

**SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA**

**DETERMINANTS OF STILLBIRTHS IN THE TAMALE
METROPOLITAN AREA**



**THESIS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN
PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD
OF MPhil APPLIED EPIDEMIOLOGY AND DISEASE CONTROL
DEGREE**

JULY, 2014

DECLARATION

I hereby declare that with exception of the references made to other peoples' work which have been duly acknowledged, this work is the result of my own research work done under supervision and that this thesis has neither in whole nor in part been presented to the University or elsewhere for another degree.

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Signature Date / /

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(SUPERVISOR)



DEDICATION

I dedicate this thesis work to the merciful souls of the silent babies at birth.



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ABBREVIATIONS

ANC	–	Antenatal care
aOR	–	adjusted Odds Ratio
BMI	–	Body Mass Index
CI	–	Confidence Interval
cOR	–	crude Odds Ratio
CS	–	Caesarean Delivery
DHS	–	Demographic and Health Survey
EmONC	–	Emergency Obstetric and Neonatal Care
FHD	–	Family Health Division
GHS	–	Ghana Health Service
ITNs	–	Insecticide Treated Nets
N/R	–	Northern Region
NVD	–	Normal Vaginal Delivery
TM	–	Tamale Metropolis
OR	–	Odds Ratio
TMHD	–	Tamale Metropolitan Health Directorate
WHO	–	World Health Organization

ABSTRACT

Background

Stillbirths are more common than the death of a baby after birth and remained a serious public health issue in the developing world. Although stillbirths are preventable, there has been a sharp increase in the rate of stillbirths in the Tamale Metropolitan area of Northern Ghana in the last couple of years. Majority of the causes and risk factors remained unknown. This study was conducted to assess the sociodemographic, obstetric and maternal medical related determinants of stillbirths. The findings will be used to guide policy change in stillbirth control and provide a basis for future studies of stillbirths in the Tamale Metropolitan area.

Method

A 1:1 unmatched case control study was conducted in the Tamale Metropolitan area. Cases were defined as resident mothers of Tamale Metropolis who delivered singleton lifeless babies at or after 28 weeks of gestation from 1st January, 2012 to 31st December, 2013. Controls were those who had live births within the same period. We abstracted data from maternal health record booklets used in index pregnancies. Also, personal interviews with mothers on home visits was conducted. We estimated both crude and adjusted odds ratios, 95% confidence intervals and p values.

Results

A total of 368 mothers (184 cases and 184 controls) participated in the study. Maternal age of ≤ 24 , prolonged labour (> 12 hours) and diastolic blood pressure of less than 80mmHg in late pregnancy were significant determinants of stillbirths (aOR 3.0, 95% CI = 1.08 – 8.39; aOR 3.5, 95% CI = 1.94 – 6.61 and aOR 2.2, 95% CI = 1.04 – 4.54 respectively)

Conclusion

Low diastolic blood pressure in late pregnancy, young maternal age and prolonged labour were the key determinants of stillbirths in the Tamale Metropolis. Improvement of community moral practices and discouraging early marriage will help reduce the menace of stillbirths. Monitoring of blood pressure and labour should be prioritized

Key: stillbirth, determinants, Tamale Metropolitan area

CHAPTER ONE

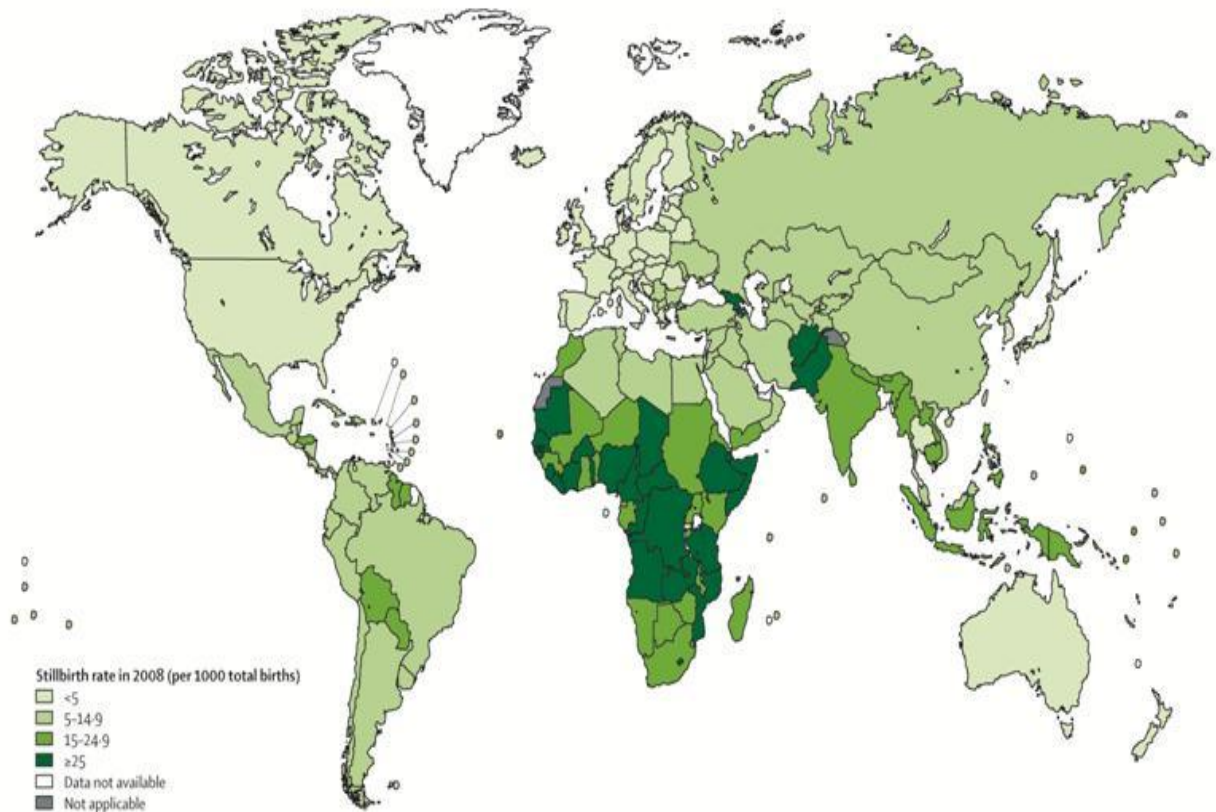
1.0 INTRODUCTION

1.1 Background to the Study

Stillbirth is a baby born with no sign of life at or after 28 completed weeks of gestation. The death of a foetus in utero or at birth is a devastating experience to the affected mothers and families. Stillbirth is an indicator of access to and quality of obstetric care including utilization of services in a geographic location. Stillbirths constitute a large proportion of perinatal deaths (Cousens et al., 2011; Bisetegnè and Hakim, 2008; Edmond et al., 2008; Stanton et al., 2006; World Health Organization, 2006) and the rates are steadily increasing worldwide. Global estimates suggest that, every day about 7,200 babies are born dead (Cousens et al., 2011; Stanton et al., 2006; World Health Organization, 2006). An estimated 1.8 million stillbirths, that is about two-thirds of the world total burden happen in just ten countries including India, Pakistan, Nigeria, China, Bangladesh, Democratic Republic of Congo, Ethiopia, Indonesia, Tanzania and Afghanistan (Lawn et al., 2011). Besides, it is no more a low and middle-income countries issue as there is a noticeable variation in the stillbirth rate in high-income nations (Flenady et al., 2011). Stillbirth rates, which had been marginally declining for decades have increased in several industrialized countries according to a study by Joseph et al., (2013), published in the Canadian Medical Association Journal (2013). The study reported that the rate of stillbirths in the British Columbia, Canada, increased by 31% from 8.08 per 1000 total births in 2000 to 10.55 per 1000 total births in 2010. Stillbirth rate for developed countries is reported between 4.2 and 6.8 per 1000 births, whereas in developing nations it ranges from 20 to 32 per 1000 births.

In Australia, the rate of stillbirth increased from 7.0 per 1000 total births in 2000 to 7.8 per 1000 in 2009 and rates in New Zealand increased from 7.8 per 1000 total births in 2007 to 8.5 per 1000 in 2009 (Joseph et al., 2013). Figure 1 below shows the world stillbirth rates by country.

Figure 1: Country variations in Stillbirth rates



Source: (Lawn et al, 2011)

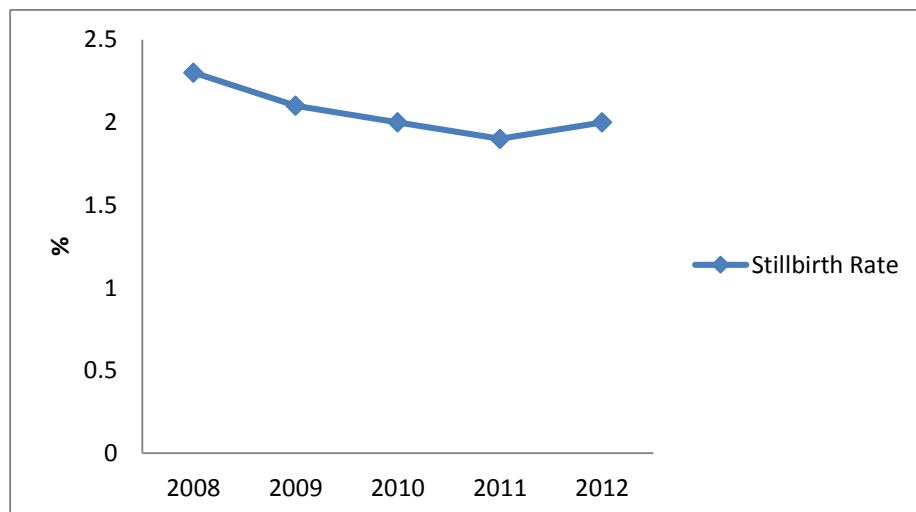
A vast majority of the stillbirths occurred in developing countries. The rates of stillbirth in developing countries are four to ten times compared to developed nations. While the largest absolute numbers of stillbirths occur in South Asia, driven by large population size of that region, the incidence rates are highest in sub Saharan Africa (Smith and Fretts, 2007).

Flenady in 2011 said an African woman has about 24 times higher chance of having a stillbirth at the time of delivery than a woman in a high-income country.

