of the systems for providing antenatal and labour services and by implementing contextual interventions for maternal, fetal and health system predictors of intrapartum stillbirths. Based on the study, the following recommendations are made for consideration by the Ministry of Health (MoH) to be implemented by the Ghana Health Service and other MoH Agencies.

A. Improving maternal care

1. The current antenatal clinic (ANC) does not provide the right environment for midwives to communicate effectively with pregnant women and their spouses. Antenatal clinics are congested and clients do not have the opportunity to ask questions or seek clarifications after a health talk has been given by the midwives. The ANC should be restructured to make it more interactive and educative and all pregnant women should be educated on predictors of intrapartum stillbirth such as PIH: this could be modelled after the pregnancy school concept which is already being implemented in hospitals in GAR.

2. As a matter of urgency, Midwives and Medical Officers involved in the care of pregnant women should be trained and coached by specialists to develop the capacity in the management of PIH; APH; PROM and anaemia in pregnancy at all levels of care. Protocols and standard operating procedures (SOPs) should be easily available at all centres where ANC and delivery services are conducted.

B. Improving newborn care

3. There is very little mention of stillbirth in national programmes. To facilitate the reduction of stillbirths, macerated and intrapartum stillbirth should be given National prominence. The Honourable Minister for Health should declare stillbirth a national priority and Ghana should celebrate stillbirth awareness and prevention day: this should be part of the days on the calendar of the MoH.
4. All Doctors and midwives who work in the labour wards and neonatal units should be trained in neonatal resuscitation and supervised to build their capacity and skills. They should be provided with SOPs to facilitate their work at all times.
5. The current perinatal death audit tool is too bulky and should be reviewed to make it user-friendly. Doctors and midwives should be trained in perinatal auditing and auditing should be mandatory in all facilities where deliveries take place, new staffs should be coached and supervised to develop the capacity to audit all stillbirths.
6. The Regional Director of Health Service should review and provide feedback on all reports on perinatal death audits to the submitting health facilities and also track the implementation of recommendations

C. Improving the Health System

7. Periphery hospitals should be improved and empowered with skills capacity, requisite human resource and logistics to manage uncomplicated labour cases. This would help to reduce referrals and subsequent congestion in the bigger hospitals which also leads delay in care provision and poor monitoring of women in labour and newborns in the immediate postnatal period
8. The Ministry of Health should review and upgrade theatres/increase the number of theatres within the country to reduce delays in providing/receiving care
9. The Ministry of Health should review existing health facilities within the newly created Regions in Ghana to address all levels of health provision and improve staff capacity to offer care, especially at the Regional Hospitals.
10. Guidelines on quality intrapartum care should be made available and staff trained to ensure adherence. Monitoring and evaluation of intrapartum care should be part of the documentation of labour.

Appendix 13: Policy brief - Reducing Preventable Intrapartum Stillbirths in Greater Accra Region

From: Linda Amarkai Vanotoo (Dr.)

To: The Country Representatives:

1. World Health Organization (WHO)
2. UNICEF, Ghana

Introduction

Stillbirth is a devastating and unexpected pregnancy outcome. It affects 2.65 million births worldwide annually: 1.3 million occur intrapartum.

Figure. 1

In Ghana, 1.7% of annual total deliveries (11 thousand) end as stillbirths; 40% occur intrapartum. Almost 2 thousand stillbirths are reported annually in Greater Accra Region (GAR), 40% occur intrapartum (fig. 1) Although one of the main strategies for reducing stillbirths in Ghana is perinatal death auditing, only 30% of perinatal deaths are audited and recommendations are hardly implemented or tracked. There is paucity of evidence on the contributory factors of stillbirths in GAR.

This study identified contributors of intrapartum stillbirths and developed a model to predict intrapartum stillbirths to guide development of contextual interventions for reduction of preventable intrapartum stillbirths and ultimately neonatal deaths.

