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SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

FACTORS ASSOCIATED WITH STILLBIRTHS IN ACHIMOTA HOSPITAL- A CASE-CONTROL STUDY

BY

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THIS DISSERTATION IS SUBMITTED TO THE SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF GHANA IN PARTIAL FUFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTERS DEGREE IN PUBLIC HEALTH (MPH) DEGREE

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DECLARATION

I, Adzi Kofi Gudugbe, declare that except for other people's investigations which have been duly acknowledged, this research proposal is the result of my own original research undertaken under supervision and that it has neither in whole nor in part been presented for another degree in this university or elsewhere.

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DEDICATION

This dissertation is dedicated to my friends and family

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LIST OF ABBREVIATIONS

ANC	-	Antenatal Care
AOR	-	Adjusted Odds Ratio
C/S	-	Caesarean Section
DHIM	-	District Health Information Management System
ENAP	-	Every Newborn Action Plan
G/DL	-	Grams/Decilitres
Hb	-	Haemoglobon
HICs	-	High Income countries
HIV	-	Human Immunodeficiency Virus
LMICs	-	Low and Middle income countries
OR	-	Odds Ratio
PMTCT	-	Prevention of Mother to Child Transmission
SB	-	Stillbirth
SD	-	Standard Deviation
SP	-	Sulfadiazine Pyrimethamine
SBR	-	Still Birth Rate
UNICEF	-	United Nations Children's Fund
WHO	-	World Health Organization

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ABSTRACT

Background: it is estimated that 2.6 million stillbirths occur worldwide and about 98% of these occur in low and middle income countries mainly sub-Saharan Africa and parts of Asia. Most of the stillbirths occurring in these low resource settings are intrapartum stillbirths occurring at post viable gestations. These are largely preventable through improved intrapartum surveillance and access to caesarean sections. Data on stillbirths in less developed countries is scanty and it is only when risk factors are identified that tailored interventions can be developed to ameliorate them.

Objective: The objective of this study was to determine the factors associated with stillbirths in the Achimota hospital.

Methodology: An unmatched 1:4 hospital based case-control study was carried out among women who delivered at the Achimota hospital between 1st January 2018 and 31st December 2019. Cases were selected using consecutive sampling and appropriate controls selected by simple random sampling and data extracted from the maternal records to determine the exposures; socio-demographic, fetal, obstetric, maternal and health facility factors that are associated with stillbirths. Trained field assistants assisted with the data collection. Data was entered into Microsoft Excel 2016 and univariate and multivariate logistic regression was done using STATA 16 to determine the exposures that were significantly associated with stillbirths. Level of significance was set at $p < 0.05$.

Results: Three hundred and ten (310) participants (62 cases and 248 controls) were recruited for this study. The multivariate logistic model showed that still births were more likely among women who resided in rural area (aOR=4.46, 95% CI 2.05-9.68), those with obstetric complications (aOR=15.88, 95% CI 5.72-44.07), low birth weight (aOR=3.83, 95% CI 1.43-

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10.26), congenital anomalies (aOR=7.60, 95% CI 1.69-34.32), medical illness and those delivered by caesarean section (aOR=2.38, 95% CI 1.11-5.12). Maternal education (aOR=0.13, 95% CI 0.03-0.54) and term delivery (aOR=0.13, 95% CI 0.05-0.35) were found to be associated with reduced odds for stillbirths.

Conclusion: No maternal education, rural residence, preterm delivery, low birth weight, obstetric complications, congenital anomalies, maternal medical illness and delivery by caesarean section were significantly associated with still births among women delivering at the Achimota hospital. Improving fetal surveillance for women with high risk pregnancies as well as screening and optimal management of medical illnesses are essential for reducing the incidence of stillbirths in the hospital.

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CHAPTER ONE

INTRODUCTION

1.1 Background

The international Classification of Disease (ICD (10th edition) defines stillbirths as death prior to the expulsion or extraction from its mother of a fetus that has reached a birth weight of 500g or a gestational age of 22 weeks. Death in this context is defined by the absence of life at birth including no heart rate or pulsation of the cord; no respirations or definitive voluntary muscle movements(Favarato et al., 2019). Stillbirths are further classified as early or late deaths. Early deaths are stillbirths occurring between 22 to 27 week or 500 to 999g and late deaths from 28 weeks till term or birth weight more than 999g(Yakoob, Lawn, Darmstadt, & Bhutta, 2010). In low and middle income countries, neonatal intensive care facilities are scarce and therefore neonates below 1000g have very little chances of survival. For this reason birth weights less than 1000g (less than 28 weeks gestation) are regarded as miscarriages in LMICs. The WHO recommends that only third trimester stillbirths (late deaths) should be used as units of comparison because of regional differences in gestational ages of viability.

Another useful classification is based on the occurrence of the stillbirth relative to the timing of labour i.e. antepartum and intrapartum referring to whether the event occurred before or during labour respectively. Intrapartum stillbirths are particularly important because it's a reflection of the quality of obstetric care during labour.

Globally, an estimated 3.2 million stillbirths occur annually and nearly 98% of these occur in low and middle income countries. Nearly half of these deaths in the LMICs occur intrapartum(Yakoob et al., 2010). The diagnosis of stillbirths in low resource settings is fraught

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with several challenges including poor availability of electronic fetal heart beat monitoring, unreliable methods of pregnancy dating and unreliable methods of diagnosing stillbirths. According to UNICEF(2015), Ghanas stillbirth rate is 22.7 per 1000 live births.

Risk factors for stillbirths include genetic abnormalities of the fetus, maternal infections and infestations, maternal medical conditions especially hypertensive disorders and diabetes mellitus as well as low socioeconomic status and other sociodemographic parameters.

1.2 Problem Statement

Globally, stillbirths account for about 3.2 million deaths annually with ninety-eight percent of these occuring in Low and medium income countries(Yakoob et al., 2010). In southern Asia and sub-Saharan Africa, estimated stillbirth rates range from 21.3 to as high as 56.9 per 1000 births compared to 3.4 per 1000 births in high-income countries (HICs)(Yakoob et al., 2010). According to UNICEF (2015) Ghana's stillbirth rate was 22.7 per 1000 live births.

These rates are gross underestimations since the WHO recommends that only third trimester stillbirths should be used as units of comparison because of regional differences in gestational ages of viability. Even though low income countries account for a large fraction of stillbirths globally, their rate of decline in stillbirth rates has been the slowest over the past 15 years (Patterson et al., 2019).

Estimates from 2015 showed that even though about two thirds of deliveries were conducted in health care facilities, nearly 1.3 million still births occurred(Lawn et al., 2016).

Data on still births especially in developing countries is scanty. There has not been enough investment to improve stillbirths data for most high burden countries. For instance most developing countries have strengthened reporting of child deaths in routine reporting systems

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without including data on stillbirths even though stillbirth data was captured in registry data in over 100 countries(Lawn et al., 2016). As of 2015, only one set of national still birth estimates for all countries globally was undertaken by the WHO, underscoring the need for further need for research(Lawn et al., 2016).

Even though stillbirths constitute a huge public health burden, it has largely been ignored in major health policies. For instance stillbirths were not included in the millennium development goals tracking and most countries do not include it in their vital statistics records

Stillbirths pose a particularly difficult social, psychological and economic challenge to families. In some African communities still births are not considered as human deaths and such deaths may not be registered or included in vital statistics(Christou et al., 2019). Mothers of stillborn babies may be considered “unclean” and may need to undergo some inhumane rites to purify them. The psychological stress on the parents is enormous and aggravated by the stigma the society associates with the event(Heazell et al., 2016). Mothers who have had previous stillbirths would need heightened fetal surveillance in subsequent pregnancies with its attendant cost implications on the family.

An estimated 7000 women suffer still births on a daily basis, majority occurring in developing countries(Lawn et al., 2016).

The Every Newborn Action Plan targets 12 or less stillbirths per 1000 births in every country by 2030. Many African countries would need to double their current progress to achieve these rates(Lawn et al., 2016).

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1.3 Conceptual Framework

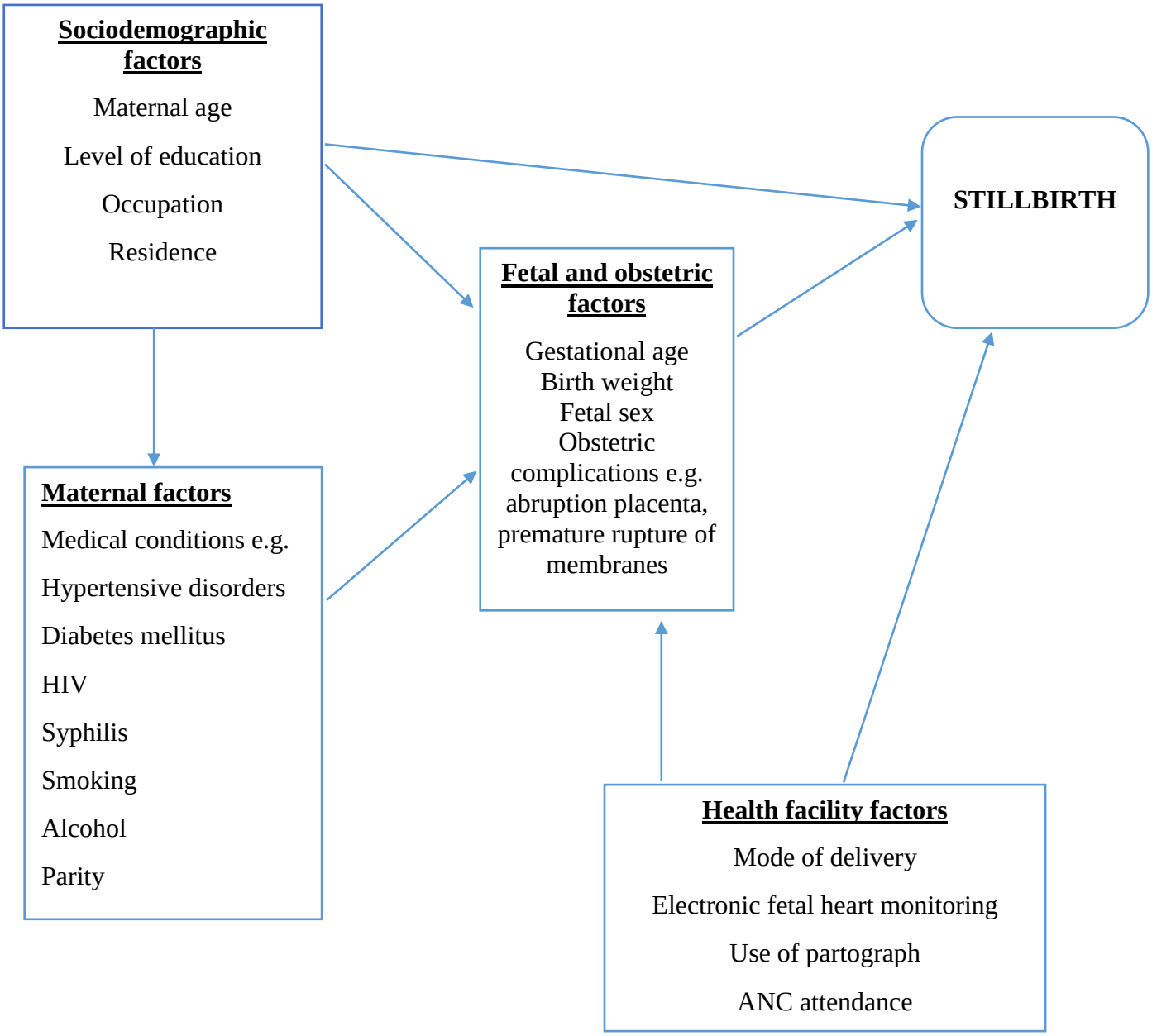

Figure 1: Conceptual Framework of Risk Factors Associated with Stillbirths

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1.4 Narrative Summary (Conceptual Framework)

The outcome variable of interest is stillbirths and the independent variables are grouped into sociodemographic, maternal, fetal and health facility factors. These sociodemographic, maternal, fetal and health facility factors influence the occurrence of stillbirths.