Nigeria has the worst record of stillbirth rate in Africa (The Lancet series, 2012) with institutional rate of stillbirth as high as 180 per 1000 deliveries (Okeudo et al., 2012). The Democratic Republic of Congo, Ethiopia and Tanzania are other countries with similar high rates of stillbirths.

Cousens et al., (2009) model estimated the rate of stillbirth for Ghana at 22 per 1000 births. According to the Ghana Health Service Annual Report (2012), the rate of stillbirth increased from 1.9% in 2011 to 2% in 2012. The rate of stillbirth is prevalent in the northern Ghana due to inequitable distribution of health resources. Engmann et al., (2012) also found high rate of stillbirth among perinatal mortalities in the Upper East of Ghana using the Navrongo Health and Demographic Surveillance System (NHDSS) Database. Figure 2 below shows the potential reversal of the already stagnating rate of stillbirth in Ghana.

Figure 2 Trend in stillbirth rate in Ghana, 2008 – 2012



Source: (Ghana Health Service, 2012)

Stillbirths are both common and devastating, and in the developed worlds, about one third has been shown to be of unknown or unexplained origin (Gardosi et al., 1998; Cnattingius and Stephansson, 2002). Antepartum and intrapartum stillbirth figures continue to fluctuate and may be attributable to inadequate availability and quality of health care during pregnancy and labour.

The global “big five” causes of stillbirths are childbirth complications, maternal infections in pregnancy notably syphilis, maternal conditions especially hypertension and diabetes, fetal growth restriction and congenital abnormalities (Lawn, 2011), still a myriad of emerging causes and risk factors exist in different geographical orientations.

Within the Northern Region of Ghana, Tamale Metropolitan area reported a sharp increase of stillbirth rate in the past four years and ranked second to Kumbungu District (DHIS2, Northern Region, Ghana Health Service, 2012). However, the determinants are largely unknown, but a greater proportion of these stillbirths are preventable. Undoubtedly, a strong foundation knowledge base of the determinants associated with stillbirths will reduce the high rate of stillbirth in the Tamale Metropolitan area.

1.2 Problem Statement

The rates of stillbirth are increasing steadily globally and represent over 50% of perinatal mortality. Also, stillbirths are underreported but still account for large proportion of perinatal deaths. According to World Health Organization (WHO) about 7,200 stillbirths are recorded in the world each day.

In Ghana, stillbirths account for a large proportion of perinatal mortalities (Ghana DHS, 2008; Engmann et al, 2012). Within the Northern Region of Ghana, stillbirth rate has increased in the Tamale Metropolis and it is currently second to Tolon-Kumbungu District. The Tamale Metropolitan Health Directorate Annual report (2012) reported an improvement in Maternal and Child Health (MC&H) services indicators, but unfortunately, there is an increased stillbirth. The causes of most of the stillbirths remained unknown but a large proportion of these deaths are preventable.

Besides, few epidemiological studies focus on the determinants of stillbirths. With the current high stillbirth rate in the Tamale Metropolitan area, a lot of babies are going to die in late pregnancy or at birth. Health authorities expressed concerned about the alarming rate of stillbirths in the Metropolis. This study was therefore carried out to assess the determinants of stillbirths in the Tamale Metropolis to help reduce the stillbirth rate.

1.3 Justification

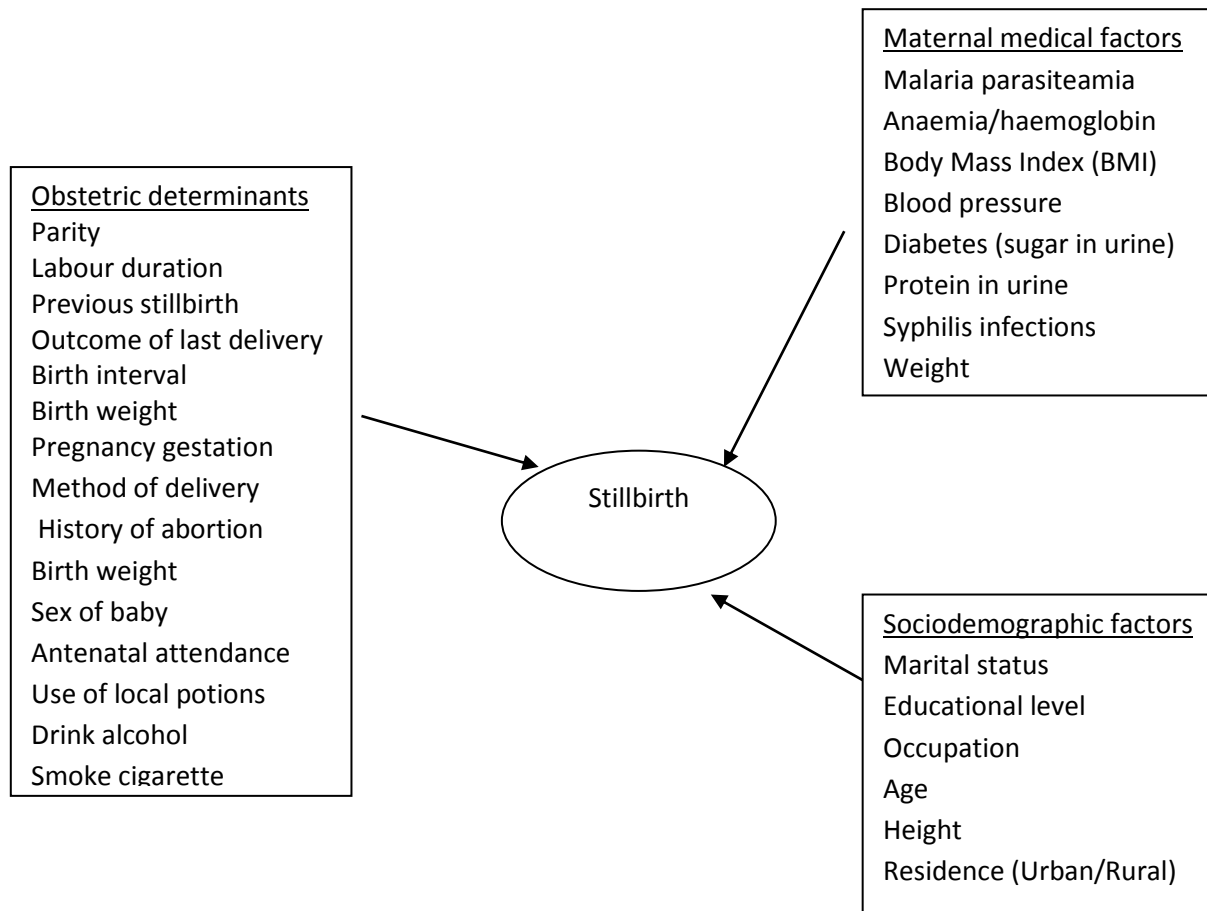
This study will provide information on the determinants of stillbirths in the Tamale Metropolitan area in relation to sociodemographic, obstetrics and maternal medical health conditions. The findings will also inform policy direction on stillbirth control in the Metropolis. Besides, the study will add knowledge to the very few published literature on the determinants of stillbirth in the Tamale Metropolitan area.

This study seeks to provide evidence based information to develop new strategies in reducing the stillbirth rate in the Tamale Metropolis.

1.4 Conceptual Framework

Figure 3 below presents the conceptual framework of the determinants of stillbirths under three headings, namely obstetric, maternal medical determinants and sociodemographic factors.

Figure 3 Conceptual framework



1.5 Objectives

1.5.1 General Objective

To assess the determinants of stillbirths in the Tamale Metropolitan Area

1.5.2 Specific Objectives

1. To assess obstetric determinants of stillbirths among women in the Tamale Metropolitan area
2. To assess the sociodemographic determinants of stillbirths among women in the Tamale Metropolitan area
3. To assess the maternal medical health determinants of stillbirths among women in the Tamale Metropolitan area

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter presents related literature on the determinants of stillbirths.

2.1 Introduction

Numerous causes and risk factors associated with stillbirths remained unknown in the low and middle income countries as well as marginalized communities. The rate of stillbirth is about four to tenfold in underdeveloped countries compared to the developed ones. Various definitions and/or classifications systems of stillbirths abound and differ by country, especially the cut off points of gestational age or birth weight. The World Health Organization (WHO) defines fetal death as “death before the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation, the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles” (WHO ICD 10, 1992). For the purpose of international comparison, WHO defined stillbirth as a baby born with no sign of life at or after 28 completed weeks of gestation. Stillbirths as a public health problem was ignored in the global health policy and was also not included initially in the Millennium Development Goals (MDGs) (Stanton et al, 2006).

2.2 Sociodemographic Determinants of Stillbirths

Some demographic determinants associated with stillbirths are modifiable. In the United States, Balayla et al., (2013) conducted a population-based cohort study using the Centers for Disease Control and Prevention's 'Linked Birth-Infant Death' and 'Fetal Death' data files to evaluate the incidence and effect of maternal age on the risk of stillbirth. They found extremes of the reproductive age spectrum to be significantly associated with stillbirth. Similarly risks for intrapartum stillbirth have also been found to be greater in teen mothers (Wilson et al., 2008).

Khalil et al., in 2013 conducted a retrospective study in the United Kingdom to examine the association of maternal age and a range of adverse pregnancy outcomes in some selected health facilities. They found that advanced maternal age was associated with increased risk of miscarriage, pre-eclampsia and caesarean section but not with stillbirth, gestational hypertension and spontaneous preterm delivery.

A case control study conducted in a tertiary hospital in Papua Guinea to determine the causes and risk factors for stillbirth and analyzed by multiple logistic regression showed a significant association between stillbirth and the following: husband's occupation unskilled, maternal age over 35 years and village residence (Amoa et al., 1998). Habib et al., (2008) conducted a registry-based study from 1999 to 2006 at a hospital in the North-eastern Tanzanian. They found that paternal farming occupation (ARR 1.5; 95% CI 1.1 to 2.2), maternal height 150 cm or lower (ARR 1.4; 95% CI 1.0 to 1.8) and residence in the rural or semi-urban area (ARR 1.4; 95% CI 1.1 to 1.7) were independently associated with higher perinatal mortality. 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 mothers whose husband's occupation was merchant (AOR = 4.4, 95% CI: 1.0-19.0), driver (AOR = 4.2, 95% CI: 1.12-15.76), &

women who were illiterate (AOR = 4.0, 95% CI: 1.2-13.5), primary school completed (AOR = 4.3, 95% CI: 1.3-13.8) and rural residence, (AOR = 2.6, 95% CI: 1.11-5.80), were independent predictors of poor birth outcomes.