Methodology

This was a descriptive quantitative and qualitative methods study conducted in six purposively selected public hospitals in GAR. The objectives were 1) to identify maternal, fetal and health service factors that contribute to intrapartum stillbirths in singleton pregnancies at/after 28 weeks gestation; 2) document perceptions of women with history of stillbirths and health professionals about causes and prevention of stillbirths and 3) develop a model to predict intrapartum stillbirths in singleton pregnancies. The study population was records of all deliveries, at or after 28 weeks gestation. 125 cases (fresh stillbirths) and 250 controls (live births) were selected from birth records. For the qualitative study, 13 women (from cases) and 14 health professionals were purposively selected. Data were extracted on cases and controls from delivery records. The women and health professionals were interviewed using indepth interview guide

Key findings

Mean age of the women was 28.8 years (range of 13 – 43 years); mean gestational age was 28 weeks (range 28.0-45.4 weeks). 96.5% of the women attended antenatal clinic at least once. Mothers who experienced pregnancy-induced hypertension had 85.0% increase risk and mothers who had premature rupture of membranes had 83.0% increase risk of intrapartum stillbirth.

Mean gestational age of live births was 38.8 weeks compared to 35.6 weeks for stillbirth. Mean birth weight was 2.7kg for stillborn babies compared to 3.1kg for livebirths. Majority of women interviewed gained excessive weight; experienced headache, had high blood pressure, blurred vision; swollen feet (all symptoms of PIH) and reduced fetal movement during the antenatal period as stated in the quote below:

"...I remember that around the same time I was having the headache my feet started to swell, the headache will go and come back, severely..." R. 8

The study also found that some of the staff lacked the capacity to conduct neonatal resuscitatio and perinatal death auditing.

The best model to predict intrapartum stillbirths was the model with combination of maternal, fetal and service delivery factors.

Conclusion

Maternal, fetal and health system factors combined to cause intrapartum stillbirths. Maternal predictors of intrapartum stillbirth were PIH, APH; PROM and anaemia in pregnancy. The main fetal predictor was gestational age and service delivery predictors were lack of skilled attendant at delivery and inadequate theatre space.

Recommended Call to action by WHO and UNICEF

Based on the study findings, I humbly call on WHO and UNICEF as a matter of urgency to consider the following action points for support to achieve SDG 3.2 which states that: *"by 2030 end preventable deaths of newborns and under-five children"*

Short term

1. A National Stakeholder Consultative meeting to discuss and place stillbirth on the national health agenda.
2. Build capacity of health professionals in care of the preterm baby, neonatal resuscitation and perinatal death auditing
3. Build capacity of health professionals in management of PIH; APH; PROM in pregnancy and provide them with relevant protocols and standard operating procedures
4. Facilitate the validation and use of the colour-coded tracking tool for early diagnosis and management of PIH during the antenatal period (developed by the author, Dr. Linda A. Vanotoo). This tool was tested in Weija/Ga South Municipalities with positive results.
5. Collaborate with other Development Partners to build capacity of midwives and Medical Officers in quality intrapartum care

Long term

6. Support MoH to develop a strategic plan for policy direction; implementation of priority actions; monitoring and evaluation of implementation to reduce preventable intrapartum stillbirths
7. Collaborate with other stakeholders to procure CTG for hospitals that conduct delivery to aid monitoring of the fetus during labour and delivery.

Appendix 14: Facility Based Perinatal Death Audit Guidelines

MINISTRY OF HEALTH – GHANA

PERINATAL DEATH AUDIT FORM

This audit form is strictly confidential and should be submitted to the Head of Facility and District Director of Health Services. Choose the type of death below:

☐ STILLBIRTH: A baby delivered without signs of life (not breathing, no heartbeats) after 28 completed weeks of pregnancy, or if gestation is unknown, with a birth weight ≥ 1000 grams.

☐ EARLY NEONATAL DEATH: Death of a live-born baby occurring within 7 days of birth.

Any correspondence regarding the content of this document should be addressed to:
The Director, Family Health Division, Ghana Health Service, PMB, Accra

Kindly 'circle' OR 'tick' the appropriate code where applicable **Date of Audit:**

Name of facility: District:

SECTION A: DATA RELEVANT TO PERINATAL DEATH

1	Folder number of baby (may be mother's ANC or folder number)	Mother's ANC No.: Folder No.:
2	Mother's age:	
3	Educational status	a. None b. Basic c. Secondary d. Tertiary or more
4	Date and time of delivery of this baby	Date: // // (DD/MM/YYYY) ☐ Unknown Time: // am/pm (circle as appropriate)
5	Gestational age of pregnancy at delivery (to the nearest estimate)	Wks ---------- Days ---------- **OR** Months ----------
6	Baby's birth weight	---------- Kg ☐ Unknown
7	Sex	a. Male b. Female c. Indeterminate d. Unknown
8	Type of pregnancy	a. Singleton b. Twin c. Other (specify):
9a	Was the patient referred to you from another facility? [ ] Mother [ ] Baby If 'Yes', name facility	a. Yes b. No c. Came from home d. Unknown f. Other (specify): Name of the facility:
9b	Time interval taken by the patient to reach your facility from referring facility/home (estimate)	Time: // (Hrs // Mins) Unknown ☐
9c	Mode of transport from the referring facility or home	a. Ambulance b. Commercial/Private vehicle c. Other (specify):