For instance advance maternal age >35 years increases a woman's chances of developing hypertension in pregnancy(maternal factors) and having a fetus with congenital anomalies and also independently the occurrence of stillbirth. Also adolescents have underdeveloped pelvises and are more likely to suffer obstructed labor and intrapartum stillbirths. Women with low educational levels have poor health seeking behavior and poor ANC attendance which increases their risk of having stillbirths.

Fetal and obstetric factors such as gestational age, fetal sex and complications such as placental abruption influence stillbirths. Male fetus have been shown to have higher odds of being stillborn compared to females. Also placental abruption which is premature separation of a normally situated placenta has a high risk of resulting in stillbirth.

Health facility factors such as lack of continuous electronic fetal monitoring leads to delays in picking up fetal heart rate abnormalities which usually precedes the occurrence of stillbirths intrapartum and therefore increases the likelihood of stillbirths. If labor is not monitored on the partograph this can lead delays in instituting interventions and result in stillbirths.

Maternal factors directly influence fetal outcomes which then directly influence stillbirths. Medical complications such as gestational diabetes and hypertension are associated with multiple obstetric complications which in turn increases the risk of stillbirths.

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1.5 Justification

In 2015, an estimated 2.6 million stillbirths occurred. The rate of decline in stillbirth rates has been much slower compared to maternal mortality rates which is exclusively targeted in the MDGs. Improved obstetrics and intrapartum care together with comprehensive fetal monitoring is essential to prevent the about 1.3 million intrapartum stillbirths(Lawn et al., 2016). The view that still births are inevitable is at best a myth.

Most causal factors implicated in still births are totally modifiable. The need to perform more extensive research into this area to establish locally relevant causal and associated factors cannot be overemphasized.

This study seeks to examine associations between maternal sociodemographic characteristics, economic, medical conditions, intrapartum practices and delivery methods as well as other relevant parameters with the occurrence of stillbirths in a typical district hospital in Ghana.

Knowledge of these linkages can inform prompt preemptive measures to forestall the occurrence of stillbirths.

1.6 Research Questions

1. What are the factors associated with stillbirths in Achimota hospital?

1.7 Study Objectives

1.7.1 General Objective:

To examine stillbirths and determine the factors associated with stillbirths in Achimota hospital

1.7.2 Specific objectives:

- To determine socio-demographic factors associated with stillbirths
- To evaluate fetal factors associated with stillbirths

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- To assess maternal factors associated with stillbirths
- To determine health facility factors that contribute to stillbirths

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CHAPTER TWO

LITERATURE REVIEW

2.1 Summary of Literature Review

The ICD 10 defines stillbirths as death or expulsion of a fetus from its mother after attaining a weight of 500g or 22 weeks gestation. Stillbirths account for 2.6million deaths annually and majority of these occur in LMICs. Several risk factors have been shown to be associated with stillbirths, these risk factors can be grouped into maternal, fetal and obstetric, sociodemographic and health facility related factors.

The sociodemographic factors that are associated with a high risk of stillbirths include maternal age more than 35 years, no formal education and rural residence. Most studies did not find any significant association between stillbirths and maternal occupation nor religion. The most consistent sociodemographic factor associated with stillbirths was maternal age greater than 35 years with relative risks ranging from 1.5 to 2.6

Preterm birth, low birth weight, previous stillbirth or bad perinatal outcome, prolonged labor as well as multiple gestation were the fetal and obstetric factors found to be associated with a high risk of still births. The risk appears to increase linearly with the extent of prematurity and low birth weight. Intrauterine growth restriction, small for gestation and oligohydramnios which are manifestations of uteroplacental dysfunction also carry a high risk of stillbirths and there is a need for heightened fetal surveillance in pregnancies with these complications to avert stillbirths. Interestingly male fetal risk appears to also confer a higher risk of stillbirths.

The maternal factors that are associated with stillbirths include smoking, illicit drug use, maternal medical conditions such as hypertension, diabetes mellitus and anti-phospholipid

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syndrome and obesity. For alcohol consumption and smoking the association appeared to a dose response relationship. These factors are of particular significance because they are largely modifiable risk factors to which public health interventions can be targeted to reduce the incidence of stillbirths.

Health facility related factors have also been shown by various studies to be associated with still births. Some of the factors associated with an increased risk of still births are non-antenatal attendance, late initiation of antenatal care and lack of electronic fetal heart rate monitoring. The factors that appeared to be protective include electronic fetal heart monitoring, use of the partograph and skilled attendant at delivery**.**

2.2 Introduction

The ICD 10 defines stillbirths as death or expulsion of a fetus from its mother after attaining a weight of 500g or 22 weeks gestation. Fetal death is defined as the absence of signs of life i.e. no heart rate or pulsation in the cord, no respiratory activity or no voluntary muscular activity(Lawn et al., 2016). The gestational age limit for stillbirths is controversial: whereas many LMICs use 28 weeks some HICs use 20 weeks. The differences in gestational age cut offs is due to differences in the accepted gestational ages of viability which in itself is dependent on availability of neonatal intensive care facilities. The WHO recommends the classification of stillbirths into early for fetal deaths occurring between 22 and 27 weeks or 500 to 999g and late for deaths occurring from 28 weeks or at least 1000g(Lawn et al., 2016). For purposes of comparison among countries the WHO recommends the use of late stillbirths.

According to a systematic review article(Patterson et al., 2019), accurate classification of stillbirths depends on accurate pregnancy dating, techniques for identifying signs of life and fetal heart rate. In LMICs, poor pregnancy dating coupled with lack of electronic fetal heart rate

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monitoring leads of misclassification of stillbirths. For instance in a severely asphyxiated newborn, umbilical cord palpation may be unreliable for identifying heart rate. In accurately declaring a flaccid newborn as a stillbirth may inadvertently lead to withholding resuscitation. Also low provider expectancy of survival for flaccid newborns may prevent them from resuscitating and falsely classifying them as stillbirths.

Stillbirths are also classified as antepartum and intrapartum depending on the timing of occurrence fetal demise relative the time of delivery. Intrapartum stillbirths are particularly potentially preventable through adequate intrapartum interventions. In low resource settings, the absence of fetal monitoring has led to over reliance on clinical signs of maceration to identify antepartum stillbirths. The signs of maceration include skin and soft tissue changes such as skin discoloration or darkening, redness, peeling and breakdown. In the absence of these changes the death is considered intrapartum. In the review article by Paterson et al (2019), up to 18% of antepartum stillbirths may be classified as fresh stillbirths and about 30% of intrapartum stillbirths may be wrongly classified as macerated. Clinical signs of maceration are therefore largely subjective.

Screening for still births is important in classifying pregnancy into low risk, medium risk and high risk so that the appropriate cost effective interventions can be put in place to avert them. According to Gordon et al (2017) in a systematic review article, the goals of screening is to categorize pregnancies into high and low risk. However, several challenges to screening were identified; still births results from multiple pathological causes hence no single test is conclusive. Again still births can occur across a wide range of gestational ages and are relatively uncommon. Modalities for screening include fetal screening, maternal screening, biochemical screening and ultrasonographic assessment (Patterson et al,2019).

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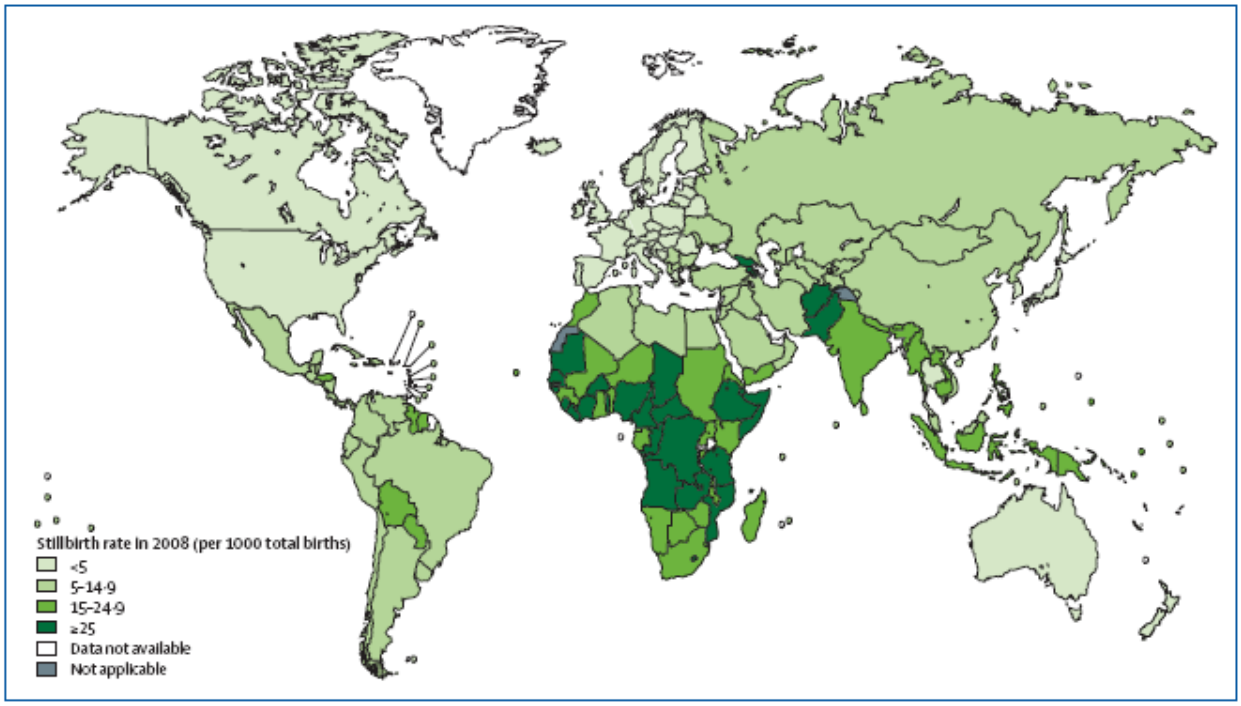
There is a wide disparity in stillbirth rates between the low and middle income countries and High Income countries. In LMICs, estimated SBR range from 21.3-56.9 per 1000 births compared to 3.4 per 1000 births in HICs(Patterson et al,2019). This difference in stillbirth rates is due to lack of electronic fetal heart monitoring and lack of access to basic and emergency obstetric care. Figure 2 below shows the distribution of stillbirths of stillbirths' worldwide.