According to a population-based case-control study of Swedish women, compared with women who were high level white-collar workers, those who were unskilled-blue collar workers (adjusted relative risks: 2.2; CI 1.3-3.7), skilled blue-collar workers (2.4; CI 1.3-4.1), and low level white-collar workers (1.9; CI 1.2-3.2) had significantly increased risk of stillbirth. Low social class was most associated with risks of term and antepartum and intrapartum stillbirths. (Stephansson, 2001)

A population-based case-control study conducted by the Stillbirth Collaborative Research Network in 5 US catchment areas from March 2006 to September 2008 identified characteristics associated with racial/ethnic disparity and interpersonal and environmental stressors, including a list of 13 significant life events (SLEs). The adjusted odds ratio for stillbirth among women reporting all 4 SLE factors (financial, emotional, traumatic, and partner-related) was 2.22 (95% CI: 1.43, 3.46). This association was robust after additional control for the correlated variables of family income, marital status, and health insurance type.

Social lifestyle factors were presumed to influence stillbirth rate decline in Denmark.

Fatma et al., in 2009 found that paternal education significantly reduced stillbirths. This was a retrospective study among women attending El-Jamahiriya Hospital in Benghazi to assess the relationship between prenatal care and pregnancy outcome.

A study conducted in Denmark by Wisborg et al., (2001) to evaluate the association between exposure to tobacco smoke in utero and the risk of stillbirth and increased mortality in the first year of life showed significant associations between exposure to tobacco smoke in utero and both

increased stillbirth and increased infant mortality. Researchers assessed the effects of maternal smoking on birth outcomes among singletons and twins by linking twins with their siblings in a 1995 Perinatal Mortality Data Set. Among singleton births there were significant associations between maternal smoking and infant mortality in both the 1-10 cigarettes/day group (adjusted relative risk: 1.60; CI 1.38-1.85) and the >10 cigarettes/day group (1.73; CI 1.45-2.01) when compared to non-smokers. No significant associations were observed when evaluating twins Pollack et al., (2000).

2.3 Obstetrics Determinants of Stillbirths

Emerging obstetrics causes and risk factors associated with stillbirth remained largely unknown or understudied, especially in the developing world. In North India, Williams et al., (2008) found significantly elevated odds of stillbirth of 3.10 (95% CI 2.69–3.57) for birth intervals of less than 18 months and 1.47 (1.30–1.68) for intervals of 18–35 months compared with intervals of 36–59 months.

Studies in some African countries considered low birth weight (LBW) as one of the leading causes of stillbirths and perinatal mortality (Hosain et al., 2000; McDermott et al., 1996; Kramer, 1987). A case control study conducted in a tertiary University Hospital, Pakistan and analyzed by logistic regression reported that obstetric factors significantly associated with stillbirth were obstructed labour (OR 16.2, CI 5.5 – 47), hypertensive disorders (OR 9.6, CI 4 – 23), abruptio placenta (OR 136, CI 52 – 356) and preterm labour (OR 15, CI 4 – 54), (Hossain et al., 2009).

A similar study was done in the Hawassa University Hospital, Ethiopia by Bayou and Berhan (2012). They also found among obstetric factors, undoubtedly antepartum haemorrhage, hypertensive disorders and obstructed labour as independent risk factors associated with stillbirths.

Also, in a case control study among women having singleton births in slum population in Bangladesh, Nahar et al., (2012) identified preterm delivery (OR=5.2, CI 3.2 – 8.5), prolonged labour (OR=2.8, CI 1.6 – 4.6) and failure of labour progress (OR=2.4, CI 1.1 – 5.5) as significant obstetric risk factors of stillbirth. Engmann et al., (2012) conducted a study to calculate perinatal mortality in the Upper East Region of Ghana. They reviewed data collected on the Navrongo

Health Data Surveillance system (NHDSS) database from January 2002 to December 2008. Most stillbirths (71%) were 31 weeks or less.

A cross sectional analytical study conducted in a public hospital at West of Mexico by Pe'rez-Molina et al., (2012) revealed spontaneous preterm delivery and deficient prenatal care as the risk factors associated with stillbirth among preterm deliveries; OR 4.38, CI95% 2.70-7.17 and OR 2.64, CI95% 1.83-3.82 respectively. By multivariate analysis, stillbirth predictors included: spontaneous preterm delivery (OR 4.00, CI 95% 2.61-6.61) and deficient prenatal care (OR 2.54, CI 95% 1.78-3.62).

A history of abortion and previous stillbirth has been reportedly significantly associated with stillbirth in different regions of Persian (Zarei, 2009; Hadavi et al., 2009). Contrary, Karimolah et al., (2014) did not find abortion and history of previous stillbirth to be associated with stillbirth in a high burden area in Northern Iran. Also, Zarei (2009) did not find significant difference in the distribution of sex association with stillbirths.

A systematic review of stillbirth literature in developing countries suggest that obstetric risk factors including prolonged and obstructed labour, preeclampsia and various infections without adequate treatment were strong risk factors for stillbirth. McClure et al., (2006)

To examine trends in stillbirth and neonatal mortality related to pregnancy-induced hypertension (PIH), researchers carried out a population-based study of 57 million singleton live births and stillbirths (24-46 weeks gestation) in the United States between 1990 and 2004 and estimated rates and adjusted odds ratios of stillbirth and neonatal death in relation to PIH. For the two time periods studied (1990-1991 and 2003-2004), risk of stillbirth (1.37; CI 1.24-1.50 for 1990-1991

& 1.52; CI 1.40-1.64 for 2003-2004) and neonatal death (1.32; CI 1.20-1.44 for 1990-1991 & 1.30; CI 1.18-1.43 for 2003-2004) were significantly higher for first births. (Ananth et al., 2010)

Aliyu MH et al., (2005), in their study of 27,069,385 births, including 1,206 women found that the risk for stillbirth is substantially elevated among very high and extremely high parity women, (OR 1.97, 95% CI 1.81-2.15 and OR 2.31, 95% CI 1.56-3.42 respectively), and suggested that care providers may consider these groups for targeted periconceptional counseling.

To assess the effect of hypertensive disorders of pregnancy on the risk of stillbirth a retrospective cohort of approximately 400,000 pregnancies identified through the birth and fetal death certificates in North Carolina between 1988 and 1991 were examined. Pregnancies among chronic hypertensive patients were more than twice as likely to result in early stillbirth compared to pregnancies among non-hypertensive patients. (Ananth et al., 1995)

In low socioeconomic settings nulliparity and grand multiparity were significantly associated with stillbirths ($p < 0.003$ and $p < 0.009$ respectively). Hossain et al., (2009) Also, from the binary logistic regression analysis, obstetric factors which were significantly associated with stillbirth were obstructed labour (OR 16.2, CI 5.5-47), hypertensive disorders (OR 9.6 CI 4-23), abruption placentae (OR 136, CI 52-356), placenta previa (OR 71, CI 21-230), and preterm labour (OR 15 CI 4-54).

Cesarean section is one component of essential obstetric services, which also includes the ability to provide parenteral antibiotics, blood transfusion, oxytocic drugs and anticonvulsants, and manual removal of the placenta and retained products of conception (Paxton et al., 2005). In developing countries, having a skilled attendant at delivery does not equate to availability of essential obstetric services and especially cesarean section (Cnattingius et al., 1998).

Antenatal care is crucial as it helps in screening potential risk factors such as maternal conditions and measurement of actual gestational age. The timing of initiation of prenatal care is vital and more beneficial if started in the first trimester of pregnancy. World Health Organization (WHO) recommends a minimum of four antenatal visits in normal pregnancies in order to benefit fully from the essential services during prenatal care. Globally, during the period 2005–2012, about 55% of pregnant women attended the recommended minimum four times antenatal care. The proportion of pregnant women in developing countries who attended at least four antenatal care visits has increased from approximately 37% in 1990 to about 50% in 2011, but in low-income countries, only 37% of pregnant women attended four times or more antenatal care during 2005–2012. (WHO, 2013)

Zeine et al., (2010) reported high utilization (86.3%) of antenatal care services among participants in a cross sectional community-based study in Southern Ethiopia. However, from those who attended antenatal care service 406 (68.2%) started antenatal care visit during the second trimester of pregnancy and significant proportion 250 (42%) had less than four visits.

A cross sectional retrospective study at Harare Maternity Hospital in Zimbabwe revealed that women delivering stillbirths are less likely to receive prenatal care (adjusted relative risk, RR =2.54; 95% Confidence interval CI 2.19 – 2.94). Feresu et al (2005) Studies in different settings have found none or fewer antenatal clinic visits to be significant risks factor for risk of stillbirth. (Igwegbe et al., 2008; Yatich et al., 2010; Ugboma et al., 2012). According to Jammeh et al., (2010), half of the Gambia rural women who experienced stillbirth had no antenatal care OR 4.46 (95%CI 0.84 – 23.43). Contrary, in Papua New Guinea a similar study observed that increasing the frequency of maternal antenatal clinic attendance was not a significant predictor of

stillbirth among mothers who initiated visits in the first trimester and also delivered at term Amoa et al (1998).

Ethiopian women age 15 – 49 who had a live birth in the five years preceding Ethiopia Demographic and Health Survey, 2011 and did not received antenatal care were 57.1%. (Ethiopia DHS, 2011). In Ghana, there is an increasing trend among pregnant women to have four or more antenatal care visits. Among women age 15-49 years who had a live birth in the five years preceding the Ghana Demographic and Health survey, about four in five (78 percent) pregnant women had four or more antenatal care visits for the most recent live birth. (Ghana DHS, 2008)

2.4 Maternal Medical Health Related Determinants of Stillbirths

Maternal chronic medical conditions, infectious diseases, psychiatric conditions, parental and environmental exposures, and psychosocial stressors have an established impact on fetal and neonatal health. Although countless studies have shown relationships between maternal risk factors and low-birth weight, pre-term birth, and fetal and infant morbidity (e.g. reduced apgar scores), fewer have demonstrated direct associations with fetal and infant death.