SECTION B: PAST OBSTETRIC HISTORY/ ANTENATAL INFORMATION OF MOTHER

10	Mother's Gravidity: Parity (include current delivery): **OR** Unknown ☐	
11	Was mother an ANC attendant?	a. Yes: **Indicate the number of attendance** – [ ] b. No c. Unknown

12	Indicate full name of facility of last ANC attendance			Name of the facility:		
13	Gestational age at booking			Wks **OR** ----------	Months **OR** ---------	Unknown ☐
14	**Were any risk factors identified in this pregnancy during ANC? (select all that apply)**	a b c d e f g h	Malaria Anaemia (Hb < 10.0g/dl after 28 weeks gestation) Hypertension / Pre-eclampsia Diabetes mellitus Urinary tract infection Sickle cell disease Syphilis (confirmed) Previous C/S	i j k l m n o p	PROM >18 hours G6PD deficiency Rhesus negative mother Last delivery < 2 years Last delivery > 10 years Cervical//uterine surgery None **Other (specify):**	
15	Mother's HIV status			a. Reactive	b. Non-reactive	c. Unknown
16	Mother on Antiretroviral?			a. Yes	b. No	c. Unknown d. Not Applicable
17 *	Use of alcohol			a. Yes	b. No	c. Unknown
18 *	Exposure to cigarette smoke			a. Yes	b. No	c. Unknown
19 *	Use of herbs/herbal tonics			a. Yes	b. No	c. Unknown
20 *	Intake of folic acid in the first 3 months of pregnancy			a. Yes	b. No	c. Unknown
21	Tetanus vaccine (TT/Td) received (including past doses)			a. TT1 b. TT2 c. TT3 d. None e. Unknown		
22	Malaria prophylaxis (SP) received in this pregnancy			a. IPT1 b. IPT2 c. IPT3 or more d. None e. Contraindicated (G6PD Def.) f. Unknown		
SECTION C1: LABOUR AND BIRTH (FILL IN INFORMATION, WHETHER DELIVERY OCCURRED IN YOUR FACILITY OR OUTSIDE YOUR FACILITY)						
23	Date and Time seen by staff on arrival in health facility			Date: // // (DD/MM/YYYY) Unknown ☐ Time: // am/pm (circle as appropriate)		
24	How did labour start?			a. No labour **(proceed to Q28)** b. Spontaneous c. Induced d. Unknown		
25	Did the mother take any herbal substance to induce or augment labour?			a. Yes	b. No	c. Unknown
26	Was a partograph used to monitor labour?			a. Yes	b. No c. Not applicable	d. Unknown
27	Length of labour			Active phase: _____ hrs _____ mins Unknown ☐ Second stage: _____ hrs _____ mins Unknown ☐ Not applicable ☐		
28	Select all complications that occurred before or during labour	a b c d e	None Meconium stained liquor Fetal distress Malpresentation (e.g. breech, face, transverse etc.) Cord prolapse	f g h i j	Shoulder dystocia Prolonged 1st stage Intrapartum haemorrhage Cephalopelvic disproportion (CPD) **Other (specify):**	

29	Mode of delivery of this baby	a. Spontaneous vaginal delivery b. Breech delivery (vaginal) c. Vacuum / forceps delivery e. Elective C/S f. Emergency C/S g. Unknown h. Other (specify):
30	Did vaginal delivery occur in spite of the decision to do the caesarean section?	a. Yes b. No c. Not Applicable
31	The time between decision for an emergency C/S // Instrumental delivery and the actual delivery of the baby	a. <1 hour b. 1 – 2 hours c. > 2 hours d. Not applicable
32	Delivered by?	a. Doctor b. Midwife c. Traditional Birth Attendant (TBA) d. Unknown e. Other (specify):
33	Delivered in?	a. Health facility (specify name): b. Home c. Unknown d. Other (specify):
34	Were any abnormalities noted on the baby at birth?	a. Yes (specify): b. No c. Unknown
35	Was there any problem with the cord? Circle all that apply	a. None b. Cord around neck c. Meconium stained d. True knots e. Spring-like cord f. Cord inserted at the edge of placenta g. Not examined h. Other (specify):
36	Placental examination	a. Not examined b. Normal c. Abnormalities (specify):
37	Maternal outcome	a. Alive b. Dead c. Unknown