Based on new estimates of 193 countries Cousens S, Stanton C, Blencowe H, et al. National, regional, and worldwide estimates of stillbirth rates in 2009 with trends since 1995: a systematic analysis. Lancet 2011; published online April 14. DOI:10.1016/S0140-6736(10)62310-0. Retrieved April 30, 2011

Figure 2: Worldwide Distribution of Stillbirths

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2.3 Sociodemographic factors associated with stillbirths

Several sociodemographic factors have been found to be associated with stillbirths. In a multisite population based study conducted in low resource settings(McClure et al., 2007), a higher relative risk for stillbirths was found for mothers aged more than 35 years (RR 1.5; 95% CI 1.2,1.8). Mothers with advanced maternal age are at a higher risk of having chromosomal abnormalities and developing medical illnesses such as hypertension and diabetes which are all independent risk factors for stillbirths. Similarly a case control study conducted in Bangladesh (Nahar et al, 2012), women aged older than 34 years have a higher risk of stillbirths compared to younger women(OR= 2.9; 95% CI 1.3,25.5). This claim is further affirmed by the findings of a systematic review article conducted in Taiwan by Liu et al (2014) that advanced maternal age is associated with a 1.6 to 2.6 fold increase risk of adverse outcomes. A case control study conducted in northern Ghana (Badimsuguru, Nyarko, Afari, Sackey, & Kubio, 2016), concluded that women at the extremes of reproductive ages were at a higher risk of stillbirths compared to women of other reproductive age groups. The proportion of stillbirths for maternal age less or equal to 24 years was 25% and 21.2% for those more than 34 years. The risk was highest for patients less or equal to 24 years with an odds ratio of 3.0 (95% CI 1.08, 8.39). in a 10 year analysis of stillbirths in a tertiary hospital in Cameroun (Tolefac, Tamambang, Yeika, Mbwagbaw, & Egbe, 2017) , maternal age ≥35 years (OR 1.79, 95% CI 1.26–2.54, p = 0.001), being married (OR 1.49, 95% CI 1.09–2.06, p = 0.016) and referral from another hospital (OR 14.16, 95% CI 7.08–28.3, p < 0.0001) were sociodemographic factors found to be associated with stillbirth. again in a multivariate logistic regression conducted in a study to assess the determinants of adverse perinatal outcomes in north Wollo, north east Ethiopia (Kassahun et al,2019), found that the likelihood of encountering adverse outcomes was 2.2 times higher for

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women more than 34 years compared to those aged 20 to 34 years(AOR=2.2; CI 95% 1.21,4.05). There was an 80% increased risk for rural dwellers compared to urban (AOR= 1.8 CI 95% 1.18,2.78) and a 3.1 fold increased odd for adverse perinatal outcomes for women with mid upper arm circumference of less than 23 compared to those with mid upper arm circumference greater than 23. The reason given for the increased risk for rural dwellers was the lack of health facilities in these areas as well as poor road networks that hinder access to health care. A case control study to evaluate the determinant of stillbirths in northern Ghana(Badimsuguru et al., 2016) found that traders and those who were employed had an increased risk of stillbirths compared to housewives with an adjusted odds ratios of 2.2 (95% CI 1.32,3.49) and 3.4 (95% CI 1.38,8.55). They however found no significant association between the level of education, maternal height, residence and stillbirths. In contrast to this study, another case control study conducted in Bangladesh to determine the factors influencing stillbirths (Nadar et al, 2012), illiterate women were found to be at an increased risk of stillbirths compared to educated women(OR=1.6; CI 1.1,2.2). Similarly a prospective study of stillbirths in developing countries (McClure & Goldenberg, 2019) showed that women with no formal education were at an increased risk of stillbirths compared to educated women (RR=1.6 95% CI 1.4,1.8). The researchers explained that women with formal education had better health seeking behaviors and were more likely than uneducated women to recognize danger sins early and report early to hospital when complications arose. A cross sectional study of birth outcomes among mothers delivering in selected health facilities in North Wollo, Northeast Ethiopia by Eshete et al (2013) observed that women who were illiterate (AOR = 4.0, 95% CI: 1.2-13.5) and those residing in rural settings (AOR = 2.6, 95% CI: 1.11-5.80) were at a higher risk of stillbirths.

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Apart from older maternal age which was significantly associated with stillbirths (aOR 1.1 95% CI 1.0,1.2) other socioeconomic factors such as place of residence, caste and religion were not significantly different between cases and controls. These findings were according to an Indian population based study to determine the level, causes and risk factors of stillbirths(Newtonraj, Kaur, Gupta, & Kumar, 2017).

2.4 Fetal and Obstetric Factors Associated with Stillbirths

According to a 10 year analysis of stillbirths in a tertiary hospital in Cameroun , birth weight less than 2500g (p<0.00001), gestational age <37 weeks (OR=19.9, 95% CI 12.3,32.2, p<0.000.1) and more than 42 weeks(OR=6.27, 95% CI 0.86,45.2, p=.096) were found to be significant risk factors for stillbirths(Tolefac et al., 2017). This finding was attributed to the fact that preterm babies have immature lungs due to inadequate surfactant production and are more likely to be stillborn. Also for pregnancies that continue beyond 42 weeks, there is a significant reduction on placental function which can eventually lead to stillbirths. In the multivariate analysis for birth weights less than 2500 g: birth weight 1500–2500 (OR 6.11, 95% CI 1.81–20.59, p = 0.004), birth weight 500–1500 (OR 627.79, 95% CI 72.47–5438). Similarly a multisite population based study conducted in low income countries by McClure et al(2007) found that male fetal sex, preterm and births weights less than 2500g had higher risks of stillbirths with odds ratios of 1.2(95% CI 1.0,1.3), 2.9(95% CI 2.5,3.4) and 4.6(95% CI 4.4,4.9) respectively.

A case control study conducted in Bangladesh by Nahar et al which sought to determine the factors that influence still births in 2012 found that, women who had preterm delivery were at a 5.2x higher odds than women who delivered at term. In a multivariate analysis in the same study, prolonged labour as well as failure to progress in labour were associated with a higher risk of stillbirths with corresponding odds ratio of 2.8(95% CI 1.6,4.6) and 2.8(95% CI 1.1, 1.5).

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Using a combined "catch and recatch" and case control method, newtonraj et al(2017) conducted a population based study in Chandigarh, a union territory in northern India and found that vaginal delivery ,induced labor, meconium stain liquor and preterm delivery in the logistical regression model had a higher risk of stillbirths with corresponding adjusted odds ratios of 8.1(95% CI 2.6,26), 2.6(95%CI 1.5,4.5), 2.0 (95%CI 1.1,3.8) and 6.4(95% CI 3.7,11) respectively.

In a systematic review article titled interventions to prevent stillbirths(Page & Silver, 2017) , one the factors that demonstrated a strong association with stillbirth was a previous history of stillbirths. Even though the occurrence of stillbirths in subsequent pregnancies is multifactorial, the overall risk increases by about 10 fold even after controlling for other factors. Twin gestation especially monoamniotic monochorionic placentation and other higher order pregnancies increases the risk of stillbirths. The researchers explained that for multiple gestations the risk of developing cord accidents, preeclampsia and other complications are considerably increased and thus increasing the risk of stillbirths.

Similarly in another systematic review article(Woods & Heazell, 2018) in the United Kingdom, previous bad obstetric outcome was identified as the strongest risk factor for stillbirths. They also found a tenfold increase risk for future stillbirth. Intrauterine growth restriction (IUGR) was found to be strongly associated with stillbirths. In this review, approximately 50% of stillborn babies had weights less than the 10^{th} centile than expected for their gestational ages (small for gestational age-SGA). In the absence of heightened fetal surveillance for small for gestational age fetuses, the risk of stillbirths is increased 5 fold. Antenatal detection of small for gestational age fetuses is thus considered an important pillar in reducing stillbirths

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2.5 Health Facility Factors Associated with Stillbirths

In a population based study the Global Networks population based birth registry' conducted between 2010 and 2016 in Zambia, Kenya, India, Pakistan and Guatemala (Saleem et al., 2018), women with no antenatal care attendance had a 1.5 to 4.5 fold increased risk of stillbirths in all 5 sites. Again patients who had a home delivery had a 3.3 increased risk of stillbirths compared to patients who delivered in a health facility.

Late initiation of antenatal care as well as non-antenatal ANC attendance was associated with an increased risk of stillbirths according to a population based study in Missouri State(Getahun, Ananth, & Kinzler, 2007).

In a 1:2 unmatched case control study conducted in a general hospital in Douala, Cameroun, they found that women who were referred from another hospital had a 14 fold higher risk of stillbirths compared to women who presented to the hospital from home. This risk was found to be very significant even after the multivariate logistic regression model with a p value of less than 0.0001 (OR=14.16 95% CI 7.08, 28.3)(Tolefac et al., 2017).