Preterm foetal death has been found to be associated with maternal infections (Goldenberg and Thompson, 2003).

According to Bader et al., (2010) Sudanese women with a history of maternal malaria in pregnancy had increased risk factor for stillbirth (odds ratio, 3.0; 95% confidence interval, 1.0–8.9; $P=0.04$). This study was conducted in a Maternity Hospital at Omdurman, Sudan.

A study conducted by Yatich et al., (2010) in two hospitals in Kumasi, Ghana revealed that malaria parasitemia in pregnancy and anaemia are significant risk factors for stillbirth. When compared to women with no malaria, women with malaria had increased risk of stillbirth (OR = 1.9, 95%CI = 1.2–9.3).

In Papua Guinea, Amoa *et al.*, (1998) found a significant association between stillbirth and syphilis and malaria by multiple logistic regression analysis. A random-effects meta-analysis of observational studies of detection and treatment of syphilis during pregnancy showed a significant 80% reduction in stillbirths [Relative risk (RR) = 0.20; 95% confidence interval (CI): 0.12 - 0.34] that is recommended for inclusion in the LiST model (Ishaque et al., 2011)

According to Warland et al., (2008), women with borderline hypotension are at increased risk of experiencing stillbirths. A matched case-control study of stillbirth and maternal blood pressure was conducted in which maternal blood pressures for a total of 124 pregnancies culminating in stillbirth were compared with maternal blood pressures in 243 (matched) pregnancies resulting in a live born infant. Women whose diastolic blood pressures fell in a borderline range (60 to 70 mm Hg) were consistently at greater risk of stillbirth relative to normotensive pregnancies. Women who had three or more mean arterial pressure values ≤ 83 mm Hg during the course of their pregnancy were at nearly twice the risk of stillbirth (odds ratio 1.78; 95% confidence interval [CI] 1.06 to 2.99; $p < 0.03$). Systolic hypotension was not significantly associated with stillbirth, but proportionately more control women were noted to have systolic hypertension (SBP ≥ 130 mmHg) than cases, and the adjusted odds of stillbirth in women who were hypertensive at either their first or last antenatal visit or whose antenatal average SBP was ≥ 30 mm Hg were all very close to 0.4 (95% CI 0.37 to 0.43; $p = 0.02$ to 0.03) relative to normotensives

Also, Chalumeau et al., (2002) reported hypertension in late pregnancy in different countries of West Africa. This study was a multicentre survey in urban communities involving six different countries: Mali, Niger, Burkina Faso, Senegal, Ivory Coast and Mauritania.

A retrospective comparison of all singleton, term (>36 weeks) deliveries between 1988 and 1999 in Israel, complicated with chronic hypertension, was undertaken to determine the risk factors and pregnancy outcome of patients with chronic hypertension during pregnancy after controlling for superimposed preeclampsia. After adjustment for superimposed preeclampsia, pregnancies complicated with chronic hypertension had a significantly higher rate of perinatal mortality. (Vanek et al., 2004)

Mantakas (2010) examined the influence of body mass index (BMI) in pregnancy on rates of adverse pregnancy outcome in overweight women who had never given birth (nulliparous). A retrospective review was conducted of all nulliparous women whose BMI was recorded at booking between January 2001 and November 2008 at the Jessop Wing of the Royal Hallamshire Hospital in Sheffield, UK. The women all delivered singleton babies and information was obtained from the hospital's database. All the women were stratified into five groups (underweight, normal, overweight, obese, and morbidly obese) and different BMI range groups were compared with the group of women with a normal BMI (20– 25). The stillbirth rate was associated with increasing obesity with RR 16.7 (CI 4.9–56) for the morbidly obese women compared to women with a normal BMI.

Sebire et al., (2001) found that obese pregnant women had significant increased risk for intrauterine compared to normal Body Mass Index (BMI). This study analyzed a validated maternity database system to examine maternal and foetal risk factors for stillbirth among these groups.

Salihu et al., in 2007 conducted a study to estimate the risk for stillbirth among three generally accepted obesity subtypes based on severity, the Missouri maternally linked cohort data containing births from 1978 to 1997 was used to examine pre-pregnancy weight and height. The study showed that obese mothers were about 40% more likely to experience stillbirth compared with non-obese gravidas. Furthermore, the risk for stillbirth increased in a dose-dependent fashion with increase in body mass index (BMI).

A population-based case control study was conducted to investigate whether the risk of antepartum stillbirth increases with body mass index during early pregnancy among 649 women with antepartum stillbirths and 690 control subjects in Swedish nulliparous women. In

comparison with infants of lean mothers (body mass index ≤ 19.9 kg/m²), infants born to overweight and obese mothers showed significantly increased risks for antepartum death. (Stephansson et al, 2001)

Reddy et al., in 2010 conducted a retrospective study using 721 stillbirths and 174,097 singleton live births at or after 23 weeks of gestation to identify possible pre-pregnancy risk factors for antepartum stillbirth and to determine whether these factors identify women at higher risk for term stillbirth. In adjusted multivariable analyses, pre-existing diabetes was independently associated with increased risk of stillbirth; (OR 2.7, CI 1.8–3.9).

CHAPTER THREE

3.0 METHODS

3.1 Type of Study

An unmatched case control study design was used. A questionnaire developed to collect data from both cases and controls. This method is a quick way of assessing the determinants associated with stillbirths and giving clues for further in-depth studies.

3.2 Study Area

Tamale Metropolitan area is located in the heart of the Northern Region of Ghana. The capital, Tamale, is also the capital of the Northern Region. It lies between 9.16° and 9.34° North and 00.36° and 00.57° West. Tamale Metropolis has a land mass of 731km² and approximately 180m above sea level. The Metropolis is boarded to the North by the Savelugu-Nanton District, South by Central and East Gonja Districts, East by the Yendi Municipal and West by Tolon-Kumbungu District. It is divided into three Sub-Metros; Tamale North Sub-Metro, Tamale Central Sub-Metro and Tamale South Sub-Metro. The health administration is sub-divided into six (6) sub-districts, namely Tamale Central, Bilpeila, Choggu, Sagnarigu, Taha-Kamina and Vitting Sub-districts. The 2012 and 2013 projected population of the Metropolis was 383205 and 404609 respectively (Ghana Statistical Service, 2014). Accordingly, the populations of women in reproductive age (WIFA) were estimated to be approximately 11113 and 11734 respectively (3% of total population). Islam is the dominant religion with an affiliated population of 84%. The Metropolis experiences one rainy season from April/May to October, with peak in July/August,

which is influenced by the moist South-West monsoon winds. It records a mean annual rainfall of 1100 mm with only 95 days of intense rainfall. The dry season is from November to March, which is influenced by the dry North-East winds (Harmattan).

Tamale Teaching Hospital is a tertiary referral centre for the three northern regions. Tamale West Hospital is a secondary level service point with Labour and Maternity Wards. These health facilities provide Comprehensive Emergency Obstetric and Neonatal Care (EmONC). Other Government health facilities exist in the Tamale Metropolis. A cross section of private and Mission health facilities also provide specialists and basic reproductive health services in the Metropolis.

Figure 4 Map of Tamale Metropolitan



3.3 Variables

3.3.1 Dependent variable

The main outcome variable of interest is stillbirth.

3.3.2 Independent variables

The independent variables collected from both cases and controls were grouped into sociodemographic and obstetric determinants as well as maternal medical related conditions.

Sociodemographic variables

- Maternal age
- Residence (urban/rural)
- Height (cm)
- Educational level (mother/husband)
- Occupation (mother/husband)
- Average time at work per day
- Religion (mother/husband)

Obstetric variables:

- Parity
- Previous stillbirth
- Birth interval
- Estimated gestation of index pregnancy in completed weeks
- Method of delivery

- Birth spacing
- Foetal presentation
- Labour duration
- History of abortion
 - Antenatal attendance (period of registration and number of antenatal care visits)
 - Use of local potions
 - Alcohol intake in index pregnancy
 - Cigarette smoking in index pregnancy
 - Sex of baby
 - Birth weight

Maternal medical related variables

- Blood pressure
- Diabetes status
- Malaria in pregnancy
- Haemoglobin concentration level at registration and 36 week
- Protein in urine
- Sugar in urine

Definition of independent variables

Parity – this is the number of pregnancies carried to viable gestational age (≥ 28 weeks).

Place of residence – this was classified into urban and rural. Urban community included Tamale town and immediate communities. Rural areas are small communities outside Tamale town

Educational level – the stage of formal education attained by a mother

Religion – Islam, Christianity, Pagan and others to be specified

Average time – this parameter tried to elicit assumed stress endured in a day at work in hours

Maternal age – the reproductive age was classified into ≤ 24 years, 25 – 34 years (active reproductive age) and above 34 years.

Previous stillbirth – one of the adverse birth outcomes that might have experienced by the mother

3.4 Study Population

The study population included resident women of Tamale Metropolitan area who delivered in Tamale Teaching Hospital and/or Tamale West Hospital. Only singleton births were included in the study.

3.5 Sample Size

A total estimated sample size of 368 women comprising 184 mothers who had stillborn babies (cases) and 184 mothers with live born babies (controls) was calculated using Fleiss formula. A case to control ratio of 1 and 95% Confidence interval at 5% level of significance was applied. Assumptions: Percentage of controls exposed was 18% and percentage of cases exposed was 30.5% with the 80% power to detect an odds ratio of 2.

3.6 Sampling Methods

Tamale Teaching Hospital and Tamale West Hospital were purposively selected as these facilities are referral centres and provide comprehensive Emergency Obstetric and Neonatal Care (EmONC). The facilities also operate with the National Health Insurance Scheme (NHIS).

Within the facilities, mothers (cases) were identified from the Labour Wards delivery registers and sample frames created. The sample size in each facility was estimated proportional to their case load. Simple random sampling was employed to obtain the required sample of each facility from their respective sample frames.

3.7 Case Definition

Case: a mother, who gave birth to a singleton stillborn baby in either Tamale Teaching Hospital or Tamale West Hospital and resident of Tamale Metropolitan area between 1st January, 2012 and 31st December, 2013.

Control: a mother, who gave birth to a singleton live born baby in either Tamale Teaching Hospital or Tamale West Hospital and resident of Tamale Metropolitan area between 1st January, 2012 and 31st December, 2013.