SECTION C2. TO BE COMPLETED FOR STILLBIRTHS ONLY (BORN WITHOUT HEARTBEAT OR RESPIRATORY EFFORT)

38	Was Fetal Heart sound present from the referring facility?	a. Yes (specify rate): b. No c. Not indicated
39	Was Fetal Heart sound present on arrival?	a. Yes (specify rate): b. No c. Not indicated
40	Indicate period when fetal heart sound was last heard	a. Antepartum b. Intrapartum (first stage) c. Intrapartum (second stage) d. Unknown
41	State of the baby at delivery	a. Fresh stillbirth b. Macerated stillbirth c. Unknown

SECTION C3: TO BE COMPLETED FOR EARLY NEONATAL DEATHS ONLY (BORN WITH ANY SIGN OF LIFE E.G. HEARTBEAT AND/OR RESPIRATORY EFFORT)

42	Did the baby cry at birth?	a. Yes b. No c. Unknown
43	If baby was resuscitated at birth, which method was used (circle all that apply)?	a. Was not resuscitated b. Suction and stimulation c. IPPV – bag and mask d. Oxygen e. Chest compression f. Other (specify): g. Unknown
44	Apgar score of this baby	_____ (1 minute) _____ (5 minutes) Unknown ☐
45	Was the baby admitted to a hospital prior to death?	a. Yes b. Brought in dead (proceed to Q47)

46	If 'Yes', please indicate problems/diagnosis identified (circle all that apply)	a. Birth asphyxia b. Prematurity c. Neonatal Jaundice d. Difficulty breathing e. Neonatal sepsis/Infections f. BleedingConvulsions/seizures g. Hypothermia h. Bulging fontanelleAnaemia i. Poor feeding j. Hypoglycaemia k. Unknown l. Other (specify):
47	Date and time of neonatal death (please estimate if mother unable to provide exact time)	Date: // // (DD/MM/YYYY) Unknown ☐ Time: // ☐ am/pm (circle as appropriate) Unknown
48	Age at time of death (estimate)	_____ Days _____ Hrs _____ Mins Unknown ☐

SECTION D: MORTALITY DETAILS, PROBABLE CAUSE OF DEATH

49	Post mortem report, if done	a. Done (report): b. Not done c. Unknown
50	Primary/Underlying cause of death: (refer mortality classification in guidelines)	a. Category No.: b. Category description:
51	Immediate/ Final cause of death for **stillbirths**: (specify if known)	
52	Immediate/ Final cause of death for **neonatal deaths**: (refer mortality classification in guidelines)	a. Category No.: b. Category description:
53	List of Avoidable Factors /Missed Opportunities / Substandard Care (choose as many as apply). Refer to the list of contributory factors in guidelines and **indicate codes**	a. b. c. d. e. f. g. h. i. j. k. l.
54	Specify preventability of death. Refer to guidelines	a. Not preventable b. Possibly preventable c. Ideally preventable
55	Indicate actions taken from lessons learnt from this death	
56	Recommendations and further actions to be taken	

57	Case summary and other comments on the case	Please attach on a separate sheet, a case summary and any other general comments on the case. **This is mandatory for all deaths audited.**

SECTION F: DETAILS OF MANAGERS

Name and Designation of Audit Chairman:

.....

Signature: ..... Date: .....

Head of Facility (BMC): Signature: ..... Date: .....

Seen by DDHS: Signature: ..... Date: .....

This document has been developed in support of reducing maternal and neonatal mortality through strengthening perinatal death audits at all levels of health care delivery in Ghana

The audit of perinatal deaths is implemented by the Ministry of Health through its implementing agencies (Teaching Hospitals, Ghana Health Service and health facilities under the Christian Health Association of Ghana, as well as Private Health facilities across the country), in partnership with UNICEF Ghana and other Development Partners

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