2.6 Maternal Factors Associated with Stillbirths

According to a systematic review article (Liu, Wang, Yu, & Su, 2014) aimed at identifying the major risk factors for stillbirths in the various trimesters, stillbirths rate s are generally 6-7 per 1000 live births when pregnancies are complicated by maternal medical illness and about 10% of all stillbirths can be attributed to maternal medical conditions. The study found that the commonest medical conditions associated with stillbirths are diabetes and hypertension. As high as 9.4% of pregnancies complicated by preeclampsia result in stillbirths with a stillbirth rate of 5 to 52 per 1000 live births. Preeclampsia is defined as high blood pressure occurring after 20 weeks gestation with significant proteinuria. The study therefore recommended that antenatal

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diagnosis of preeclampsia, education and prevention of progression should form the cornerstone of management. It also emerged that diabetes in pregnancy carries a 5 fold increased risk for stillbirths compared to non-diabetic pregnancies and gestational diabetes accounts for 3% of all stillbirths. However with optimal glycaemia control, gestational diabetes perinatal outcomes are similar to those in the general population. Other medical conditions found to be significantly associated with increased risk of stillbirths include hypothyroidism, systemic lupus erythematosus and antiphospholipid syndrome.

In a nationwide survey in Taiwan, a total of 8481 stillbirths and 932497 live births were recorded between January 2001 and December 2004, pregnant women with cervical incompetence(OR=17.1 95%CI 14.0,20.9), rhesus incompatibility(OR=6.96 95% CI 3.65,13.3) and hypertensive disorders(OR=4.67 95%CI 3.40,6.43) in pregnancy had adjusted odds ratios of stillbirths several times greater than for women without these conditions. These associations remained significant even after adjusting for maternal age, ethnicity, parity, fetal sex and gestational age(Hu et al., 2012).

A prospective observational study conducted in south Africa to determine the causes of stillbirths among 294 south African women found that the commonest medical conditions associated with stillbirths were hypertension and diabetes mellitus accounting for 19% and 2% of stillbirths respectively. Significantly 16% of the stillbirths were associated with maternal bacterial infection(Madhi et al., 2019).

A systematic review article in 2017(Page & Silver, 2017) found that chronic hypertension, gestational hypertension and preeclampsia cause about 10% of all antepartum stillbirths usually resulting from placental insufficiency, fetal growth restriction and placental abruption. Preexisting maternal hypertension was found to Increase the risk of stillbirths by about three

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fold, gestational hypertension by 30% and preeclampsia by 60%. The study also revealed that type 1 and type 2 pregestational diabetes mellitus which is found in about 3 to 5% of all pregnancies doubles the risk for stillbirths even after controlling for other confounders. Poor glycemic control, congenital malformation, fetal macrosomia and intrauterine growth restriction in the setting of diabetes increases the risk of stillbirths. Other maternal medical conditions identified to be associated with an increased risk of stillbirths are chronic kidney disease, systemic lupus erythematosus and antiphospholipid syndrome.

Also maternal obesity which is defined as a body mass index of greater than or equal to 30kg/m2(Vais & Kean, 2012) increases the risk for developing diabetes mellitus and hypertension. Obesity was still found to be associated with a high risk for stillbirths even after controlling for confounders (OR= 3.1).

Maternal smoking was found to increase the risk of stillbirths by 30 to 250% and this association demonstrates a dose response relationship. Smoking has been found to reduce fetal oxygenation since it increases the proportion of carboxyhemoglobin. The nicotine also causes vasoconstriction and therefore reducing blood flow to the fetus and resulting in fetal death. This study however did not find any significant association between illicit drugs, alcohol and the risk of stillbirths(Page & Silver, 2017).

In an article titled “Stillbirths; is it preventable” (Woods et al, 2018), Women whose body mass index was outside the normal (BMI 20-24.9kg/m2) had an increased risk of stillbirths. This risk was higher for women who were morbidly obese (BMI of greater or equal to 35kg/m2). For every 5 unit increase in BMI the risk of stillbirths increase by 21 %(RR=1.21 95% CI 1.09, 1.35). Interestingly maternal sleep position was found to have an association with stillbirths. Women who sleep supine were at a 2.3 times higher risk for stillbirths compared to women who

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adopt other sleep positions. The population attributable risk for sleeping positions from the study was about 3.7% and would require a large scale intervention to effect change.

Maternal cigarette smoking also had a strong link with stillbirths. The risk is dose dependent and greatest for women who smoke more than 10 sticks per day. This risk was about 47% higher compared to nonsmokers (OR=1.47 95%CI 1.37, 1.57) and still higher than for women who smoke less than 10 sticks per day (OR=1.09 95% CI 0.97, 1.24). However women who stop smoking in the first trimester had a return to base line stillbirth rates as for nonsmokers in the general population. Also there was an increased risk of stillbirths for women with a parity of greater or equal to 3(Woods & Heazell, 2018).

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CHAPTER THREE

METHODOLOGY

3.1 Study Design

The study was an unmatched 1:4 hospital-based case- control study conducted in the Achimota hospital in the Okaikoi north district of the greater Accra region. The cases and controls were selected from hospital maternal records.

3.2 Study Area

The study was conducted in the Achimota hospital located in the Okaikwei north constituency. The Okaikwei North Municipal Assembly (ONMA) is one of the thirty- eight newly created District/Municipal Assemblies in 2018. The capital of the Municipal Assembly is Abeka. It was carved from the Accra Metropolitan Assembly on 14th November, 2017 and inaugurated in March 2018. The ONMA was established under the Local Governance Act, 2016, (Act 936) with Legislative Instrument (L.I) 2307. It has eleven (11) electoral areas and includes Apenkwa, Wuoyeman, Blema Gor, Olengele Koona, Gbemomo, Anorhuma, Akweteman, Nii Boiman, Achimota, Abofu and Anumle. The Okaikwei north district has an urban population of 228,271 (Ghana Statistical Service, 2013) representing 5.7% of the total population of Accra

3.2.1 Health facility

The study was conducted in the Achimota hospital within the Okaikoi north district of the Accra metropolitan assembly. The hospital was established in 1927 as a community hospital primarily to serve surrounding school namely Achimota School, John Tei School and St John's School. In 1973, the hospital's management was taken over by the Ministry of health to provide primary healthcare services to people living in the surrounding communities. In 1985, the hospital was upgraded to a district hospital and has since provided secondary care. Currently, the hospital

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serves a population of 63174 in its catchment area. It serves as a referral facility for all the primary care facilities in the Okaikoi north as well as other facilities in surrounding districts. The hospital has a high patient turnover and high antenatal care attendance. It is an 88 bed facility which provides general outpatient services, antenatal care, basic and emergency obstetric care, in-patient and dental care services. The hospitals clientele has a good mix of the various social and economic classes. In 2019, the hospital's daily OPD attendance was 331. Annual antenatal care attendance in 2018 was 21246 and total deliveries was 3152. The maternity unit has a core medical strength of 46; made up of 1 specialist obstetrician gynecologist, 6 medical officers, 5 house officers and 44 midwifery staff.

3.3 Study Variables

Dependent variable: the outcome variable is stillbirth

Independent variables:

Socio-demographic factors: The factors examined included;

- Maternal age
- Residence(rural/urban)
- Educational level
- Occupation

Fetal and obstetric factors:

- Previous stillbirth
- Estimated gestation of index pregnancy in completed weeks
- Method of delivery
- Fetal presentation

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- Labour duration
- History of abortion
- Antenatal attendance (period of registration and number of antenatal care visits)
- Sex of baby
- Birth weight

Maternal factors:

- Medical illness
- Parity
- Previous stillbirth
- Hemoglobin level
- Malaria in pregnancy
- HIV in pregnancy

Health facility factors:

- Fetal heart monitoring
- Use of partograph
- Intermittent preventive therapy
- Mode of delivery
- Antenatal attendance

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Table 1: Study Variables

Variable	Operational definition	Scale of Measurement	Type
Independent variables			
Maternal age	Age at last birthday	Continuous	Ratio
Occupation	Occupation of the woman Civil servant/NGO Student Self-employed Unemployed	Categorical	Nominal
Level of education	Highest level of education attained by the woman No formal education Primary Junior high Senior high/vocational Tertiary education	Categorical	Ordinal
Place of residence	Where the woman resides Rural- those residing outside the Greater Accra region (such as Nsawam and Kasoa) Urban – those residing in the Greater Accra region	Categorical	Nominal
Parity	The number of times a woman had given birth to a fetus with a gestational age of 28 weeks or more.	Discrete	Interval
Gestational age	The gestational age of the pregnancy at the time of delivery	Continuous	Ratio
Previous stillbirth	History of fetal death after 28 weeks gestation	Categorical	Binary
Antenatal visits	Number of times a woman has attended antenatal care in index pregnancy	Discrete	Interval
Congenital anomaly	The presence of any congenital anomaly	categorical	Binary
Partograph use	The use of partograph for monitoring labour	Categorical	Binary
Mode of delivery	Route of delivery of baby	Categorical	Binary
Maternal hemoglobin	Woman's hemoglobin level at the time of delivery	Continuous	Ratio
Maternal medical illness	If the woman had been diagnosed of any medical illness in pregnancy	Categorical	Binary
Specific medical illness	Hypertension Diabetes mellitus Sickle cell disease	Categorical	Nominal

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	Renal disease Others		
Obstetric complication	if patient was diagnosed of an obstetric complication in pregnancy	Categorical	Binary
Specific obstetric complication	Cord prolapse Antepartum hemorrhage Fetal distress Malpresentation Failure to progress Big baby Preeclampsia Uterine rupture others	Categorical	Nominal
HIV in pregnancy	The mothers hiv status	Categorical	Binary
Syphilis	The mothers syphilis status	Categorical	Binary
Blood group	A B AB O	Categorical	Nominal
Intermittent preventive therapy	Number of times a woman received SP (sulphadoxine pyremethamine)	Discrete	Interval
Fetal heart monitoring	The use of electronic fetal heart monitoring in labour	Categorical	Binary
Fetal presentation	The presentation of the fetus	Categorical	Nominal
Fetal sex	The sex of the baby	Categorical	Binary
Birth weight	The weight of the baby at birth	Continuous	Ratio
Number of fetuses	Single multiple	Categorical	Binary

3.4 Sampling

3.4.1 Study Population

All women who delivered at the Achimota hospital between **1st January 2018 to 31st December 2019** who met the criteria for either cases or controls.

Case definition: a woman who delivered a dead baby in the Achimota hospital between January 2018 and December 2019.

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Controls: a woman who delivered a live baby in the Achimota hospital between January 2018 and December 2019.

Inclusion criteria: live and stillborn babies after 27 completed week or weighing at least 1000g between January 2018 and December 2019 were included as either controls or cases respectively.

Exclusion criteria: babies delivered before 28 weeks or weighing less than 1000g were excluded from the study.