3.7.1 Cases and Controls Selection

The cases selected from each facility were proportional to the case load in the facilities from the 2012 and 2013 deliveries records. An equal number of controls were selected from these facilities.

Cases selection

Simple random sampling was employed to select 143 and 41 cases from Tamale Teaching Hospital and Tamale West Hospital respectively. The lists of cases (sample frames) for each facility were coded and fed into the computer and Microsoft Excel 2007 used to electronically generate randomly the required number for each facility separately. The research assistants used the lists of the selected cases to abstract records from the delivery registers, in-patient folders and maternal health record books. We conducted verbal autopsy with the mothers to possibly augment missing data. Mothers were located by their home addresses for face to face interviews during home visits. We generated more cases randomly from the remaining list using the

computers to replace those that could not be located by their addresses or refused to participate in the study.

Controls selection

Simple random sampling was employed to select 143 and 41 controls from Tamale Teaching Hospital and Tamale West Hospital respectively. The list of controls (sample frames) for each facility were coded and fed into the computer and Microsoft Excel 2007 used to electronically generate randomly the required number for each facility separately. The research assistants used the list of the selected controls to abstract records from the delivery registers, in-patient folders and maternal health record books. Mothers were located by their home addresses for face to face interviews during home visits. We conducted verbal autopsy with the mothers to possible augment missing data. We generated more controls randomly from the remaining list using the computers to replace those that could not be located by their addresses or refused to participate in the study.

3.8 Data Collection Techniques

A structured questionnaire was designed to abstract the hospital maternal records from the study sites. Also, we visited mothers in their homes and abstracted antenatal records from their Maternal Health Record books used during the index pregnancy. The Research Assistants conducted face to face interview with the mothers during home visits to complete sociodemographic parameters that were not documented. The tool captured antenatal visits and screenings at registration and week 36, obstetric and maternal medical records as well as sociodemographic variables of mothers and births.

3.9 Data Quality Control

The following measures were instituted at various stages of the study to ensure quality data generation. Data collection tool was pretested to ensure quality data capture during the study. Research Assistants and data entry clerks were trained three days each on data collection and data entry respectively. Supervisors supervised the Research Assistants on the field to observe data collection processes.

During the data collection, thirty six (10%) of the completed forms containing the raw data were randomly selected by the supervisors and checked to identify errors and/or omissions and corrective action made. These checks were repeated during data entry. We provided a back up electronic device for storage of the data.

3.10 Data Processing and Analysis

We processed and analyzed the data using Epi Data 3.1 and STATAES version11 software package respectively. The data was coded and entered into a predesigned soft tool using Epi Data. The data was then exported to STATAES11 software for analysis. We run the frequencies of cases and controls to ascertain completeness of each independent variable. The percentages of the cases and controls frequencies of independent variables were calculated. Initially, univariate analysis was done for all determinants using logistic regression and calculated the odds ratios (OR), 95% confidence intervals (95% CI) and p values. Significance level was set at a p-value less than 0.05. The variables which were significant as well as those proven biologically plausible in literature to be risk factors for stillbirths were put in a multivariate logistic regression model and run to detect significant determinants. The results were presented in two by two tables which

displayed the frequencies, percentages, crude and adjusted odds ratios and p values for easy visualization

3.11 Ethical Considerations

Ethical approval for the study was obtained from the Ethical Review Committee of the Ghana Health Service. Permission was also obtained to conduct the study in the Tamale Metropolitan area from the following institutions: Tamale Metro Health Directorate, the Tamale Teaching Hospital and the Tamale West Hospital. Informed consent was obtained from each participating mother who met the inclusion criteria and agreed to participate in the study. At the beginning of all interviews, we thoroughly explained to each mother her rights to participate, refuse to participate or opt out at any stage of the interview and this will not affect their care at any health facility.

3.12 Pretesting of the Study

The study was piloted in the Savelugu/Nanton District. The pretest was necessary to enable us assessed the field competence of the data collection tool and also to make the necessary corrections and inputs to it.

3.13 Limitations of the Study

Our study had some limitations which should be taken into account in interpreting these results.

1. This was a retrospective study and we were uncertain about the caliber of personnel who recorded the data as well as the accuracy of tools used to estimate the parameters.
2. We also anticipated some degree of recall bias especially those who delivered in early 2012.

CHAPTER FOUR

4.0 RESULTS

4.1 Sociodemographic Determinants of Stillbirths

4.1.1 Demographic characteristics of the study participants

A total of 368 mothers (184 cases and 184 controls) participated in the study. Table 1 below shows the demographic characteristics of the participants in the study.

Table 1 Demographic characteristic of cases and controls

Characteristic	Cases (%) n=184	Controls (%) n=184	Total (%) N =368
Maternal age/yrs			
≤ 24	46 (25.0)	56 (30.4)	102 (27.7)
25 - 34	99 (53.8)	90 (48.9)	189 (51.4)
35 - 46	39 (21.2)	38 (20.7)	77 (20.9)
Height/ cm			
< 150	38 (20.9)	21 (13.2)	59 (59.3)
≥ 150	144 (79.1)	138 (86.9)	282 (82.7)
Residence			
Urban	84 (45.7)	99 (53.8)	183 (49.7)
Rural	100 (54.3)	85 (46.2)	185 (50.3)

Out of the 368 mothers, those aged 25 – 34 years were of the highest frequency 189 (51.4%) while mothers aged 24 years or less were 102 (27.7%). Those aged between 35 and 46 years were 77 (20.9%). The proportion of stillborn mothers aged 24 years or less was 25.0% while over aged (≥ 35 years) mothers formed 21.2%. Controls mothers aged 24 years or less were 30.4% while 20.7% were 35 years or more.

Fifty nine (17.3%) of the mothers were less than 150cm in height. About 21% of the cases were under 150cm compared to 13.2% of the controls.

Mothers in the rural area were 185 (50.3%) compared to mothers in the urban communities, 183 (49.7%). Comparing cases to control by residence, 100 (54.3%) cases resided in rural areas compared to 85 (46.2%) controls.

Table 2 Demographic determinants associated with stillbirth among 184 stillborn and 184 live born mothers in Tamale Metropolitan area, 2012 – 2013.

Determinant	Cases (%) n= 184	Controls (%) n= 184	cOR	pvalue	aOR	pvalue
Maternal age/yrs				0.490		0.026
≤ 24	46 (25.0)	56 (30.4)	1.3 (0.82, 2.17)		3.0 (1.08, 8.39)	
25 - 34	99 (53.8)	90 (48.9)	1.0		1.0	
35 - 46	39 (21.2)	38 (20.7)	1.1 (0.63, 1.82)		1.1 (0.55, 2.23)	
Maternal height/cm				0.062		
≥ 150	144 (79.1)	138 (86.8)	1.0			
< 150	38 (20.9)	21 (13.2)	0.5 (0.32, 1.03)			
Residence				0.117		
urban	84 (45.7)	99 (53.8)	1.0			
rural	100 (54.3)	85 (46.2)	0.7 (0.47, 1.08)			

The demographic determinants associated with stillbirths are shown in Table 2. Maternal age was found to be significant demographic determinant associated with stillbirth ($p = 0.026$) at the multivariate analysis, though in the univariate model it was not significant ($p = 0.49$). In univariate analysis, the odds of stillbirth among mothers of age 24 years or less was 1.3 (0.82, 2.17) times than the mothers in the active reproductive age (25 – 34 years) though was not statistically significant. However, in the multivariate analysis, it was shown to be significantly associated with stillbirth (aOR = 3.0, 95% CI 1.08 – 8.39). Maternal height and residence (urban/rural) were not significant determinants ($p = 0.062$ and $p = 0.117$ respectively).

Table 3 Socioeconomic determinants association with stillbirths among the 368 study mothers in the Tamale Metropolitan area, 2012 – 2013

Determinant	Cases (%) N= 184	Controls (%) N = 184	cOR	pvalue	aOR	Pvalue
Mother education level				0.004		0.297
tertiary	4 (2.2)	13 (7.1)	1.0		1.0	
secondary	28 (15.2)	38 (20.7)	0.4 (0.12, 1.42)		1.2 (0.11, 12.25)	
primary	35 (19.0)	17 (9.2)	0.2 (0.04, 0.53)		0.6 (0.05, 8.50)	
no education	117 (63.6)	116 (63.0)	0.3 (0.09, 0.96)		1.1 (0.08, 12.35)	
Mother occupation				0.002		0.270
house wife	62 (33.7)	34 (18.5)	1.0		1.0	
trade	113 (61.4)	133 (72.3)	2.2 (1.32, 3.49)		1.4 (0.67, 3.01)	
employed	9 (4.9)	17 (9.2)	3.4 (1.38, 8.55)		2.5 (0.27, 23.85)	
Average time at work (hours), n = 271				0.937		
≤ 8	89 (73.6)	111 (74.0)	1			
> 8	32 (26.4)	39 (26.0)	0.9 (0.56, 1.68)			
Mother religion				0.397		
Christian	14 (7.6)	10 (5.4)	1			
Moslem	170 (92.4)	174 (94.6)	1.4 (0.62, 3.31)			
Husband education level				0.116		
Tertiary	26 (14.1)	21 (11.4)	1			
Secondary	28 (15.2)	44 (23.9)	1.9 (0.92, 4.09)			
Primary	24 (13.1)	29 (15.8)	1.5 (0.67, 3.29)			
No education	106 (57.6)	90 (48.9)	1.1 (0.55, 1.99)			
Husband occupation				0.011		0.091
employed	29 (15.8)	36 (19.6)	1.0		1.0	
trade	85 (46.2)	106 (57.6)	1.0 (0.57, 1.76)		1.2 (0.48, 3.13)	
farmer	65 (37.5)	40 (21.7)	0.5 (0.25, 0.87)		0.6 (0.23, 1.89)	
no work	1 (0.5)	2 (1.1)	1.6 (0.14, 18.66)		0.7 (0.02, 24.85)	
Husband religion				0.478		
Christian	11 (6.0)	8 (4.3)	1			
Moslem	173 (94.0)	176 (95.7)	1.4 (0.55, 3.56)			

Univariate and multivariate analyses of socioeconomic determinants and risk of stillbirth among the study mothers are shown in Table 3 above. Mother education ($p = 0.004$), mother occupation ($p = 0.002$) and husband occupation ($p = 0.011$) were found to be significantly associated with

the risk of stillbirth in the univariate analysis. Mothers with secondary education, primary education and no education were at lower risk of stillbirth in the univariate analysis (cOR = 0.4, 95% CI 0.12 – 1.42; cOR = 0.2, 95% CI 0.04 – 0.53; cOR = 0.3 95% CI 0.09 – 0.96 respectively) compared to tertiary education. However, in the multivariate model, secondary education of the mother marginally increased the risk for stillbirth compared to mothers with tertiary education (aOR = 1.2, 95% CI 0.11 – 12.25) though this was not statistically significant. Mothers with primary education had lower risk (aOR = 0.6, 95% CI 0.05 – 8.50) in the multivariate analysis, but this association was not significant. Also, the odds of stillbirth among mothers with no education was 1.1 (0.08 – 12.35) times higher than mothers with tertiary education (Table 3).

The odds of stillbirth among mothers whose husbands had no work was 1.6 (0.14 – 18.66) times higher than mothers whose husbands were employed in the univariate analysis.

Mothers who were employed (cOR = 3.4, 95% CI 1.38, 8.55) and those who were engaged in trade (cOR = 2.2, 95% CI 1.32 – 3.49) had significant increased risk for stillbirth in the univariate analysis. The probabilities of these determinants were not significant in the multivariate model. Mother with primary education had significant lower risk for stillbirth in univariate analysis (cOR = 0.2, 95% CI 0.04 – 0.53). This determinant lost its significance in the multivariate analysis (aOR = 0.6, 95% CI 0.05, 8.50).

The average time spent by the mother at work ($p = 0.937$), mother religion ($p = 0.397$) and husband education level ($p = 0.116$) were not significantly associated with stillbirth. Mothers who overwork (>8 hours/day) were 10% less likely to have stillbirth compared to those who do ≤ 8 hours in a day (Table 3). A mother affiliated to Islam was 1.4 (0.62 – 3.31) times higher of

experiencing stillbirth than a Christian mother. This probability was not statistically significant in the multivariate analysis.

4.2 Obstetric Determinants Associated with Stillbirths

Table 4 Obstetric determinants and risk of stillbirth among 184 cases and 184 controls in the Tamale Metropolitan area, 2012 – 2013.

Determinant	Cases (%) N= 184	Controls (%) N = 184	cOR	pvalue	aOR	Pvalue
Parity				0.443		
0	49 (26.6)	41 (22.3)	1.0			
1	34 (18.5)	43 (23.4)	1.5 (0.82, 2.78)			
2 - 3	58 (31.5)	64 (34.8)	1.3 (0.76, 2.77)			
≥ 4	43 (23.4)	36 (19.6)	1.0 (0.54, 1.83)			
Birth interval (in months)				0.003		0.140
≥ 24	108 (77.7)	130 (90.3)	1.0		1.0	
< 24	31 (22.3)	14 (9.7)	2.6 (1.29, 5.69)		2.0 (0.79, 5.19)	
Gestation (weeks)				0.341		
≥ 37	103 (56.0)	112 (60.9)	1.0			
< 37	81 (44.0)	72 (39.1)	0.8 (0.54, 1.24)			
Foetal presentation				0.0517		0.76
Cephalic	167 (90.8)	178 (96.7)	1.0		1.0	
Breech	15 (8.2)	5 (2.8)	0.3 (0.11, 0.87)		0.9 (0.18, 4.51)	
Transverse	2 (1.1)	1 (0.5)	0.5 (0.04, 5.22)		Empty	
Mode of delivery				0.069		0.059
SVD	134 (72.8)	152 (82.6)	1.0		1.0	
C/D	49 (26.1)	30 (16.3)	0.5 (0.33, 0.92)		0.5 (0.23, 1.18)	
Vacuum del	2 (1.1)	2 (1.1)	0.8 (0.12, 6.34)		0.3 (0.03, 2.64)	
Labour duration (hours)				0.000		0.000
≤ 12	60 (32.6)	128 (69.6)	1.0		1.0	
> 12	124 (67.4)	56 (30.4)	4.7 (3.04, 7.33)		3.5 (1.94, 6.61)	
Birth weight (Kg)				0.000		0.006
< 2.5	66 (35.9)	17 (9.2)	0.2 (0.09, 0.32)		0.3 (0.12, 0.74)	
2.5 - 3.9	108 (58.7)	156 (84.8)	1.0		1.0	
≥ 4.0	10 (5.4)	11 (6.0)	0.7 (0.31, 1.85)		1.0 (0.29, 3.16)	
Sex of baby				0.143		
Female	78 (42.4)	92 (50.0)	1.0			
Male	106 (57.6)	92 (50.0)	0.7 (0.48, 1.11)			
Cord accident				0.026		0.099
No	175 (95.1)	182 (98.9)	1.0		1.0	
Yes	9 (4.9)	2 (1.1)	0.2 (0.04, 1.00)		0.2 (0.03, 1.44)	

In this study, birth weight ($p = 0.006$), labour duration ($p = 0.000$) and birth interval ($p = 0.0035$) were found to be significantly associated with stillbirth (Table 4).

Mothers with shorter birth intervals (< 24 months) had increased risk of stillbirth compared to mothers with longer birth intervals (≥ 24 months) (cOR = 2.6, 95% CI 1.29 – 5.69) in the univariate analysis. This determinant lost its significance in multivariate analysis (cOR = 2.0, 95% CI 0.7 – 5.19).

The odds of stillbirth among mothers who labored for more than 12 hours was 4.7 (3.04 – 7.33) times higher than mothers who labored for 12 hours or less. In multivariate analysis, the risk remained significant (aOR = 3.5, 95% CI 1.94, 6.61).

In the univariate analysis, the odds of stillbirth among mothers with low birth weight (< 2.5 kg) babies was 0.2 (0.09, 0.32) times the odds of stillbirth among mothers with normal birth weight (2.5 – 3.9kg) babies. Low birth weight remained protective in the multivariate analysis (aOR = 0.3, 95% CI 0.12 – 0.74). The odds of stillbirth among over weight (≥ 4 kg) babies was 0.7 (95% CI 0.31 – 1.85) times the odds of stillbirth among normal birth weight (2.5 – 3.9kg) in the univariate analysis, however, in the multivariate analysis, there was no association observed (OR = 1).

The risk of stillbirth was lower among mothers with cord accident occurrences at delivery (cOR = 0.2, 95% CI 0.05, 1.00), but this effect was not statistically significant.

Parity ($p = 0.443$), gestation ($p = 0.341$), presentation ($p = 0.051$), mode of delivery ($p = 0.069$) and sex of the baby ($p = 0.143$) were not significant determinants of stillbirth (Table 4).

In this study, the risk of stillbirth decreased with increasing parity (Table 4). Grandmultiparous (≥ 4 births) mothers had a similar risk of stillbirth as the nulliparous (OR = 1.0, 95% CI 0.54 – 1.83).

This study also found breech presentation to be significantly lower (cOR = 0.3, 95% CI 0.11 – 0.87) in univariate analysis, but lost the significance in multivariate analysis (aOR = 0.9, 95% CI 0.18 – 4.51). Transverse foetal presentation at birth reduced the risk of stillbirth (cOR = 0.5, 95% CI 0.04 – 5.22) in univariate analysis though not statistically significant.

In the univariate analysis, caesarean delivery significantly reduced the risk of stillbirth of mothers compared to mothers who had normal vaginal delivery (cOR = 0.5, 95% CI 0.33 – 0.92). However, the association disappeared in multivariate analysis (table 4). Also, this study results revealed that the risk of stillbirth among vacuum delivery mothers was lower compared to normal delivery (cOR = 0.8, 95% CI 0.12 – 6.34), but this was not significant.

The study also found preterm delivery to have reduced risk of stillbirth (cOR = 0.8, 95% CI 0.54 – 1.24) in the univariate analysis though the association was not significant.

Table 5: Past obstetric history and prenatal care of index pregnancy association with stillbirth among 368 mothers in the Tamale Metropolitan area, 2012 – 2013

Determinant	Cases (%) N = 184	Controls (%) N = 184	cOR (95% CI)	p value	aOR (95% CI)	p value
Abortion				0.066		
No	169 (91.8)	158 (85.9)	1.0			
Yes	15 (8.2)	26 (14.1)	1.8 (0.94, 3.62)			
Previous stillbirth				0.737		
No	165 (89.7)	163 (88.6)	1.0			
Yes	19 (10.3)	21 (11.4)	1.1 (0.57, 2.15)			
Timing of ANC registration				0.292		
≤ 12	52 (28.3)	66 (35.9)	1.0			
13 - 24	130 (70.7)	116 (63.0)	0.7 (0.45, 1.09)			
25 - 36	2 (1.1)	2 (1.1)	0.7 (0.11, 5.78)			
Number of ANC attendance				0.494		
≥ 4	149 (81.0)	154 (83.7)	1.0			
<4	35 (19.0)	30 (16.3)	1.2 (0.70, 2.06)			
Mother used potions				1.0		
No	181 (98.4)	181 (98.4)	1.0			
Yes	3 (1.6)	3 (1.6)	1.0 (0.13, 7.56)			

In this study, all the mothers attended antenatal care clinic at least once in their index pregnancy.

Timing of ANC registration ($p = 0.292$) and number of attendance ($p = 0.494$) were found not to be significant determinants. Second trimester ANC registrants had lower risk for stillbirths compared to the first trimester registrants (cOR 0.7, 95% CI 0.45 – 1.09), but it was not significant.

The odds of stillbirth among three or less ANC clinic attendees were 1.2 (0.70, 2.06) times the odds of stillbirth among mothers with a minimum ANC clinic attendance of four times, but this

risk was not significant. There was no association in the use of potions in index pregnancy (OR = 1) between cases and controls.

There was no significant association of maternal history of abortion (cOR = 1.8, 95% CI 0.94 – 3.62) and previous stillbirth (cOR = 1.1, 95% CI 0.57 – 2.15) as shown in Table 5 above.

4.3 Maternal Medical Health Related Factors

Table 6 Maternal medical related determinants of stillbirth among 368 mothers in the Tamale Metropolitan area, 2012 – 2013.