3.4.2 Sample Size

The sample size for the study was calculated assuming a power of 80% to detect a hypothesized odds ratio of 2.0 with 42% exposure to prematurity among study population at an alpha level of 0.05 (Duut et al, 2018). Open Epi sample size calculator Version 3 was used in the sample size determination.

N1= (r + 1)/r * $\bar{p}$(1-$\bar{p}$)(Zβ-Zα/2)2 / (p1-p2)2 N2= rN1

Where N1= number of cases

N2= number of controls

Zβ = desired power, 0.84 for a power of 80% Zα/2= confidence level (95%)= 1.96

p1= proportion of cases with exposure

p2 = proportion of controls with exposure= 42%

r = ratio of controls to cases

and $\bar{p}$= (p1+rp2)/(r+1)

Minimum sample size calculated from the above N1 (cases) = 60 N2 (controls) = 240;

Total = 300

Minimum sample size = 300 (60 cases and 240 controls)

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The ratio of 1:4 was chosen based on the number of cases obtained (62 cases) and the minimum sample size of 300 required for the study.

3.4.3 Sampling Method/Technique

The study was conducted in the obstetrics and gynecology unit if the Achimota hospital using maternal health records between January 2018 and December 2019. Cases were sampled using a consecutive sampling approach from the first case to the last case.

A simple random technique using the random number table was used to select controls. All the controls in the delivery register were numbered and the random digit table was used to select the 248 Controls. A data extraction tool was used to extract the appropriate information from the cases and the controls**.**

3.5 Data Collection Technique and Tools

A quantitative data collection tool was used. Information for both cases and controls was obtained using a structured data collection tool. Trained research assistants extracted the information from the hospitals delivery records at the maternity unit. Cases or controls with incomplete information had their folders retrieved with assistance from the hospital's record staff. A case was defined as a woman who delivered a dead baby after at least 28 completed weeks gestation or birthweitght of at least 1000g in the Achimota hospital between January 2018 and December 2019. Cases were obtained using a consecutive sampling method from the first case to the last case.

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Controls were defined as a woman who delivers a live baby after at least 28 weeks gestation or birth weight of at least 1000g within the study period at the Achimota hospital. A simple random sampling method using the random digit table was used to get the controls

3.6 Data Processing and Analysis

All data captured were entered into Microsoft Excel 2016. The data was cleaned before the analysis with Stata 16.

Descriptive statistics was performed for all variables and expressed as means and standard deviation for continuous variables such as age. Categorical variables like educational status, occupation and marital status were expressed as proportions and presented as graphs or charts where appropriate.

The Chi-square test and Student t-test were used to test the association of categorical and continuous exposure variables and stillbirths respectively.

Univariate analysis (logistic regression) was done to test the association between socio-demographic factors, maternal and obstetric factors, health facility factors and stillbirths. This was presented as crude odds ratios on a 95% confidence interval. The final multivariate logistic regression model fitted to determine significant factors associated with stillbirths.

All statistical analysis was done at a 95% significance level with p values < 0.05 were considered statistically significant.

3.7 Quality Control

Experienced research assistants were engaged by the principal investigator for data collection. Data control measures were instituted to ensure the reliability and validity of the data. The research assistants were trained on the aims and objectives of the study, the data collection tools

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and techniques and ethical guidelines concerning data collection. In order to ensure that the aim s and objectives of the study were duly met the principal investigator participated in the data extraction. The data extraction tool was checked for errors and completeness and appropriate corrections made before entry into the statistical software for analysis. All data collected were verified by a statistician in the presence of the researcher to ensure reliability and validity of the results.

3.8 Ethical Clearance

Ethical approval was obtained from the Ghana Health Service Ethics Review Committee (GHS-ERC-056/02/20) and permission was sought from the management of the Achimota hospital.

The information obtained was treated with the highest level of confidentiality and used solely for purposes of this research. Data was collected and analyzed in its aggregated form to ensure anonymity. The participants' information captured on the data extraction tool was not included in the publication. No unauthorized person or group was allowed to review or have

Access to the information so extracted from the register apart from the principal investigator and the supervisor.

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CHAPTER FOUR

RESULTS

4.1 Sociodemographic Characteristics of Study Participants

The study was a hospital based unmatched 1:4 unmatched case control study conducted at the Achimota hospital using maternal delivery records from 1st January 2018 to 31st December 2019. A total of three hundred and ten participants were recruited involving sixty two (62) cases and two hundred and forty eight (248) controls.

Table 2 and 3 below shows the sociodemographic characteristics of the study participants.

Table 2: Socio-Demographic Characteristics of Study Participants at the Achimota Hospital

Demographic Characteristics	Frequency	Percent	Total
Mother's AGE			304*
Below 25	62	20.4	
25-30	133	43.8	
31-35	68	22.4	
36+	41	13.5	
Level of Education			271*
No Education	12	4.4	
Primary	44	16.2	
JHS	93	34.3	
SHS/TECH	65	24.0	
Tertiary	57	21.0	
Occupation			291*
Civil Servant/NGO	50	17.2	
Self-employed	203	69.8	
Student	11	3.8	
Unemployed	27	9.3	
Place of Residence			294*
Urban	251	85.4	
Rural	43	14.6	

**Missing data- data not entered in maternal delivery record books*

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Out of the 304 participants 133 representing 43.8% were in the 25 -30 age group whereas those below 25 and above 35 were 62(20.4%) and 41(13.5 %) respectively. The median age group was 25-30 for both the cases and controls and there was no statistically significant difference between the ages of the cases and controls ($p>0.05$).

Majority of the study participants 259(95.6%) had some formal education. Comparing the cases to the controls, there was statistically significant difference in the levels of education of the two groups with a p value of 0.001 as shown in table 3.

Majority of the study participants were self-employed 203(69.8%) and there was no difference in the type of employment between the cases and the controls.

Two hundred and fifty six 251(85.4%) of the study participants resided in the urban areas and there was statistically significant difference in the type of residence of the cases and the controls.

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4.2 Sociodemographic Factors Associated with Stillbirths

Table 3: Demographic Characteristics and still birth

Demographic Characteristics	controls n(%)	cases n(%)	Chi-square(p-value)
Mother's Age group			5.99(0.112)
Below 25	53(21.9)	9(14.5)	
25-30	110(45.5)	23(37.1)	
31-35	50(20.7)	18(29.0)	
36+	29(12.0)	12(19.4)	
Level of Education			17.86(0.001)
No Education	7(3.2)	5(9.8)	
Primary	28(12.7)	16(31.4)	
JHS	81(36.8)	12(23.5)	
SHS/TECH	58(26.4)	7(13.7)	
Tertiary	46(20.9)	11(21.6)	
Occupation			2.90(0.408)
Civil Servant/NGO	42(18.2)	8(13.3)	
Self-employed	156(67.5)	47(78.3)	
Student	10(4.3)	1(1.7)	
Unemployed	23(10.0)	4(6.7)	
Place of Residence			24.17(<0.001)
Urban	211(90.6)	40(65.6)	
Rural	22(9.4)	21(34.4)	

A chi square test of independence performed to determine the association between stillbirths and the sociodemographic factors is shown in table 3. The mothers level of education and their place of residence was associated with stillbirths with p values of 0.001 and <0.001 respectively. No association was found between maternal age and mother's occupation.

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Table 4: Univariate and Multivariate Analysis of Sociodemographic Factors Associated with Stillbirths

	STILL BIRTH	
SocioDemographic Characteristics	**cOR[95%CI]p-value**	**aOR[95%CI]p-value**
Mother's Age group		
Below 25	Ref	
25-30	1.23[0.53-2.84]0.626	
31-35	2.12[0.91-5.32]0.097	
36+	2.43[0.97-6.82]0.074	
Level of Education		
No Education	Ref	Ref
Primary	0.80[0.22-2.94]0.737	0.51[0.13-1.94]0.324
JHS	0.21[0.06-0.76]0.018	0.17[0.04-0.62]0.008
SHS/TECH	0.17[0.04-0.68]0.012	0.13[0.03-0.54]0.005
Tertiary	0.33[0.09-1.26]0.105	0.24[0.06-0.94]0.041
Occupation		
Civil Servant/NGO	Ref	
Self-employed	1.58[0.69-3.60]0.275	
Student	0.52[0.06-4.69]0.564	
Unemployed	0.91[0.25-3.36]0.891	
Place of Residence		
Urban	Ref	Ref
Rural	5.03[2.53-10.01]0.000	4.46[2.05-9.68]0.001

In the univariate regression (table 4), the odds of having a stillborn baby was 2.43 times higher for mothers aged more than 35 years compared to those below 25 years even though this did not reach statistical significance(cOR= 2.43, 95% CI 0.92-6.46)

With regards to the level of education, some education appears to be protective against stillbirths compared to no education even though this association was only statistically significant for junior high and senior high levels both in the univariate and multivariate regression. In the multivariate model, the odds of having stillbirths was 0.17 (aOR=0.17, 95% CI 0.04-0.62) and 0.13 (aOR=0.13, 95% CI 0.03-0.54) times for JHS and SHS levels compared to no education with p = 0.008 and p= 0.005 respectively.

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There was no association between mother's occupation and stillbirths

Place of residence was found to be associated with stillbirths both in the univariate and multivariate models. In the multivariate regression, the odds for having stillbirths was 5.03 times higher for mothers residing in the rural areas compared to those residing in the urban areas (p=0.001) as shown in table 4.

4.3 Fetal factors associated with stillbirths

Table 5: Fetal Factors Associated with Still Birth

FETAL FACTORS	**controls** n(%)	**cases** n(%)	**Chi-square(p-value)**
GESTATION AGE			32.09(<0.001)
Preterm	51(25.5)	35(67.3)	
Term	149(74.5)	17(32.7)	
FETAL SEX			0.29(0.587)
Male	130(53.5)	35(57.3)	
Female	113(46.5)	26(42.7)	
PRESENTATION			3.82(0.051)
Cephalic	204(100.0)	53(96.4)	
Breech	0(0.0)	2(3.6)	
NUMBER OF FETUSES			5.64(0.018)
Single	229(94.2)	52(85.2)	
Multiple	14(5.8)	9(14.8)	
FETAL ABNORMALITY PRESENT			11.68(0.001)
No	238(97.9)	53(88.3)	
Yes	5(2.1)	7(11.7)	
COMPLICATION			44.99(<0.001)
No	213(87.7)	30(49.2)	
Yes	30(12.3)	31(50.8)	
BIRTH WEIGHT			36.71(<0.001)
>2500g	215(89.2)	34(56.7)	
<2500g	26(10.8)	26(43.3)	

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Table 5 above shows the chi square analysis for the fetal factors associated with stillbirths. The gestational age, number of fetuses, the presence of fetal anomalies, obstetric complications and the birth weight were found to be associated with stillbirths with p values less than 0.05. A total of 12 babies were identified with congenital anomalies made up of 7 cases and 5 controls. Of the controls 4 had an extra digit whilst one had hydrocephalus. Of the 7 cases, 5 had syndromic features and the remaining 2 had hydrocephalus. The commonest complications encountered were fetal distress (33.3%), abruptio placentae (7.8%) and preeclampsia (4.6%). Other factors such as fetal sex and presentation were not associated with stillbirths.