Determinant	Cases (%) N = 184	Controls (%) N = 184	cOR (95% CI)	p value	aOR (95% CI)	p value
Malaria in pregnancy				0.166		
No	149 (81.0)	138 (75.0)	1.0			
Yes	35 (19.0)	46 (25.0)	1.4 (0.86, 2.33)			
Haemoglobin level at registration (g/dl) (N = 365)				0.928		
≥ 11.6	46 (25.3)	47 (25.7)	1.0			
< 11.6	136 (74.7)	136 (74.3)	1.0 (0.61, 1.56)			
Haemoglobin level at 36 weeks (g/dl) (N = 287)				0.576		
≥ 9.5	104 (66.2)	82 (63.1)	1.0			
< 9.5	53 (33.8)	48 (36.9)	1.2 (0.71, 1.86)			
Sugar in urine				0.085		
No	183 (99.5)	179 (97.3)	1.0			
Yes	1 (0.5)	5 (2.7)	5.1 (0.59, 44.18)			
Protein in urine				0.616		
No	145 (78.8)	141 (76.6)	1.0			
Yes	39 (21.2)	43 (23.4)	1.1(0.69, 1.85)			
Systolic BP (mmHg) at registration (N = 367)				0.0391		0.587
100 - 139	163 (88.6)	148 (80.9)	1.0		1.0	
≤ 99	21 (11.4)	35 (19.1)	1.8 (1.02, 3.29)		1.3 (0.54, 2.98)	
Diastolic BP (mmHg) at registration (N = 367)				0.0001		0.055
80 - 85	48 (26.1)	19 (10.4)	1.0		1.0	
86 - 90	7 (3.8)	2 (1.1)	0.7 (0.14, 3.79)		0.2 (0.00, 5.58)	
< 80	129 (70.1)	162 (88.5)	3.2 (1.77, 5.66)		1.9 (0.79, 4.83)	
Systolic BP (mmHg) at 36 weeks (N = 361)				0.012		-
100 -139	157 (87.7)	158 (86.8)	1.0		1.0	
140 -159	10 (5.6)	2 (1.1)	0.2 (0.04, 0.92)		0.1 (0.00, 1.23)	
≤ 99	12 (6.7)	22 (12.1)	1.8 (0.87, 3.81)		2.3 (0.77, 7.12)	
Diastolic BP (mmHg) at 36 weeks (N = 361)				0.000		0.004
80 - 85	58 (32.4)	30 (16.5)	1.0		1.0	
86 - 90	27 (15.1)	8 (4.4)	0.6 (0.23, 1.41)		1.0 (0.24, 4.32)	
91 -120	5 (2.8)	2 (1.1)	0.7 (0.14, 4.22)		31.5 (0.52, 1900.63)	
< 80	89 (49.7)	142 (78.0)	3.1 (1.84, 5.16)		2.2 (1.04, 4.54)	

In univariate analysis, systolic blood pressure ($p = 0.039$) and diastolic blood pressure ($p = 0.0001$) at registration as well as systolic blood pressure ($p = 0.012$) and diastolic blood pressure ($p = 0.000$) at 36 weeks were significantly associated with stillbirth. In the univariate model, mothers with systolic blood pressure of ≤ 99 mmHg and diastolic blood pressure of < 80 mmHg at registration had significant increased risk for stillbirth compared to mothers with systolic blood pressure range of 100 – 139mmHg and diastolic blood pressure range of 80 – 85mmHg (cOR = 1.8, 95% CI 1.02 – 3.29 and cOR = 3.2, 95% CI 1.77 – 5.66 respectively). In multivariate analysis, the associations effects reduced and the determinants also became insignificant ($p = 0.587$ and $p = 0.055$ respectively).

Systolic blood pressure and diastolic blood pressure at 36 weeks remained significant in multivariate analysis. The odds of stillbirth among the mothers with diastolic blood pressure of < 80 mmHg at 36 weeks was 3.1 (1.84 – 5.16) times the odds of stillbirth among mothers with diastolic blood pressure range of 80 – 85mmHg at 36 weeks. In multivariate analysis, this association remained independently significant (aOR = 2.2, 95% CI 1.04 – 4.54).

In univariate analysis, malaria in pregnancy (cOR = 1.4, 95% CI 0.86 – 2.33), sugar in urine (cOR = 5.1, 95% CI 0.59 – 44.18) and protein in urine (cOR = 1.1, 95% CI 0.69 – 1.85) were found to increase the risk of stillbirth although these were not statistically significant (Table 6).

Mother with haemoglobin (≥ 11.6 g/dl) at registration had similar risk of stillbirth as the mothers with haemoglobin (< 11.6 g/dl) (cOR = 1.0, 95% CI 0.64 – 1.64) in the univariate analysis.

The odds of stillbirth among mothers with haemoglobin level of 9.5g/dl or higher at 36 weeks were 120% times the mothers with haemoglobin of < 9.5 g/dl but this was not statistically significant (Table 6).

CHAPTER FIVE

5.0 DISCUSSION

In this unmatched case control study, we assessed the sociodemographic, obstetric and maternal medical related determinants of stillbirths in the Tamale Metropolitan area. The result of the study revealed that maternal age of ≤ 24 years, prolonged labour (> 12 hours) and diastolic blood pressure of < 80 mmHg at 36 weeks were significant determinants of stillbirths in the Tamale Metropolitan area. Low birth weight (< 2.5 kg) reduced the risk of stillbirth.

5.1 Demographic characteristics of cases and controls

The extremes of reproductive age spectrum substantially conferred risk of stillbirth to mothers who fell within these categories of ages. Our results suggest that mothers who were 24 years or less had three folds elevated odds of stillbirth compared to mothers in the age brackets between twenty five and thirty four years. Our study result was similar to Wilson et al (2008) findings which demonstrated that early child bearing is significantly associated with stillbirth but inconsistent with what was found in a study in the United States of America (Balayla et al, 2011). This could be that, young women in the developed countries may be well built due to good nutrition and also having access to good health care.

The place of residence of the mother was not a significant determinant of stillbirth in this study, however in a study by Habib et al (2008) in Tanzania and Amoa et al (1998) in Papua New Guinea found otherwise. Rural mothers might have benefited from outreach ANC services in Metropolis

Maternal height was observed not to be significantly associated with stillbirth in this study. This study result was not consistent with what was reported by Habib et al., (2008) in North-eastern Tanzania. They found mothers who are 150cm or less to be at increased risk of stillbirth. The perception of short stature mothers' vulnerability to stillbirth has been seriously challenged in recent studies. Other obscure factors may have influenced the occurrence of stillbirth in this group of women.

In this study, the mothers' education was not significantly associated with stillbirth in the multivariate analysis. Our study result was not consistent with other studies in Africa and Sweden (Eshete et al., 2013; Stephansson et al., 2001). Though illiteracy is high among the mothers, their attitude towards maternal care will have been better as observed in the study where many mothers attended ANC at least twice.

Also, mother occupation did not play significant role in the occurrence of stillbirth among the participating women. This study finding contradicts with the study by Stephansson et al., (2001). Many of the mothers in this study were engaged in trade and could be assured meeting her basic daily needs.

5.3 Obstetric Determinants Associated with Stillbirths

The diagnosis of obstetric causes and risk factors associated with stillbirths remained the most difficult effort in stillbirth prevention in the developing world where health service delivery is limited.

This study found prolonged labour (≥ 12 hours) to be the most significant obstetric determinant of stillbirth. The findings from this study was consistent with a study by Nahar et al., (2012) who reported prolonged labour among singleton births in a slum population in Bangladesh and Hossain et al., (2009) in Pakistan. A systematic review of stillbirth literature in developing countries suggested that prolonged labour was one of the obstetric risk factors for stillbirth (McClure et al., 2006). Many mothers still attempt home delivery due to illiteracy or delayed in seeking skill delivery and this can prolong labour as seen in health facilities. Also, malnutrition depletes maternal energy and these mothers easily become exhausted in labour. This can remotely prolonged labour.

Williams et al., (2008) found significantly elevated odds of stillbirth for short birth intervals and this exhibited a dose response effect. This study observed that short birth interval (< 24 months) significantly increased the risk for stillbirth among the mothers. The greater percentage of the population of Tamale Metropolis is Muslims and some Islamic practices restrict women to benefit from some family planning services. This norm therefore exposes the mothers to frequent delivery at short intervals without adequate time to recover.

Low birth weight ($< 2.5\text{kg}$) was found to be protective compared to normal birth weight ($2.5 - 3.9\text{kg}$). Stillbirths in normal birth weight may be related to foetal infection in late pregnancy (Goldenberg and Thompson, 2003) as a result of deficient prenatal care. In modern studies, low

birth weight babies are more likely to die in the neonatal period than before birth due to immaturity, hypothermia, hunger and low immunity.

This study found that prenatal care was not significant determinant of stillbirth. This study result was similar to studies reported in Papua New Guinea (Amoa et al, 1998) but contrary to studies in the Gambia rural setting (Jammeh et al, 2010) and urban Ghana (Yatich et al, 2010). Initiating prenatal care early and increasing the frequency of ANC attendance significantly reduce the risk of stillbirth. Antenatal care affords pregnant women the opportunity to have their pregnancies monitored and potential complications addressed. All the mothers attended ANC care at least once during their index pregnancies with 32% as first trimester registrants. Seventeen percent had maximum of 3 ANC attendances. One possible explanation for the lack of significant findings might be due to at least 4 ANC attendances among registrants irrespective of when they registered. That is, more mothers met the WHO recommended number of ANC visits (≥ 4).

In this study, parity was found not to be significant determinants of stillbirth. This study finding differ from the study by Hossain et al., (2009) who reported nulliparity and grandmultiparity to have increased risk for stillbirth.

This study found that breech delivery was safer compared to normal vaginal delivery, though this mode of delivery did not significantly increase the risk of stillbirth. The assertion is that, conscious effort was made by qualified attendant in the care of breech presentation mothers at delivery. The finding of this study is different from the study by Feresu et al., (2005) in Zimbabwe.

This study results showed that a history of abortion and previous stillbirth was not significantly higher in women with stillbirths than those in the live births group. This study was not consistent

with other studies in Persian (Hadavi et al., 2009; Zarei, 2009), but similar to Karimolah et al. (2014) study in Northern Iran. The associated phenomenon of these variables with stillbirth remained under vigorous studies.