Table 6: Univariate and Multivariate Regression Analysis of Fetal Factors Associated with Stillbirths

	STILL BIRTH	
FETAL FACTORS	**cOR[95%CI]p-value**	**aOR[95%CI]p-value**
GESTATION AGE		
< 37 weeks	Ref	Ref
> 37 weeks	0.17[0.08-0.31]0.000	0.13[0.05-0.35]0.000
FETAL SEX		
Male	Ref	
Female	0.85[0.48-1.51]0.587	
PRESENTATION		
Cephalic	Ref	
Breech	7.77[0.69-87.36]0.097	
NUMBER of FETUS		
Single	Ref	Ref
Multiple	2.83[1.16-6.89]0.022	0.52[0.15-1.83]0.314
FETAL ABNORMALITY PRESENT		
No	Ref	Ref
Yes	6.29[1.92-20.57]0.002	7.60[1.68-34.32]0.008
COMPLICATIONS		
No	Ref	Ref
Yes	7.34[3.90-13.79]0.000	15.88[5.72-44.07]0.000
BIRTH WEIGHT		
>2500g	Ref	Ref
<2500g	6.32[3.29-12.15]0.000	3.83[1.43-10.26]0.008

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In the univariate regression (table 6) the odds of having stillbirths was reduced by 83% if the fetus is delivered at term (>37 weeks) compared to those who were preterm. This reduction was further increased to 87% in the multivariate model and remained statistically significant with a p value <0.001 (aOR=0.13, 95% CI=0.05 – 0.35).

Multiple fetuses had a 2.83 fold higher odds of being stillborn compared to singleton fetuses in the univariate model (p= 0.022). However, the association between stillbirths and the number of fetuses did not reach statistical significance after controlling for other factors.

Babies born with congenital anomalies had a 6.29 higher odds of being stillborn compared to those without abnormalities n (cOR=6.29, 95% CI=1.92 – 20.57). In the multivariate analysis, this association was still statistically significant (p=0.008)

The odds of having a stillbirth was increased 15.88 fold for pregnancies that had an obstetric complication compared to those that did not even after controlling for other confounding factors (p< 0.001).

Stillbirths were more frequent among babies whose weight was less than 2500g compared to those with optimal weights (aOR=3.83, 95% CI=1.43 – 10.26) as shown in table 6.

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4.4 Maternal factors associated with stillbirths

Table 7: Chi-square Analysis of Maternal Factors Associated with Still Birth

MATERNAL FACTORS	controls n(%)	cases n(%)	Chi-square(p-value)
PARITY			0.16(0.922)
None	73(30.0)	18(29.1)	
One child	72(29.6)	20(32.2)	
2+ children	98(40.4)	24(38.7)	
PREVIOUS STILL BIRTH			0.60(0.440)
No	236(97.1)	59(95.2)	
Yes	7(2.9)	3(4.8)	
HAEMOGLOBIN			3.32(0.068)
Anaemic	117(56.7)	40(70.2)	
Normal	89(43.3)	17(29.8)	
BLOOD GROUP			2.59(0.459)
A	43(20.6)	8(18.2)	
B	52(24.9)	8(18.2)	
AB	12(5.7)	5(11.4)	
O	102(48.8)	23(52.3)	
RHESUS			1.62(0.203)
Negative	13(6.5)	5(12.2)	
Positive	188(93.5)	36(87.8)	
SYPHILLIS			0.27(0.603)
Negative	221(97.8)	57(96.6)	
Positive	5(2.2)	2(3.4)	
HEPATITIS B			0.32(0.571)
Negative	226(97.0)	59(98.3)	
Positive	7(3.0)	1(1.7)	
HIV			9.12(0.003)
Negative	238(99.2)	51(92.7)	
Positive	2(0.8)	4(7.3)	
HIGH BLOOD PRESSURE			0.54(0.461)
No	151(89.3)	48(85.7)	
Yes	18(10.7)	8(14.3)	
MEDICAL ILLNESS			63.66(<0.001)
No	242(100.0)	45(75.0)	
Yes	0(0.0)	15(25.0)	
CERVICAL DILATATION AT PRESENTATION			6.75(0.080)
No dilation	61(25.1)	17(27.4)	
1-4cm	48(19.8)	15(24.2)	
5-7cm	74(30.5)	9(14.5)	
8-10	60(24.5)	21(33.9)	

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A chi square test of independence performed to determine the association between stillbirths and maternal factors as shown in table 6 above. HIV and the presence of maternal medical illness were found to be significantly associated with stillbirths. Other factors such as parity, previous stillbirths, blood group, syphilis, hepatitis B, high blood pressure and cervical dilatation at presentation were not associated with stillbirths

Table 8: Univariate Analysis of the Maternal Factors Associated with Stillbirths

MATERNAL FACTORS	STILL BIRTH cOR[95%CI]p-value
PARITY	
None	Ref
One child	1.13[0.55-2.30]0.744
2+ children	0.99[0.15-1.96]0.984
PREVIOUS STILL BIRTH	
No	Ref
Yes	1.71[0.39-5.93]0.445
HAEMOGLOBIN	
Anaemia	Ref
Normal	0.56[0.29-1.05]0.071
BLOOD GROUP	
A	Ref
B	0.83[0.29-2.39]0.725
AB	2.24[0.62-8.12]0.220
O	1.21[0.50-2.92]0.668
RHESUS	
Negative	Ref
Positive	0.50[0.17-1.48]0.210
SYPHILLIS	
Negative	Ref
Positive	0.55[0.07-4.53]0.576
HEPATITIS B	
Negative	Ref
Positive	0.56[0.07-4.61]0.587
HIV	
Negative	Ref
Positive	9.18[1.64-51.46]0.012
HIGH BLOOD PRESSURE	
No	Ref
Yes	1.40[0.57-3.42]0.462
CERVICAL DILATION	

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No dilation	Ref
1-4cm	1.12[0.51-2.47]0.777
5-7cm	0.44[0.18-1.05]0.064
8-10	1.25[0.60-2.61]0.542

Even though the odds of stillbirths was 71% higher for mothers with previous stillbirths, this association did not reach statistical significance in the univariate analysis (cOR=1.71, 95% CI=0.43 – 6.82) as shown in table 8.

The odds of having a stillborn baby was 40% higher for mothers with a high blood pressure compared with normotensive women but this was not statistically significant n (cOR=1.40, 95% CI=0.57 – 3.42).

Mothers who were HIV positive had a 9.18 fold higher odd of having a stillbirth compared to HIV negative patients n (cOR=9.18, 95% CI=1.64 – 51.46) and this association was statistically significant in the univariate analysis (P= 0.012)

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4.5 Health facility factors associated with stillbirths

Table 9: Chi Square Analysis of Health Facility Factors Associated with Still Birth

FACILITY FACTORS	controls n(%)	cases n(%)	Chi-square(p-value)
PARTOGRAPH			15.68(<0.001)
No	58(29.9)	31(59.6)	
Yes	136(70.1)	21(40.4)	
METHOD OF DELIVERY			19.88(<0.001)
Spontaneous vaginal delivery	189(79.1)	31(50.8)	
Vacuum Assisted	2(0.8)	1(1.6)	
Caesarian section	48(20.1)	29(47.5)	
INTERMITTENT PREVENTIVE THERAPY			1.65(0.438)
None	121(49.8)	30(48.4)	
1-2	45(18.5)	8(12.9)	
≥3	77(31.7)	24(38.7)	
ANC VISIT			1.89(0.596)
None	51(21.0)	17(27.4)	
1-3	18(7.4)	3(4.8)	
4-8	124(51.0)	32(51.6)	
≥9	50(20.6)	10(16.1)	

The use of partograph and mode of delivery were strongly associated with stillbirths in the chi square analysis with p values less than 0.001 as shown in table 9. Other factors such as intermittent preventive therapy and antenatal visits were not associated with stillbirths

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Table 10: Univariate and Multivariate Analysis of the Health Facility Factors Associated with Stillbirths

	STILL BIRTH	
FACILITY FACTORS	**cOR[95%CI]p-value**	**aOR[95%CI]p-value**
PARTOGRAPH		
No	Ref	Ref
Yes	0.29[0.15-0.54]0.000	0.37[0.18-0.76]0.007
METHOD OF DELIVERY		
Spontaneous vaginal delivery	Ref	Ref
Vacuum Assisted	3.04[0.27-34.60]0.369	3.64[0.31-42.05]0.301
Caesarian section	3.68[2.03-6.69]0.000	2.38[1.11-5.12]0.026
INTERMITTENT PREVENTIVE THERAPY		
None	Ref	
1-2	0.72[0.30-1.68]0.444	
≥3	1.26[0.68-2.31]0.461	
ANC VISIT		
None	Ref	
1-3	0.50[0.13-1.91]0.311	
4-8	0.77[0.39-1.52]0.456	
≥9	0.60[0.25-1.44]0.251	

The use of partograph for monitoring labour appeared to be protective with a 72% reduction in the odds of having a stillbirth compared to labour that is not monitored. In the multiple logistic regression this association was statistically significant (aOR=0.37, 95% CI=0.18 – 0.76).

Spontaneous vaginal delivery has a reduced odds for stillbirths compared to vacuum delivery and caesarean section. The odds for stillbirths was increased 3.0 and 3.68 times for vacuum and caesarean section respectively even though this was only significant for caesarean delivery both in the univariate and multivariate logistic regression models as shown in table 10 above.

Some antenatal attendance was shown to be protective against stillbirths compared to non-attendance even though the odds did not appear to reduce linearly with increasing antennal attendance. The odds for stillbirths for those who attended antenatal care 1-3, 4-8 and >8 times

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were 0.50 (cOR=0.50, 95% CI 0.13-1.91), 0.77 (cOR=0.77, CI 95% 0.39-1.52) and 0.60 (cOR=0.60, 95% CI 0.25-1.44) respectively. This association was however not statistically significant as shown in table 10.