Preterm delivery has been reported to be associated with increased risk of stillbirth (Nahar et al, 2012; Engmann et al, 2012). This study found preterm delivery not to be associated with stillbirth and different from other studies elsewhere (Hossain et al, 2009; Nahar et al, 2012; Perez Molina et al, 2012) and Ghana (Engmann et al, 2012).

5.4 Maternal Medical Health Factors

In this study, we found maternal hypotension at 36 weeks to be significantly associated with stillbirths. Mothers with systolic blood pressure of ≤ 99 mmHg were at increased risk of stillbirth. Also, mothers with diastolic blood pressure of < 80 mmHg at 36 weeks significantly increased their risk of stillbirth. This study finding is similar to the study conducted by Warland et al., (2008) in Australia who found borderline hypotension as a contributory risk factors for stillbirth, but inconsistent to the study by Vanek et al., (2004) in Israel who found hypertension as a risk factor for stillbirth. A study in Pakistan reported that abnormal high blood pressure can trigger premature delivery (Hossain et al., 2009). Abnormal low blood pressure can precipitate adverse pregnancy outcome.

This study results revealed that sugar in urine (indicating possible diabetes) of the mother increased the risk of stillbirth up to 5.1 times though not statistically significant. Karimollah et al (2014) reported similar results in a study from Babul, Northern Iran. Our study was not consistent with a similar study by Reddy et al (2010) in the United States which showed that diabetes was independently associated with increased risk of stillbirth. The disparity could have been due the fact that this in study only one person was tested positive.

The study found that malaria was associated with stillbirth, but not significant. However, this study was not consistent with Bader et al., (2010) in the Sudanese pregnant women population attending Maternity Hospital, Yatich et al., (2010) in Kumasi, Ghana and Amoa et al., (1998) in New Papua Guinea. The use of ITNs provides protection and is available for use

This study found that anaemia was not a determinant for stillbirth in the bivariate analysis, however, it was not consistent with a study by Yatich et al., (2010) in Kumasi, Ghana. Though

most studies found anaemia as a determinant, the finding in this study could be due to the fact that most of the anaemic mothers in the study were borderline cases.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion.

Mothers who are 24 years or less may have greater odds of stillbirth in the Tamale Metropolitan area. Prolonged labour is more likely to be a contributing determinant of stillbirth. Low birth weight was found to be protective. Borderline diastolic hypotension in late pregnancy may significantly increase the mothers' odds of stillbirth. The knowledge this study adds is that lower borderline hypotension is a strong determinant of stillbirth

6.2 Recommendations

Tamale Metropolitan Health Directorate/Health Facilities

- The Metropolitan Health Administration should involve religious and opinion leaders to educate the communities on the need for early reporting to health facilities to avoid prolonged labour
- The Tamale Metropolitan Health administration should collaborate with the health facilities to initiate and/or pilot normal birth weight stillbirth audits to stop babies from dying.

Midwives and Community Health Officers

- Midwives and Community Health Nurses should prioritize the care of all pregnancies in late pregnancy as the study has found pregnancies with normal foetal weight to be at risk of stillbirth
- Midwives and Community Health Officers should monitor the blood pressure of pregnant mothers in late pregnancy to identify mothers with low diastolic blood pressure and give appropriate intervention.

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Appendix A

Consent Form – Participant

Study title: Determinants of stillbirths in the Tamale Metropolitan area

Principal Investigator: Adam Bukari Badimsuguru

Qualification: MPhil Applied Epidemiology and Disease Control Student

Address: School of Public Health, University of Ghana, Legon

Hello, my name is and I am conducting this interview on behalf of Adam Bukari Badimsuguru, a Master of Philosophy Applied Epidemiology and Disease Control student of the School of Public Health, University of Ghana.

The number of children we lose during pregnancy and at child birth has been increasing in recent years and a concern to health authorities as well as the people in the Tamale Metropolis. This study seeks to understand how pregnant women appreciate the role played by health service delivery and the effects of our social lives on the problem. You are being invited to participate in the study because I understand you know the importance of your health, especially during pregnancy and you also delivered your last pregnancy at Tamale Teaching Hospital/ Tamale West Hospital. I will ask you to consider taking part in the study. If you agree to participate in this study, I will ask you a few questions centered on your last pregnancy and child birth. This will take about 20 minutes of your time.

You will also give me your Maternal Health Record book you used in your last pregnancy to record what was documented. However, if you do not have one I will like to ask you some questions concerning your last pregnancy to enable me get the information. If you agree to

participate, you be among 368 women who will also be participating in this study in the Tamale Metropolitan area.

Participating in this study is entirely voluntary. You have the right to refuse to participate and this will not affect your rights in anyway, especially to your health care. You are also at liberty to withdraw from this study at any stage of your participation. I will like to see you participate to the end.

There are no direct benefits or risks in participating. You will not be paid or compensated for your participation. However, the information that the study will come out with, will help us to understand the factors and circumstances associated with the increased stillbirths in the Tamale Metropolis. The questions are not very sensitive. However, you may feel uncomfortable answering some of them and you can choose not to answer them.

All the information collected from you will be treated strictly confidential and will be used for the intended purpose only. You will not be identified by name in any dissemination reports or publications resulting from this study.

The Ghana Health Service Ethics Review Committee has reviewed and given approval for this study to be conducted.

Do you have any questions for me?

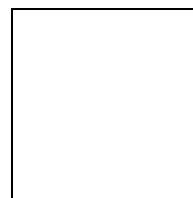
If you have any further questions regarding this study you may contact Adam Bukari Badimsuguru on telephone number 0547910067.

PARTICIPANT CONSENT

I have been adequately informed about the purpose, procedures, potential risks and benefits of this study. I have had the opportunity to ask questions and any questions that I have asked have been answered to my satisfaction. I know that I can refuse to participate in this study without any loss of benefit to which I would have otherwise been entitled. I understand that if I agree to participate I can withdraw my consent at any time without losing any benefits or services to which I am entitled. I understand that the information collected will be treated confidentially. I freely agree to participate in this study.

ID of participant:

Signature or Right thumb print: OR



Date:

If participant cannot read the form themselves, a witness must sign here:

WITNESS

I was present while the benefits, risks and procedures were read to and/or interpreted to the understanding of the volunteer. All questions were answered and the volunteer agreed to take part in the research. She also voluntarily released her Maternal Health book to the Research Assistant for records abstraction.

Date

Signature of witness

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

Date

Signature of Research Assistant

Appendix B

Questionnaire

Study title: Determinants of stillbirths in the Tamale Metropolitan area

Record ID

Interviewer ID

Date of completion of the form: -- -- / -- -- / -- -- -- --.

The questions below are in three sections. Please record the data as per question in the space or options provided under various sections

SOCIODEMOGRAPHIC

1. Maternal age (years) at delivery

.....

2. Height (cm) of the mother (as recorded in the Maternal Health Record book).

.....

3. Weight (kg) of the mother at: Registration

4. Weight (kg) of the mother at 36 weeks

5. Marital status of the woman.

a) Married b) Single c) Divorce d) widow

6. Residential area of the mother.

Urban/Rural

7. Religion of the mother.

a) Christian b) Moslem c) Pagan d) Other (specify)

8. Educational level of the mother.

a) No formal education b) Primary c) Secondary d) Tertiary

9. Occupation of the mother.

a) No work b) Farming c) Trade d) Formal (Public and other sectors)

10. Average time spent at work in a day during pregnancy.

a) ≤ 8 hours b) > 8 hours

11. Do mother drink alcohol during index pregnancy?

Yes/No

12. Do mother smoke?

Yes/No

13. Occupation of the husband.

a) No work b) Farming c) Trade d) Formal (Public and other sectors)

14. Educational level of the husband.

a) No formal education b) Primary c) Secondary d) Tertiary

15. Religion of the husband.

a) Christian b) Moslem c) Pagan d) Other

OBSTETRIC CARE

16. Number of visits to antenatal clinic in index pregnancy.

..... (Count record from Maternal Health Record book)

17. Gestation of index pregnancy at first antenatal clinic visit.

.....

18. Used or taken local herbs/ potion (s) in index pregnancy?

Yes/No

19. Antenatal folic acid taken.

Yes/No

20. Parity of the woman in index pregnancy.

.....

21. Outcome of her last delivery (if applicable).

a) Alive b) Stillbirth c) Died within first week d) Died within first four weeks

22. History of previous stillbirth?

Yes /No

23. Birth interval of last delivery and index pregnancy.

.....

24. Gestation of pregnancy (in completed weeks relative to last menstrual period as recorded

in Maternal Health Record book or maternity notes).

25. Interval between last antenatal visit and admission to hospital for delivery.....

26. Excessive bleeding per vagina before onset of labour.

Yes/ No

27. Foetal presentation (as recorded in maternity notes).

a) Cephalic (Vertex) b) Breech c) Transverse d) Other e) Not recorded

28. Presence of prolapsed cord?

Yes/No

29. Method of delivery.

a) NVD b) C/S c) Vacuum assisted delivery d) Forceps assisted delivery

30. Admission status to facility for delivery.

a) Referred to facility b) Direct admission to facility

31. Use partograph to monitor progress of labour?

Yes/No

32. Weight (kg) of baby at birth.

MATERNAL MEDICAL HEALTH

33. VDRL status.

a) Reactive b) Non reactive c) Indeterminate d) Not done

34. If reactive,

Treated/not treated (observe maternal treatment notes)

35. Haemoglobin level (g/dl) on first antenatal registration of index pregnancy

.....

36. Haemoglobin level (g/dl) on antenatal visit at week 36

37. Diagnosis of malaria in index pregnancy?

Yes/ No

38. Sulfadoxine pyrimethamine doses received during antenatal care in index pregnancy.

.....

39. Blood group of mother. a) A b) B c) AB d) O

40. Urinalysis.

Sugar: Protein: (record positive/negative or as documented in laboratory results)

41. Systolic blood pressure (mm/Hg) at registration and 36 weeks.

First registration..... 36 week Not recorded

42. Diastolic blood pressure (mm/Hg) at first registration.

First registration..... or Not recorded

43. Diastolic blood pressure (mm/Hg) at 36 week or Not recorded

44. History of admission in early pregnancy? Yes/No, if yes write diagnosis