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CHAPTER FIVE

DISCUSSION

5.1 Introduction

The study was an unmatched case control study that examined the various factors associated with stillbirths in the Achimota hospital. Of the sociodemographic factors assessed, maternal residence and level of education were found to be significantly associated with still births. The gestational age, presence of congenital anomalies, obstetric complications as well as the birth weight were the fetal determinants of stillbirths identified from this study. Maternal medical illnesses were the chief maternal determinant of stillbirths whereas the significant health facility factors associated with stillbirths were the presence of fetal heart beat at presentation, the use of partograph and the mode of delivery.

5.2 Sociodemographic Factors Associated with Stillbirths

5.2.1 Maternal Age

Advanced maternal age is a well-known risk factor for stillbirths. Our study found a linear increase in the odds of stillbirths with increasing maternal age even though this association was not statistically significant. The odds of still births was 2.4 fold higher for women over the age of 35 years compared to those below 25 years of age. This finding is corroborated by a similar case control study conducted in Bangladesh(Nahar et al, 2012), which found that women aged older than 34 years have a higher risk of stillbirths compared to younger women(OR= 2.9; 95% CI 1.3,25.5). Similarly a multicenter population base study conducted in in low resource settings (McClure et al., 2007) , found a higher relative risk of stillbirths for women aged >35 years (RR 1.5; 95% CI 1.2,1.8). This finding is further affirmed by the findings of a systematic review

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article conducted in Taiwan by Liu et al (2014) that advanced maternal age is associated with a 1.6 to 2.6 fold increase risk of adverse outcomes.

A case control study conducted in northern Ghana (Badimsuguru et al., 2016) concluded that women at the extremes of reproductive ages were at a higher risk of stillbirths compared to women of other reproductive age groups. The proportion of stillbirths for maternal age less or equal to 24 years was 25% and 21.2% for those more than 34 years. Contrary to our findings, risk was highest for patients less or equal to 24 years with an odds ratio of 3. A 10 year analysis of stillbirths in a tertiary hospital in Cameroun (Tolefac et al., 2017) showed that maternal age ≥35 years was associated with a 1.8 fold increased odds of stillbirths . Again in a study to assess the determinants of adverse perinatal outcomes in north Wollo, North East Ethiopia (Kassahun et al,2019), found that the likelihood of encountering adverse outcomes was 2.2 times higher for women more than 34 years compared to those aged 20 to 34 years.

There is overwhelming evidence therefore that pregnant women with advanced maternal age would need intensive fetal surveillance activities to avert the occurrence of stillbirths

5.2.2 Level of Education

In this research, some maternal education conferred protective effects on mother's against stillbirths with a general reduction on odds of stillbirths with increasing level of education compared to no formal education. This association was very significant for the junior high and senior high level of education which incidentally appeared to be the modal levels of education for the study participants. . In line with our findings, another case control study conducted in Bangladesh to determine the factors influencing stillbirths (Nadar et al, 2012), found that illiterate women were at an 60% increased risk of stillbirths compared to educated women. Similarly a prospective study of stillbirths in developing countries (McClure & Goldenberg,

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2019) showed that women with no formal education were at a 1.6 fold increased risk of stillbirths compared to educated women. A cross sectional study of birth outcomes among mothers delivering in selected health facilities in North Wollo, Northeast Ethiopia (Esthete et al,2013) observed that women who were illiterate had a 4 fold increased risk of stillbirths compared to educated women. This protective effect seen with maternal education could be partly explained by the better health seeking behavior of these women and their abilities to recognize warning signs earlier and therefore report early when complications arise and their greater tendency to keep antenatal care appointments.

Contrary to our findings, a case control study to evaluate the determinants of stillbirths in Northern Ghana (Badimsuguru et al., 2016), found no significant association between stillbirths and level of education.

5.2.3 Occupation

Our study found no significant association between mothers occupation and stillbirths. This was not consistent with a similar study carried out in northern ghana (Badimsuguru et al., 2016) which found those who were employed had an increased risk of stillbirths.

5.2.4 Residence

In the multivariate regression model, the odds of stillbirths for rural dwellers was increased 5 fold compared to urban dwellers and this association was statistically significant (p=0.001). This could be partly explained that most of the participants from the rural areas resided in the newly developing areas of Accra which are characterized by lower standards of livings and poorer access routes which often compromise access to health care and adversely impact the health seeking behavior of the residents. These findings were consistent with a cross sectional study of

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birth outcomes among mothers delivering in selected health facilities in North Wollo, Northeast Ethiopia by Esthete et al (2013) which found that those residing in rural settings were at a higher risk of stillbirths compared to those in urban areas. Contrary to these findings, two other studies: one in northern Ghana(Badimsuguru et al., 2016) and the other in India(Newtonraj et al., 2017) found no association between stillbirths and place of residence.

5.3 Fetal and Obstetric Factors Associated with Stillbirths

5.3.1 Gestational Age

This research found that the odds of stillbirths were reduced by 83% if the babies are born beyond 37 weeks compared to preterm delivery. This is consistent with literature since preterm babies have low birth weight and have not attained fetal lung maturity and are therefore at an increased risk of perinatal morbidity and mortality. In a 10 year analysis of stillbirths in a tertiary hospital in Cameroun , Tolefac and colleagues found that the odds of stillbirths was increased almost 20 fold at a gestational age <37 weeks (Tolefac et al., 2017). Similarly a multisite population-based study conducted in low income countries (McClure et al, 2007) found that preterm deliveries (<37 weeks) had higher risks of stillbirths. Furthermore, a case control study conducted in Bangladesh which sought to determine the factors that influence still births in 2012 found that, women who had preterm delivery were at a 5 fold higher odds than women who delivered at term(Nahar, Rahman, & Nasreen, 2013). To further affirm this finding, Newtonraj and colleagues conducted a population based study in Chandigarh (India)using a combined "catch and recatch" and case control method, found that preterm delivery had a higher risk of stillbirths (Newtonraj et al., 2017)

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5.3.2 Fetal Sex

Our study found an 15% reduction in the odds of stillbirths of female neonates compared to males but this association did not reach statistical significance (cOR=0.85, 95% CI 0.48-1.51, p=0.587). This finding was consistent with a study done by McClure et al(2007), who found that male fetal sex had higher risks of stillbirths with odds ratios of 1.2(95% CI 1.0,1.3).

The high risk of stillbirths with male fetuses has been shown to be due to the faster rates of development and higher metabolic rates compared to females which makes them more susceptible to stressors such as endocrinological fluctuations, oxidative stress and nutritional deficiencies(Mondal, Galloway, Bailey, & Mathews, 2014)

5.3.3 Number of Fetuses

Multi fetal gestations had a 2.8 fold higher odds of stillbirths compared to singleton pregnancies in the univariate analysis. It is well known fact that multiple gestations are associated with increased perinatal morbidity and mortality. This can be attributed to the higher incidence of obstetric complications such as preeclampsia, preterm PROM, polyhydramnios, cord accidents, malpresentation and preterm delivery with the attendant risks to the fetus. According to a systematic review done by Page and colleagues (Page & Silver, 2017), twin gestation especially monoamniotic monochorionic placentation and other higher order pregnancies increases the risk of stillbirths.

5.3.4 Congenital Anomalies

In this study, newborns with congenital anomalies had an 6 fold increased odds of being stillborn compared to normal newborn. Even though the exact components of the syndromic babies were not documented, such babies usually have underlying chromosomal abnormalities such as trisomies some of which have associated cardiac malformations that are not compatible with life.

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Furthermore, fetuses that have congenital anomalies are at an increased risk of intrauterine growth restriction which is an independent risk factor for stillbirths(Frey et al., 2014).

5.3.5 Obstetric Complication

Pregnancies that had obstetric complication were at a 7 fold increased chances of resulting in a stillbirth. These complications(mainly fetal distress, abruption placentae and preeclampsia) are known to be associated with increased perinatal morbidity and mortality(Germain, 2017) and hence our findings.

5.3.6 Birth Weight

In the multivariate logistic regression model, the odds of having a stillbirth was increased 6.3 fold for babies with low birth weight (<2500g) compared to babies with optimal weight. Low birth weight may result from either prematurity or small for gestational weight babies. In latter group, only 10% of small for gestational age babies are normal i.e. constitutionally small) with the remaining 90% resulting from factors such as hypertensive disorders and TORHES (Toxoplasmosis, Other Agents, Rubella, Cytomegalovirus, and Herpes Simplex infections) which result in uteroplacental insufficiency with resulting intrauterine growth restriction(Schlaudecker et al., 2017). In a systematic review article(Woods & Heazell, 2018) in the United Kingdom, Intrauterine growth restriction (IUGR) was found to be strongly associated with stillbirths. In that review, approximately 50% of stillborn babies had weights less than the 10^{th} centile than expected for their gestational ages (small for gestational age-SGA). In the absence of heightened fetal surveillance for small for gestational age fetuses, the risk of stillbirths is increased 5 fold.

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Several studies have affirmed the association of low birth weight with still births.. In the multivariate analysis for birth weights less than 2500 g, Tolefac and colleagues(Tolefac et al., 2017) found that birth weight 1500–2500 had a 6 fold increased odds for stillbirths and birth weight 500–1500 had an over 600 fold odds of stillbirths. Similarly a multisite population based study conducted in low income countries by McClure et al(2007) found that births weights less than 2500g had higher risks of stillbirths with odds ratio of 4.6.

5.4 Maternal Factors Associated with Stillbirths

5.4.1 Maternal Medical Illness

Maternal medical illness was associated with an increased odds of stillbirths. Of the medical illnesses, 57% were hypertensive disorders and 21% had gestational diabetes mellitus. According to a systematic review article (Liu et al., 2014) aimed at identifying the major risk factors for stillbirths in the various trimesters, stillbirths rate s are generally 6-7 per 1000 live births when pregnancies are complicated by maternal medical illness and about 10% of all stillbirths can be attributed to maternal medical conditions. The study found that the commonest medical conditions associated with stillbirths are diabetes and hypertension. . It also emerged that diabetes in pregnancy carries a 5 fold increased risk for stillbirths compared to non-diabetic pregnancies and gestational diabetes accounts for 3% of all stillbirths. In gestational diabetes Mellitus, high circulating glucose stimulates the fetal pancreas to secrete more insulin leading to fetal hyperinsulinaemia(Kc, Shakya, & Zhang, 2015). Insulin is an anabolic hormone and stimulates excessive fetal growth with resultant increase in fetal metabolism. This increased metabolism creates a state of relative hypoxia in the fetal tissues leading to increased extramedullary erythropoiesis resulting in polycythemia which increases the incidence of

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intrauterine thromboembolic events and cardiac failure which may lead to antepartum stillbirths(Kc et al., 2015). Also the incidence of congenital anomalies which is an independent risk factor for stillbirths is increased in gestational diabetes. However with optimal glycaemia control, gestational diabetes perinatal outcomes are similar to those in the general population.

In a nationwide survey of risk factors for stillbirths in Taiwan between January 2001 and December 2004, pregnant women with hypertensive disorders in pregnancy had increased odds of stillbirths compared to normotensive women. This associations remained significant even after adjusting for maternal age, ethnicity, parity, fetal sex and gestational age(Hu et al., 2012). Also, prospective observational study conducted in south Africa to determine the causes of stillbirths among 294 south African women found that the commonest medical conditions associated with stillbirths were hypertension and diabetes mellitus accounting for 19% and 2% of stillbirths respectively (Madhi et al., 2019).

A study conducted by Page and colleagues (Page & Silver, 2017) found that chronic hypertension, gestational hypertension and preeclampsia cause about 10% of all antepartum stillbirths usually resulting from placental insufficiency, fetal growth restriction and placental abruption. Preexisting maternal hypertension was found to Increase the risk of stillbirths by about three fold, gestational hypertension by 30% and preeclampsia by 60%. The study also revealed that type 1 and type 2 pregestational diabetes mellitus which is found in about 3 to 5% of all pregnancies doubles the risk for stillbirths even after controlling for other confounders. Poor glycemic control, congenital malformation, fetal macrosomia and intrauterine growth restriction in the setting of diabetes increases the risk of stillbirths.

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5.4.2 HIV

HIV positive mothers had a 9.2 times increased odds for stillbirths compared to HIV negative women. This could be partly explained by the fact that HIV is associated with decreased immunity leading to frequent infections, maternal anemia and poor general health which may contribute to uteroplacental dysfunction, intrauterine growth restriction and therefore a higher risk of stillbirths. A prospective cohort study conducted in Tanzania to determine the predictors of stillbirths among HIV positive women concluded that improving maternal immune status through early initiation of antiretroviral therapy, micronutrient supplementation, early screening and treatment for syphilis and gonorrhea would help improve pregnancy outcomes(Kupka et al., 2009).

Similarly, a study conducted in the UK and Ireland among women delivering between 2007 and 2015 found that stillbirth rates were much higher among HIV positive women compared to the general population(Favarato et al., 2019).

5.5 Health Facility Factors Associated with Stillbirths

5.5.1 Use of Partograph

This study showed that the odds of stillbirth for labour monitored using a partograph was reduced by 71% in the univariate regression and this reduced to 63% in the multivariate regression and this association was statistically significant. The use of partograph is very useful in the management of labour because it entails half hourly fetal heart monitoring and allows for the early detection of fetal heart rate abnormalities which are usually predictive of fetal distress and allows for prompt intervention to prevent adverse fetal outcomes. Intrapartum monitoring of the fetal heart using the partograph is a priceless intervention especially in the prevention of intrapartum stillbirths. The partograph is extremely useful especially in low resource settings

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because it facilitates early detection of abnormal progress of labor and aid in timely referral to centers where emergency obstetric care services are available so that complications can be adequately managed. According to the WHO (1994), the introduction of the partograph has led to a reduction in the incidence of prolonged labor and improved maternal and perinatal morbidity and mortality.

5.5.2 ANC Attendance

This study demonstrated a reduction of the risk of stillbirths for mothers who have had some antenatal care visits compared to the non-attendants. The reduction in the odds of stillbirths was 50%, 77% and 60% for those who attended 1to 3, 4 to 8 and more than 8 times respectively even though this did not reach statistical significance. Antenatal care attendance is a preventive intervention because it is during these visits that risk factors are picked up during pregnancy and managed appropriately to prevent poor neonatal outcomes. According to the WHO (2018), it is recommended that every pregnant woman has a minimum of 8 antenatal care contacts in order to reduce perinatal mortality and improve care experience. In a population based study conducted between 2010 and 2016 in Zambia, Kenya, India, Pakistan and Guatemala, women with no antenatal care attendance had a 1.5 to 4.5 fold increased risk of stillbirths in all 5 sites(Saleem et al., 2018). Late initiation of antenatal care as well as non-antenatal ANC attendance was associated with an increased risk of stillbirths according to a population based study in Missouri State(Getahun et al., 2007).

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5.5.3 Mode of Delivery

Compared to vaginal delivery, the odds of having a stillbirth was increased 3.0 fold and 3.68 fold for vacuum assisted deliveries and caesarean deliveries respectively in the univariate analysis. In the adjusted analysis, the risk further increased to 3.64 fold for vacuum deliveries and reduced to 2.38 fold for caesarean deliveries. The association was only statistically significant for caesarean deliveries. This association could be explained by the fact that majority of the indications for the caesarean sections from our study were fetal distress and abruptio placentae which are themselves associated with high perinatal mortality.

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CHAPTER SIX

CONCLUSION/RECOMMENDATION

6.1 Limitations

- Secondary data was used for this study and therefore data on certain factors such as maternal smoking and mothers BMI could not be assessed because data was not available
- The study was a hospital based one and therefore did not account for stillbirths that occurred at home since they may not have been reported and therefore our stillbirth rate may not reflect the true burden of stillbirths.
- A number of participants had incomplete data entered into the delivery register.

6.2 Conclusion

No maternal education as well as rural residence is associated with an increased odds of stillbirths among women delivering at the Achimota hospital. Delivering at gestational age of >37 weeks confers a protective effect against stillbirths compared to preterm delivery. The odds of stillbirths is increased 8-fold for babies with congenital anomalies and 16-fold for pregnancies with obstetric complications. Low birth weight is associated with an increased odds of stillbirths. Maternal medical illness such as hypertension and gestational diabetes mellitus is strongly associated with stillbirths and this finding underpins the relevance of antenatal screening and optimal management of these conditions to reduce the incidence of stillbirths. The odds of stillbirths is reduced when labour is monitored using the partograph. Caesarean delivery is associated with a 5-fold increased odds for stillbirths.

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6.3 Recommendations

❖ **National Health policy**

- To intensify screening methods among antenatal care attendants for gestational diabetes mellitus by adopting the WHO's recommended Oral Glucose Tolerance Testing for all pregnant women between 24 -28 weeks to aid early diagnosis and commencement of therapy to optimize glycemic control and reduce the incidence of stillbirths

❖ **The District health Directorate**

- The public health unit should organize more outreaches especially into the peri urban and rural communities within their catchment area to increase surveillance on pregnant women as a way of identifying detecting risk factors and therefore reducing the incidence of stillbirths

❖ **Health workers**

- Heightened fetal surveillance for high risk pregnancies such as those with medical illnesses and multiple gestation with a multidisciplinary approach involving the midwives, physician specialist and the obstetricians
- Strict usage of the partograph for monitoring of labour should be enforced for all patients delivering at the Achimota hospital

❖ **Opportunity for further research**

- There is a need for a bigger multicenter study to increase the generalizability of the findings to better inform policy making.
- A prospective study design in order to reduce missing data.

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APPENDICES

APPENDIX A: SAMPLE DATA EXTRACTION TOOL

TOOL: FACTORS ASSOCIATED WITH STILLBIRTH IN ACHIMOTA HOSPITAL: A CASE CONTROL STUDY

Q NO	QUESTION	Coding categories	CODE
Section A: Demographic characteristics of participant			
1	Maternal age at delivery	…….	AGE
2	Level of education	No formal education	EDU
		Primary	
		JHS	
		SHS/Tech/Vocational	
		Tertiary	
3	Employment status	Civil servant/NGO	EMP
		Self-employed	
		Student	
		Retired	
		Unemployed	
4	Place of residence	Urban	RES
		Rural	
Section B: Maternal factors			
5	Gestational Age at delivery	…….	GEST
6	Parity	……..	PARA
7	Has the woman had a	YES	PSB
	Previous stillbirth?	NO	
8	Number of ANC visits	……..	ANC VISIT
9	Degree of cervical dilatation	……..	DIL

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on arrival in labour		
10 Haemoglobin level	…….….	HAEM LEVEL
11. Blood group	A	BLOOD GROUP
	B	
	AB	
	O	
12 RHESUS	positive	RHESUS
	negative	
13 Syphilis infection	Yes	SYPH
	No	
14 Hepatitis B infection	Yes	HEPB
	No	
15 HIV/AIDS infection	Yes	HIV
	No	
16 The woman had	YES	BP
High blood pressure	No	
17 The woman had Obstetric	YES	COMPLIC
complication during labour	NO	
18 specific obstetric	cord prolapse	SPECOMP
Complication	antepartum hemorrhage	
	Fetal distress	
	Preeclampsia	
	Malpresentation	
	Uterine rupture	
	Failure to Progress	
	Big baby	
	Others	

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19 Any medical illness	Yes	MEDICAL
	No	
20 Specific illness	DIABETES MELLITUS	SPEC ILL
	SICKLE CELLL DISEASE	
	CHRONIC HYPERTEHNSION	
	RENAL DISEASE	
	OTHER	

Section C. Fetal Factors

21 Fetal heart beat present	Yes	FHR
	No	
22 Abnormality present	Yes	ABNOR
	No	
23 Weight of fetus	……	FW
24 Fetal presentation	Cephalic	PRESENT
	Breech	
	OTHER	
25 Sex of Baby	Male	SEX
	Female	
26 Number of fetuses	Yes	NUMBER
	No	

Section D: Health facility factors

27 Monitoring of fetal heart	YES	MONITOR
	NO	
28 BIRTH OUTCOME	LIVE	OUTCOME
	Fresh stillbirth	
	Macerated stillbirth	

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29 Use of partograph	Yes No	PARTO
30 Number of times sulfadiaxine pyrimethamine was given	…….	SP
31 Method of delivery	Spontaneous vaginal delivery Vacuum assisted Forceps delivery Caesarian section	MODE

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APPENDIX B: ETHICAL CLEARANCE

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
GPS Address: GA-050-3303
Tel: +233-302-681109
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Email: ethics.research@ghsmail.org

MyRef. GHS/RDD/ERC/Admin/App 120/220
Your Ref. No.

1st July, 2020

Adzi Kofi Gudugbe
Korle Bu Teaching Hospital
Department of Obstetrics and Gynaecology
P. O. Box KB 77
Korle Bu

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC 056/02/20**
Study Title	Factors Associated with Stillbirths in Achimota Hospital: A Case Control Study
Approval Date	1st July, 2020
Expiry Date	30th June, 2021
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
Dr. James Akazili
(Head, Ethics & Research Management Department)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra