UNIVERSITY OF CAPE COAST

NEONATAL OUTCOMES AMONG OBESE PARTURIENTS AT THE KORLE- BU TEACHING HOSPITAL

ISABELLA DARKO

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BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's name: ……

Signature: ……..

Date……

Supervisor's Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's name: ……

Signature: ……..… Date…….……

Co- Supervisor's name: ……...

Signature: ……..… Date……

ABSTRACT

The primary purpose of this study was to determine factors that influence neonatal outcomes among obese parturients at the Korle-Bu Teaching Hospital. It specifically set out to determine whether maternal obesity had an influence on neonatal outcomes and to assess the sociodemographic factors, obstetric characteristics, preexisting medical disorders and obstetric complications that influenced neonatal outcomes.

This study was a cross sectional retrospective study which assessed the medical records of 748 mothers who delivered at the Korle-Bu Teaching Hospital, Accra. A data collection checklist was used to collect data. Chi-square tests and odds ratios were used to analyze the data.

The main findings were that 28.3% of the parturients were obese. Birth outcome remained statistically associated with maternal BMI. Obese mothers were 40% less likely to have live births compared to those who were non-obese. All the obese mothers had neonates with low Apgar scores after birth. Maternal age, residence and antenatal visits were seen to be significantly associated with birth outcomes. Obese mothers who suffered obstetric complications were at a higher risk of being admitted to the neonatal intensive care unit.

Maternal obesity is associated with higher risks of adverse neonatal outcomes. The results of this study highlight maternal obesity as an important public health concern in our country. More studies with larger sample sizes are required to further augment these results.

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DEDICATION

To my beloved daughter Amaris Dzidzor Garti

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LIST OF ACRONYMS

APA	American Psychological Association
APH	Antepartum Haemorrhage
APOW	Annual Program of Work
BMI	Body Mass Index
CIA	Central Intelligence Agency
CDC	Center for Disease Control
GDHS	Ghana Demographic Health Survey
GDM	Gestational Diabetes Mellitus
GHS	Ghana Health Service
GSGDA	Ghana Shared Growth Development Agenda
HIV	Human Immunodeficiency Virus
HSMTDP	Health Sector Medium Term Development Plan
IOM	Institute of Medicine
IRB	Institutional Review Board
IUGR	Intrauterine Growth Restriction
JHS	Junior High School
LGA	Large for Gestational age
MDG	Millennium Development Goals
MOH	Ministry of Health
MSAF	Meconium Stained Amniotic Fluid
NICU	Neonatal Intensive Care Unit
PIH	Pregnancy Induced Hypertension
SHS	Senior High School

UNICEF	United Nations Children's Fund
UTI	Urinary Tract Infection
VBAC	Vaginal Birth After Cesarean Section
WHO	World Health Organization
WHSA	Women's Health Study of Accra

CHAPTER ONE

INTRODUCTION

This thesis is about neonatal outcomes among obese parturients at Korle- Bu teaching hospital. This chapter presents the background of the study, problem statement and the purpose of the study, research questions, specific objectives, conceptual model, hypothesis as well as the significance of the study. It also highlights the delimitations, limitations, operational definition of terms and the list of abbreviations.

Background to the Study

Obesity is often a lifelong problem that commonly affects women (Dickerson, 2001; Scidell, 2005). According to Khan (2012) about half of women of childbearing age are obese or overweight at the start of pregnancy. This non-communicable disease has become a subject of grave concern as it has reached epidemic proportions and has been designated as one of the most important global health threats (World Health Organization, 2000; Biritwum, Gyapong & Mensah, 2005). Hitherto the world was concerned with the management and prevention of communicable diseases. Today with the emergence of non-communicable diseases, the tables have been turned (de-Graft Aikins, Unwin, Agyemang, Allotey, Campbell & Arhinful, 2010). Prevalence rates in Africa for major non communicable diseases have risen exponentially over the last twenty years and currently outstrip rates for some infectious diseases such as HIV/AIDS probably because African health policymakers and their development partners prioritize infectious diseases and health issues noted explicitly in the Millennium Development Goals (MDGs), where chronic diseases are neglected (de- Graft Aikins 2010). More so in

Africa, past attention focused more on under nutrition and food security with the neglect of obesity (WHO, 1998). Therefore there is little data on obesity amongst Africans.

Obstetricians in most countries care for pregnant obese and morbidly obese women daily (Flegal, Carroll, Ogden & Curtin, 2010) and are well aware that obesity has implications for all aspects of maternal health and outcomes during pregnancy. Most scholars agree that maternal obesity is a real challenge in modern day obstetrics (Olayemi, Umuerri & Aimakhu, 2002; Okpere, 2003; Flegal et al., 2010). This is because maternal obesity is associated with multiple pregnancy complications and adverse perinatal outcomes. Pregnancy outcomes have been shown to deteriorate in a linear manner as BMI increases (Raatikainen, Heiskanen & Heinonen, 2006).Women who gain excessive weight during pregnancy are at risk for postpartum weight retention and long term obesity and its comorbidities such as diabetes and hypertension later in life (Rooney, Schauberger & Mathiaon, 2005; Linne, Dye, Barkeling & Rossner, 2004).

Adverse neonatal outcomes are among health burden challenges. In times past global efforts were directed in the area of reducing infant mortality to the detriment of neonatal mortality. Meanwhile neonatal mortality accounts for almost 40 percent of the estimated 9.7 million under-five deaths and for nearly 60 percent of infant (under-one) deaths (UNICEF, 2012). Almost two-thirds of infant deaths occur in the first month of life. Among those, more than two-thirds die in their first week and among those, two thirds die in their first 24 hours after birth (Lawn et al., 2001). What is worrisome is the fact that

highest national rates of neonatal mortality occur in Sub-Saharan Africa (UNICEF, 2012).

Several publications suggest the adverse effects of obesity on neonatal outcomes (Sebire et al., 2001; Lu et al., 2001). Neonatal outcomes commonly related to maternal obesity are post maturity, low Apgar score at 1 and 5 minutes, neonatal intensive care admissions and neonatal death (Bloomberg, 2013; Fraser, 2006). Thus it is clear that obesity is of special concern for women who are pregnant.

According to Duda et al. (2007) the prevalence of obesity is high among Ghanaian women. Ghana's demographic health survey (DHS) indicates that the percentage of women aged 15-49 overweight or obese grew from 25% to 30% between 2003 and 2008 with the highest values among urban women **(**Benkeser, Biritwum & Hill, 2012) thus efforts need to be put in to ensure that this menace is nipped in the bud. In 2009, the Institute of Medicine (IOM) in America released new recommendations regarding gestational weight gain. In Ghana contrastingly there are no guidelines on weight gain and neither is there a management protocol on obesity in pregnancy even though the height and weight of pregnant women are routinely measured at antenatal clinics.

Research on obesity in Ghana has largely explored individual characteristics and lifestyle behaviors in relation to obesity (Dake, Tawiah & Badasu 2010; Biritwum et al., 2005; Amoah, 2003). Even though some research has been conducted on obesity among women of childbearing age in Ghana, very few studies have examined obesity in pregnant populations. The fourth and fifth Millennium Development Goals (MDGs) aim to improve

maternal and child health by the year 2015. Survival of the newborn is dependent upon the health status of the mother; therefore, the likelihood of the former is incumbent upon improvement of the latter.

Problem Statement

Neonates are dying in their numbers and according to the Ministry of Health Ghana, as at 2012 neonatal mortality accounted for 80- 85% of infant mortality (MOH, 2012). The causes of infant mortality are not well ranked to include maternal causes. However, it is known that obesity influences conditions that are detrimental to high risk factors towards neonatal outcomes (Potti, Jain, Mattrogiani & Dandolu, 2012; Sukalich, Mingione & Glantz, 2006; Habli, Levine, Qian & Sibai, 2007). These conditions include gestational diabetes, heart diseases, antepartum and postpartum hemorrhages as well as pregnancy induced hypertension.

It is also well established that obesity in a pregnant woman can be a high risk obstetric situation that is associated with unfavorable neonatal outcome (Olayemi, Umuerri & Aimakhu, 2002; Okpere, 2003). High risk pregnancies continue to be associated with high perinatal morbidity and mortality in developing countries. Compared with pregnant women with normal weights, women with body mass index (BMI) > 30 have significantly more perinatal morbidity (Leddy, Power & Schulkin, 2008). As obesity is preventable, the risk of adverse outcomes can be reduced if appropriate interventions are put in place. The question is whether or not maternal obesity really is a problem in Ghana.

Little is known about maternal obesity and neonatal outcomes in Ghana. As the proportion of Ghanaian women who are overweight and obese

is rapidly increasing (Benkeser, Biritwum & Hill, 2012) it is imperative that researchers understand the relationship between maternal obesity and neonatal outcomes in order to develop programs of preconception planning and weight control. Studies conducted so far are from western countries and there is a paucity of data from developing countries. This study therefore seeks to identify the relationship between maternal obesity and neonatal outcomes among obese women in Ghana.

Purpose of the Study

The primary purpose of this study was to determine neonatal outcomes among obese parturients at the Korle-Bu Teaching Hospital.

Specific objectives were to:

1. Determine whether maternal BMI had an influence on neonatal outcomes.
2. Assess the sociodemographic characteristics of obese mothers that influenced neonatal outcomes.
3. Identify the obstetric characteristics of obese mothers that influenced neonatal outcomes.
4. Identify preexisting medical conditions of obese mothers that influenced neonatal outcomes.
5. Identify obstetric complications of obese mothers that influenced neonatal outcomes.

Research questions

The study sought to answer the following the following research questions

1. Does Maternal BMI Influence Neonatal Outcomes?

2. What Sociodemographic Factors of Obese Mothers Influence Neonatal Outcomes?
3. What Obstetric Characteristics of Obese Mothers Influence Neonatal Outcomes?
4. What Preexisting Medical Conditions of Obese Mothers Influence Neonatal Outcomes?
5. What Obstetric Complications of Obese Mothers Influence Neonatal Outcomes?

Significance of the Study

The present study made several noteworthy contributions to practice, society and the body of knowledge on maternal obesity. This study brings in new knowledge that would be valuable for policy direction in the area of maternal and child health. Findings from this study could direct policy makers to concentrate on policy guidelines on how to manage obesity in pregnancy in order to control the condition. This will go a long way to reduce the burden of chronic diseases that consume health resources and lead to premature deaths. In the long term it has been projected that the obesity epidemic will increase health care costs and inevitably increase poverty and disability rates (Kottke, Wu & Hoffman, 2003).

Obesity is known to bring fatalities in terms of outcomes. Numerous problems posted by obesity can be avoided with good monitoring and if health care workers understand how to manage the condition in a timely manner. For instance, pregnant women who are obese may have an increased risk of interventions during their labour and birth including caesarean section and as such may need specialist attention from obstetricians instead of midwives.

With more and more overweight and obese women becoming pregnant it is imperative that healthcare professionals help to educate and support these women through their pregnancies and the benefits of this should not be underestimated.

The research gap in Ghana remains very wide since very little has been done on maternal obesity in Ghana. This research will serve as a base for future studies by providing literature in the area thus the findings of the study can be used as a stepping stone for further studies.

This study makes a contribution to women's health in Ghana in the sense that it will inform the general public of obesity in general and the consequences for pregnant women who are obese.

Delimitations

The study methodology was a cross sectional retrospective survey of mothers. The study was delimited to pregnant women who were attendants and had delivered at the Korle- Bu Teaching Hospital from September 2013 to November 2013. Korle- Bu Teaching Hospital was chosen because it is the main tertiary referral center and takes referrals from all hospitals in Ghana.

Limitations

A number of caveats need to be noted regarding the present study. It would also be more informative if data could have been collected on the pregnant woman's nutritional habits and physical activity as these are contributing factors to obesity. However this data is missing as it is not routinely collected. Also it would be ideal if accurate measurements of maternal weight prepregnancy could be obtained to calculate the maternal BMI. About half of pregnancies were unplanned and the information was not

available. However a study in Brisbane showed that there is a very good correlation (r = 0.95) between weight recorded at the first antenatal visit and the prepregnancy weight (Mamun, Lawlor & O'Callaglan, 2005).

Another limitation is the use of secondary data because the authenticity cannot be validated as there is no guarantee that the weighing scales used were calibrated properly or were even of the best quality. More so, a similar problem could be encountered with height measurements. Additionally data was collected and entered by different people some of whom could have put in estimates instead of accurate measurements. Also, most of the folders had missing data especially with regards to height measurements, hence were not used in this analysis.

Organization of the Study

Chapter two of this thesis presents a review of literature. Chapter three focuses on the research methodology employed. Chapter four presents the results of the study in tables as well as a discussion of the findings citing literature to support the research findings informed by the specific objectives of the study. Finally chapter five provides the summary of the study as well as draws conclusions and makes recommendations.

CHAPTER TWO

REVIEW OF LITERATURE

Literature review for this study spans 1990 to 2013. This is because the relevance of maternal obesity as a crisis is a very recent phenomenon. Although there are many studies on obesity in general, only literature that is concerned with obesity in the prenatal period, pregnancy and postpartum was reviewed as they bear significant impact to this study**.** A systematic review of the literature was performed using HINARI and Medline and CINAHL databases (1990– 2014). Studies were excluded if they were not in English and if they were not available in full text through the internet. Each article was examined to determine if the inclusion criteria in the sample was clearly defined, if the outcomes were assessed using objective criteria and whether or not appropriate statistical analysis was used.

Theoretical Perspectives of Overweight and Obesity

Obesity is defined as an abnormal increase in the proportion of fat cells (Dickerson, 2001). The World Health Organization also defines obesity as excessive fat accumulation that presents a risk to health (WHO, 2006). Several methods define obesity (skin fold, percentage of ideal body weight, waist: hip ratios, body mass index (BMI). The most accurate assessment of obesity is body fat content (Atkinson, 1993). The most common and crude measure of obesity is the Body Mass Index (BMI) or Quetelet Index. The BMI is a statistical measure which is a function of weight and height, expressed as weight in kilograms (kg) and height in centimeters squared (cm^2). Desirable BMI is between 19 and 24.9. An adult who has a BMI between 25 and 29.9 is considered overweight. An adult who has a BMI of 30 or higher is considered

obese (Centre for Disease Control, 2008). Most people tend to gain weight gradually in adulthood for numerous reasons including declining physical activity plus small increases in dietary intake. BMI is an appropriate indicator of prepregnancy nutrition when assessed in women who are well nourished (World Health Organization, 1995).

There is however an absence of pregnancy-specific body mass index (BMI) criteria to define maternal obesity. Research, guidelines, and clinical practice utilize the World Health Organization (WHO) general population BMI criteria to define first trimester obesity (WHO, 2000). Pregnancy specific BMI should be based on height and weight measured in early pregnancy (ideally less than 12 weeks).

Pathophysiology of Obesity

The causes of obesity in general are multifaceted. Some authors attribute obesity to storage of excess calories as fat (Rosenbaum & Liebel, 1998), others to hormonal regulation of the appetite (Korner & Leibel, 2003), genetics (Kumar, Abbas & Fausto, 2005), estrogenic influences (Clegg & Woods, 2004), sedentary lifestyles (Spence-Jones, 2003) and societal influences (Klauer & Aronne, 2002).

Global Perspectives of Maternal Obesity

Obesity is on an upsurge all over the globe. In 2008, 10% of men and 14% of women in the world were obese compared with 5% for men and 8% of women in 1980. Further projections showed that more than 700 million adults will be obese by 2015 (WHO, 2011). An estimated 297 million women over the age of 20 were identified as obese in 2013 (WHO, 2013). This public

health threat is an enormous burden because it crosses international borders and affects the very young to the most aged.

Statistics available showed that in the USA and Europe, 20‑40% of women are found to gain more than the recommended weight during pregnancy resulting in an increased risk of maternal and fetal complications (Kanagalingam, Forouhi, Greer & Sattar, 2005; Cedregen, 2006). In the United States specifically, obesity has taken the number one spot as a health crisis (Wyatt, Winters, & Dubbert, 2006) and amongst pregnant women in America, more than one half are overweight with 8% of reproductive-aged women extremely obese (Flegal, Carroll, Kit & Ogden, 2012). Similarly, the rate of obese Canadian women has also grown from 33.9% in 1978 to 53.4% in 2004 with the prevalence of obesity during pregnancy also on the increase (Davies, Maxwell & McLeod, 2010).

The United Kingdom is no exception. National datasets have identified a twofold increase in first trimester obesity over two decades, increased risk of obesity-related adverse pregnancy outcomes, and associations with sociodemographic inequalities (Heslehurst, Rankin, Wilkinson & Summerbell, 2010). It was reported by Lewis as cited in Khan (2012) that more than half of all women who died in the UK between 2003 and 2005 were either overweight or obese.

Across Asia, the Americas and the oceanic regions the obesity story remains the same. For instance an Australian study of more than 14,000 pregnant women found that 34% were overweight, obese, or morbidly obese (Callaway, Prins, Chang & McIntyre, 2006) and in Saudi Arabia 30% of

pregnant women were reported to be obese (Meher, Aslam, Ahmed, Rajab & Kattea, 2009).

Adopted by the World Health Assembly in 2004, the WHO Global Strategy on Diet, Physical Activity and Health is the WHO's response to this canker. This strategy describes the actions needed to support healthy diets and regular physical activity. The Strategy calls upon all stakeholders to take action at global, regional and local levels to improve diets and physical activity patterns at the population level (WHO, 2004).

The Sub-Saharan African data

Maternal obesity in Sub-Saharan Africa is associated with increased risk of early neonatal death (Creswell, Campbell, De Silva & Filippi, 2012). Sub-Saharan Africa already has the highest rates of neonatal death in the world (UNICEF, 2012). According to the United Nations Children's Fund (2012) the largest absolute number of newborn deaths occurs in South Asia but the highest national rates of neonatal mortality occur in Sub-Saharan Africa. In addition the prevalence of overweight and obesity is increasing in Sub-Saharan Africa and there is overwhelming evidence corroborating this notion. A recent review of obesity prevalence in West Africa indicated that between 2000 and 2004, 10% of West African adults were obese (Abubakari et al., 2008). Culture and dietary patterns of African societies have and continue to be responsible for this upward trend. In Sub-Saharan African countries like Ghana socio-cultural perceptions about fatness and marriage does exist especially among women (Amoah, 2003). Obesity is viewed as a sign of high social status, fertility and prosperity. Thus this poses a serious

threat as this is no small challenge in the presence of such entrenched cultural norms of behavior and beauty.

The prevalence of obesity is high among pregnant Sudanese, South African, Morrocan and Tunisian women. (Rayis, Abbaker, Salih, Diab & Adam, 2010; Basu, Jeketera & Basu, 2010; Mokhtar et al., 2001). A team of Nigerian researchers have raised alarm over the rising maternal mortality risk from obesity among pregnant women in their country (Ezeanochie, Ande & Olagbuji, 2011). In one Nigerian study by Jeremiah , Nyeche, Akani and Akani (2011), the prevalence of obese pregnant women was reported to be 7.4%.

Maternal Obesity and Neonatal Outcomes in Ghana

Although there has been relatively little research on maternal obesity in Ghana, there is growing support for the claim that the prevalence of obesity is increasing especially among women (Dake, Tawiah & Badasu, 2010). Findings from Duda et al. (2007) lend support to this claim. Using a sample of 1237 non-pregnant women in Ghana, they found that a total of 430 women (34.8%) were obese; 340 (27.4%) were overweight; 369 (29.8%) were normal weight; and 98 (8.0%) were underweight**.** Konan (2010) also reports that in Ghana the overall crude prevalence of overweight (25.0-29.9 kg/m2) and obesity (≥30kg/m2) among childbearing women is 40% and 18% in urban and rural areas, respectively.

In the study by Biritwum et al. (2005), it was discovered that the prevalence of obesity was 5.5% and it was higher among females (7.4%) compared to males (2.8%). It was more common among the married than unmarried. Obesity was highest among the employed compared to self-

employed or the not working for pay. Obesity was highest in Greater Accra (16.1%) and virtually not present in Upper East or Upper West regions. By ethnicity, obesity was highest among Ga Adangbe, Ewes and Akans 14.6%, 6.6% and 6.0% respectively. Similarly Amoah (2003) in a study to evaluate the socio demographic variations of obesity among Ghanaian adults found that overweight and obesity were highest among the Akan and Ga tribes and relatively low among Ewes. Furthermore subjects with tertiary education had the highest prevalence of obesity (18.8%) compared with less literate and illiterate subjects (12.5–13.8%). Subjects whose jobs were of a sedentary nature had higher levels of obesity (15%) than subjects whose jobs involved heavy physical activity (10%).

Another study which gives credence to earlier reports of an increase in the prevalence of overweight and obesity among urban Ghanaians is by Abubakari et al. (2008), who showed that urban Ghanaians have a significantly higher combined prevalence of overweight and obesity, 22.0% for men and 50.0% for women, than their rural counterparts with 10.3% for men and 19.0% for women. Again, obesity was found to be higher in women than in men. This may in part be due to physical inactivity and fat and sugar rich diet that most urban females consume.

State of Maternal and Child Health in Ghana

The total population of Ghana stands at approximately 24 million with a 67.3% literacy rate among its citizenry (CIA, 2012). The female literacy rate as at 2010 was 65.3% (Ghana Population and Health Census, 2010). According to the World Health Organization (WHO) statistics as at 2012, Ghana's total expenditure on health was 4.8% of its GDP. Ghana like other

countries in the sub Saharan region continues to be plagued with high maternal mortality rates even though improvements have been made with regards to other health indicators. In 2007 the maternal health survey put the figure of maternal mortality in Ghana at 451/ 100, 000 live births. Currently the Maternal Mortality Rate is 350 deaths/100,000 live births (2010) and the infant mortality rate is 39.7 deaths/1,000 live births (CIA, 2013). The neonatal mortality rate (per 1000 live births) in Ghana was last reported at 28 in 2010, according to a World Bank report published in 2012.

Like most countries, Ghana is going through an epidemiologic transition where the prevalence of non-communicable diseases is increasing. Over the last few decades non communicable diseases like hypertension, stroke, diabetes and cancers have become top 10 causes of death and obesity is intricately linked to the development of these diseases (Agyei-Mensah & de-Graft Aikins, 2010).

Quality Assurance for Maternal Outcomes in Ghana

Ghana has implemented a number of policies and strategies to achieve improvement in the health of pregnant women and their babies and a reduction of maternal mortality; however none of these specifically target obesity issues. One example is the free maternal health policy which was introduced in 2008. The main objective of this policy was to reduce the number of women dying from pregnancy related complications. However the real impact of this policy is yet to be realized five and a half years on. With the current slow progress and just one year to go, it is unlikely for the MDG 2015 target will be realized. The health sector faces a lot of challenges. Paramount among them is the large gaps in access to health care between urban and rural as well as the rich and

poor; gender gaps in access to health care due to poverty and limited access to health facilities especially by deprived communities.

Ghana's health priorities as spelt out in the Ghana Shared Growth Development Agenda (GSGDA 2010- 2013) provide inspiration for the development of the Health Sector Medium Term Development Plan (HSMTDP 2010- 2013). The Annual Programme of Work (APOW) is the last to be implemented under HSMTDP and emphasis is being placed on maternal and child health promotion amongst others. Some of the objectives spelt out include bridging equity gaps in access to health care and nutrition services and intensifying prevention and control of non-communicable and communicable diseases just to mention a few.

Prenatal care in Ghana is quite encouraging. According to UNICEF, almost 92 percent of Ghanaian women have at least one antenatal examination visit during their pregnancy and the percentage of women who record at least four antenatal visits is 87% (UNICEF, 2013). However the paradox is that most of these women do not have supervised deliveries in health centers. Antenatal care services in the country are largely provided by public and private health institutions. However in the rural areas it is not uncommon to find traditional birth attendants at the helm of affairs giving prenatal care. Cultural, as well as religious beliefs plays a role in the type of care pregnant women receive. In most African societies decision making with regard to maternal care is often made by husband or other family members (WHO, 1998). This is one aspect of culture that largely impacts maternal and fetal outcomes because in life threatening situations health workers face a peril if the husband is not available or refuses to give his consent.

The current strategy for delivery of antenatal care services is geared towards promoting individualized client-centered and comprehensive services and disease detection and at risk assessment. The World Health Organization began promoting a new model of antenatal care (ANC) for low-income countries, known as Focused Antenatal Care. With this model few antenatal visits are encouraged once the pregnancy is uncomplicated (WHO, 2011). In Ghana, a registered pregnant woman visits an antenatal clinic about 4–6 times over the course of pregnancy, and there is a general tendency to book late in the second trimester. There are no recommendations on weight gain in pregnancy, and there are no specific management guidelines for obesity in pregnancy. Ideally at the initial prenatal visit, height and weight should be recorded for all women to allow calculation of body mass index (calculated as weight in kilograms divided by height in meters squared). Recommendations for appropriate weight gain should be reviewed at the initial visit and periodically throughout pregnancy. Nutrition consultation should be offered to all overweight or obese women, and they should be encouraged to follow an exercise program. But is this what really happens in our health institutions?

The current body of literature documents that pregnant women who are overweight and obese incur increased risks for both mother and neonate even though some authors have argued that there are inconsistencies in relation to evidence that points to the fact that obesity alone is associated with poor perinatal outcomes. For the purposes of this discussion both maternal and neonatal adverse outcomes will be explored and dissenting arguments also examined.

Hypertensive Disorders in Pregnancy

Maternal obesity is also associated with an increased risk of hypertensive disorders of pregnancy, including preeclampsia and the risk increases linearly with obesity. For each increase in BMI of 5 to 7 kg/m2, there is a corresponding 2-fold increase in the risk of developing preeclampsia (Weiss et al., 2004; O' brein, Ray & Chan, 2003). Overall, the literature (Kumari, 2001; Bianco, Smilen, Davis, Maxwell & McLeod, 1998) suggested that obese pregnant women have a 14±25% incidence of pre-eclampsia. Obese pregnant women were at increased risk of pregnancy induced hypertension (PIH). Sukalich, Mingione and Glantz (2006) found a significant association between obesity and mild and severe PIH. Furthermore obesity also increased the likelihood that women would experience more severe forms of hypertensive complications.

In a population based study PIH was associated with an increased risk of stillbirth and neonatal death (Ananth & Basso, 2010). In this analysis, despite adjustments for preexisting hypertension and diabetes, the increased risk of stillbirth among multiparas with PIH persisted. As compared with normotensive pregnancies, hypertensive pregnancies that delivered at 35 and 36 weeks of gestation had higher rates of neonatal intensive care unit admissions (57.1% vs 34.5% $P < .05$ and 33.3% vs 10.7% $P < .001$). The rate of neonatal intensive care unit admission was found to be greater in hypertensive pregnancies that delivered at 37 weeks of gestation (Habli, Levine, Qian & Sibai, 2007).

Women with recurrent pre-eclampsia have increased adverse neonatal outcomes because recurrent pre-eclampsia develops early and is severe (Hnat

et al., 2002). Therefore, they were more likely to deliver preterm and small-for-gestation age babies. These infants were prone to have low 5 minute Apgar scores, and need surfactant, ventilators and are likely to be admitted to the neonatal intensive care unit (Cruz, Gao & Hibbard, 2011).

Gestational Diabetes

Available evidence seems to point to the fact that gestational diabetes mellitus (GDM) and impaired glucose tolerance are commonly seen in clients with high BMI (Jaleel, 2009). For instance in a prospective multicenter study of more than 16,000 patients by Weiss et al. (2004), a BMI of 30–39.9 was associated with an increased risk of gestational diabetes mellitus (odds ratio [OR], 2.6 and 4.0). There is overwhelming evidence corroborating the notion that a BMI greater than 40 is most often associated with increased risk for gestational diabetes (Joy, Istwan, Rhea, Desch & Stanziano, 2009; Sebire et al., 2001; Steinfeld et al., 2000).

Some publications have tried to discern the influence of gestational diabetes on neonatal outcomes. Premature labour occurs in up to 20% of diabetic pregnancies (Gillmer & Hurley, 1999). A study done by Perveen and Saeed (1996) has shown that 15 (38%) of diabetic women delivered pre term. Al-Khalifah, Al-Subaihin, Al-Kharfi, Al-Alaiyan and Khalid (2002) studied the neonatal short term outcomes of gestational diabetes mellitus in Saudi mothers. A total of 766 mothers (419 GDM mothers and 347 controls) with their term babies were included in the analysis. Infants born to GDM mothers had significantly higher risk of neonatal intensive care admissions admissions (OR 2.7 (95% CI 1.5, 4.9), *p* value 0.0004). Almarzouki (2013) reported that neonatal intensive care unit (NICU) admissions are also significantly higher

among pregnancies with gestational diabetes mellitus. Similar results were also reported by Ray, Vermeulen, Shapiro and Kenshole (2001). Gasim (2012) asserts that GDM is recognized to be associated with increased rates of adverse maternal and neonatal outcomes. Patients with GDM had a significantly higher incidence of preterm delivery (p=0.0226) and admission to the neonatal intensive care unit (p=0.0003) amongst others. However, the rate of Apgar scores <7 at 5 minutes was similar in both groups of patients

Other Maternal Complications

Other maternal complications associated with maternal obesity mentioned in the literature include urinary tract infections, hemorrhage and meconium stained amniotic fluid. According to Meher, Aslam, Ahmed and Kattea (2009) the frequency of urinary tract infection (UTI) is higher in obese females as compared to normal weight. Jaleel (2009) also found a significant increase in infections like urinary tract infection and vaginal candidiasis during pregnancy in pregnant women who are overweight. In a South African study, UTI was significantly increased (P<0.001 and P=0.002) among the morbidly obese women (Basu, Jeketera & Basu, 2010). The data seems to suggest that obese women are more susceptible to urinary tract infections. The literature also points out some neonatal outcomes associated with UTI. Schieve and associates conducted a study involving 25,746 pregnant women and found that the presence of UTI was associated with premature labour (Schieve, Handler, Hershow, Persky & Davis, 1994). UTI was also found to increase the risk of prematurity in that same study. Comparing the outcome of pregnancy for those exposed and unexposed to UTI during pregnancy, Dimetry et al. (2007) revealed that there was a significantly higher percentage

of pre-term deliveries and low-birth weight infants among the group exposed to UTI during pregnancy. The risk ratios were (2.2) and (9.8) respectively. Also, Laura et al. (1994) documented that women exposed to antepartum UTI were found to be at greater risk of delivering infants with low-birth weight (OR= 1.6) and they were likely to experience premature labour (OR= 1.8) even after adjusting for potentially confounding variables. Similar results were also reported by Mazor-Dray, Levy, Schlaeffer and Sheiner (2009) that maternal UTI is independently associated with pre-term delivery. In a Ghanaian study, it was reported by Siakwa et al. (2014) that maternal UTI was significantly associated with birth outcome (live birth/stillbirth x= 5.221, P= 0.022) and gestational age where odds ratio showed that pregnant women with UTI were 3.4 times more likely to have preterm delivery than those without. In that same study Apgar score at 1 minute was also 3.8 times more among mothers with UTI than among the control group.

Adverse neonatal outcomes have also been identified with reference to hemorrhage in pregnancy be it antepartum or postpartum (Lam & Wong, 2002). Ahmed, Ellah, Mohammed and Eid (2009) in a study of prepregnancy obesity and pregnancy outcome identified ante partum hemorrhage as being significantly more in obese women (R.R 3.14). To date, no study has demonstrated an increased risk of placenta praevia with obesity. In a prospective descriptive study conducted by Sheikh, Khokhar, Sirichand and Raheela bilal Shaikh (2010) it was observed that 79.16% of women with antepartum hemorrhage had preterm deliveries with maximum deliveries at gestational age 33- 36 weeks. APH was independently associated with at least a 3-fold risk of neonatal intensive care unit admission in a study that was

carried out to predict maternal risk factors of neonatal intensive care admissions (Ross et al., 1999). Stillbirth has also been reported as a complication associated with antepartum hemorrhage (Bhandari, Raja, Shetty & Bhattacharya, 2014). Bener, Saleh and Yousafzai (2012) reported an increased risk of Apgar score at 1 minute less than 7 as a result of APH. Further evidence from Lam, Wong, and Ho (2000) indicated that neonates whose mothers have suffered APH had a low Apgar score at the first minute and were more likely to be admitted to the neonatal intensive care unit.

Meconium is the name given to substances, which have accumulated in the fetal bowel during intrauterine life. Although meconium is passed at birth sometimes, it can also be passed before birth into the amniotic fluid and most often, this presents with a high-risk situation whereby fetal delivery must be expedited. Available research showed that meconium stained amniotic fluid (MSAF) resulted in lower Apgar scores (Berkus et al., 1994; Tayade, 2012) and is associated with stillbirths (Ahanya, Lakshmanan, Morgan & Ross, 2005). On the other hand, Becker, Solomayer, Dogan, Wallwiener and Fehm (2007) found no statistically relevant difference in the Apgar scores of neonates born to women who experienced MSAF. Other authors have also identified increased NICU admissions associated with MSAF (Berkus et al., 1994).

Similarly, fetuses of pregnant women who are overweight or obese are at increased risk of prematurity, stillbirth, low Apgar scores, congenital anomalies, macrosomia and childhood obesity (Stothard, Tennant, Bell & Rankin, 2009). Overall obesity has been intricately linked to adverse outcomes in neonates although some authors disagree.

Gestational Age at Delivery

Some studies have reported a higher rate of premature delivery for obese women than for women of normal weight (Baeten, Bukusi & Lambe, 2001) According to others, a low prepregnancy body mass index (BMI) has been associated with preterm delivery (Hickey, Cliver, McNeal & Goldenberg, 1997). Sebire et al. (2001) and Kumari (2001) found a significantly decreased risk for preterm delivery in obese patients. Aly et al. (2009) showed that mothers with obesity and morbid obesity were more likely to deliver prematurely (16.7 and 20.3%, respectively) when compared with non-obese women (14.5%). Preterm babies are more likely to be admitted to the neonatal intensive care unit (Dudell & Jain, 2006).

In the literature, other scholars (Stotland, Washington & Caughey, 2007; Bhattacharya, Campbell, Liston & Bhattacharya, 2007) have identified post maturity as being more common among obese women. In 2007, Stotland et al. studied prepregnancy BMI and the length of gestation at term. Results from their study showed that overweight women are more likely to deliver at 40, 41, and 42 weeks gestation than are women who were underweight or normal weight. Obese women had 69% higher adjusted odds of reaching 42 weeks' gestation, compared with women of normal prepregnancy BMI (adjusted odds ratio, 1.69; 95% confidence interval, 1.23-2.31).

One study by Bhattacharya et al. (2007) found that women who were either overweight or obese experienced more postdate pregnancies than women who had a normal BMI ($p < 0.05$). Further evidence supporting this claim is from the study conducted by Kiran, Hemmadi, Bethel and Evans

(2005) where women with a BMI > 30 were at higher risk for experiencing a postdate pregnancy .

Birth Outcome

Miscarriage and stillbirth both refer to intrauterine fetal death, and are both associated with maternal obesity (Sirimi & Goulis, 2010). A recent meta-analysis revealed that obese pregnant women have an estimated risk of stillbirth that is twice that of normal weight pregnant women (Chu et al., 2007). This finding is supported by Kristensen, Vestergaard, Wisborg, Kesmodel and Secher (2005) who studied the association between maternal prepregnancy body mass index (BMI) and the risk of stillbirth and neonatal death using a total sample of 24,505 singleton pregnancies in their analyses. Findings from this study showed a more than doubled risk of stillbirth (odds ratio = 2.8, 95% confidence interval [CI]: 1.5-5.3) and neonatal death (odds ratio = 2.6, 95% CI: 1.2-5.8) among obese women compared with women of normal weight. No statistically significant increased risk of stillbirth or neonatal death was found among underweight or overweight women.

A large Swedish cohort study also reported a greater risk of antepartum stillbirth among obese patients than among women who had a BMI of less than 20 (Cnattingius, Bergstrom, Lipworth & Kramer, 1998). Huang et al., (2000) supported these findings by identifying maternal prepregnancy weight greater than 68 kg as a risk factor for unexplained fetal deaths, even after controlling for maternal diabetes and hypertensive disease. Jaleel (2009) did not find any increase in still births among obese women in Pakistan. However, the small number of patients in that study may account for this difference.

Apgar Scores

Maternal obesity wass associated with a significantly increased risk for decreased Apgar scores at birth. Compared with newborns of normal weight women, the risk to receive low Apgar scores is increased in newborns of obese (OR 1.4, 95% CI 1.1-1.7) and morbidly obese mothers (OR 2.0, 95% CI 1.5-2.7) (Chen et al., 2010). Similarly Vinayagam and Chandraharan (2012) reported that women whose BMI was 40 kgm² had an increased risk of having a lower Apgar scores as compared to women of normal BMI (OR 3.09, 95% CI 1.07–8.94). On these grounds one can argue that low Apgar scores are partly due to the stress the fetus goes through during the birth process. Most often obese women have prolonged labours.

In a retrospective cohort study, Apgar score at minute 5 of all singleton term babies delivered in a hospital in Iran, from 2007 to 2009 were evaluated. Logistic regression analysis showed maternal overweight (in odds ratio of 3.7, 95 % CI 2.4-4.6) and obesity (in odds ratio of 13.4, 95 % CI 9.7-14.1) were risk factors of neonatal low Apgar score, and the researchers concluded that maternal prepregnancy overweight should be targeted for appropriate management to prevent complications of low Apgar scores in the newborn (Sekhavat & Fallah, 2013).

El-Gilany and Hammad (2010) also reported from a Saudi Arabian study that a neonate born to an obese mother will have a low 1-min Apgar score. On the other hand, some studies have reported no difference in Apgar score between neonates of obese and normal weight women (Rode, Nilas, Wojdemann & Tabor, 2005). Kerrigan and Kingdon (2008) when examining neonatal outcomes also found no significant differences in the Apgar scores at

either one or five minutes of age for women in the obese and overweight category.

Neonatal Intensive Care Unit Admissions

Overall, the main reasons for neonatal intensive care admission as reported by Fallah et al. (2011) were low-birth weight, preterm birth and respiratory conditions. Offspring of obese mothers had a 3.5-fold increased risk of admission to the neonatal intensive care unit (Lewis, as cited in Khan, 2012). In another study, it was noticed that the neonate born to an obese woman had a greater risk of being admitted to the neonatal intensive care unit (Tosson & Al husaini, 2005).

Crane, Murphy, Burrage and Hutchens (2013) were also in agreement. According to them extremely obese women were more likely to have neonates admitted to NICU as compared to non-obese (16.9% vs. 7.8%). Minsart, Buekens, Spiegelare and Englert (2013) reported a 38% increased need for intensive care among obese women. Similarly Jeremiah et al. (2011) also found that there was a higher rate of admissions into the neonatal intensive care unit among the obese group (9.3%) than the non-obese group (4%). Taken together all these authors seem to suggest that maternal obesity will inevitably lead to admission in the neonatal intensive care unit.

Obstetric and Sociodemographic Characteristics Associated with Neonatal Outcomes

Parity

Biologically, childbearing is associated with higher body weight among women. Many women attribute their obesity to large weight gains during pregnancy (Stotland, Cheng, Hopkins & Caughey, 2006), gains which

they often never lose. After giving birth, most women find it hard to lose the weight gained probably because of lack of exercise or simply because they are put on a fattening diet. This may lead to overweight or obesity. Batnitzky (2008) and Sukalich et al. in (2006) revealed that women who are overweight or obese are less likely to be nulliparous. Results from other researchers provided confirmatory evidence that increasing parity was associated with obesity. Agbeko, Kumi-Kyereme, Druye and Osei Berchie (2013) reported from a Ghanaian study that women who had given birth to seven or more children had higher probabilities of being overweight or obese compared to women with no children. Similarly Duda et al. (2007) reported that total pregnancies greater than 5 were a risk factor for obesity. According to Luoto, Mannisto and Raitanen (2001) women with more than two deliveries are more often obese than other women.

Obese nulliparous women were at increased risk of elective preterm deliveries (Smith et al., 2007). Severinski, Mamula, Severinski and Mamula (2009) studied the neonatal outcome among grand multiparas compared with multiparas and indicated a significantly higher incidence of low APGAR scores at 1 and 5 minutes, and higher late fetal mortality (2.8% vs 0.1%; P=0.002). Further evidence shows the risk for stillbirth was substantially elevated among very high and extremely high parity women (Aliyu et al., 2005). According to Ngowa, Ngassam, Dohbit, Nzedjom and Kasia (2013) older multiparous women had increased incidence preterm delivery (12% vs 9.2%, RR=1.30, $p<0.05$); admission to special care neonatalogy unit (14.1% vs 10.2%, RR=1.38, $p<0.05$); and low Apgar scores at 1min and 5min than their younger counterparts (20-29years).

Mode of delivery

When examining obesity and mode of birth, findings show strong statistical evidence of an association between obesity and mode of birth, with significantly lower rates of normal vaginal birth and higher rates of both emergency and elective caesarean section (C/S) amongst obese women (Sebire et al., 2001; Kaiser & Kirby, 2001). Thus it can be said that the rate of successful vaginal delivery decreases progressively as maternal BMI increases (Chu et al., 2007).

The risk for operative delivery (cesarean section and assisted vaginal delivery (forceps and vacuum) in obese women was increased significantly in comparison to women who are either underweight or are of healthy weight (Robinson, O'Connell, Joseph & McLeod, 2005). Operative vaginal delivery is linked with low Apgar scores. In a study of operative vaginal delivery the incidence of low Apgar scores at 5-minutes (X^2=8.19; OR =8.80, P=0.004) was realized. There was no significant difference in either the neonatal mortality rate or NICU admission rate (Igwegbe, Monago & Ugboaja, 2010). There is also evidence pointing that forceps-assisted vaginal deliveries are associated with 5-minute Apgar scores less than 7 as compared with vacuum-assisted vaginal deliveries (Werner et al., 2007).

With regards to cesarean section births, the relationship between body mass index (BMI) and cesarean delivery is well established with some studies showing a direct linear relationship between the two (Ehrenberg et al., 2004; Lynch , Sexton , Hession & Morrison, 2008; Jeremiah et al., 2011). Lynch et al. (2008) particularly reported a 2- to 3-fold increase in cesarean delivery rate for both primigravid and multigravida obese women. The reason obese

pregnant women are more likely to end up with a cesarean delivery is not known, but a theory is that obese women are more likely to experience dysfunctional labour. However, it is important to note that even in the presence of an increased BMI there could be other mediators of a cesarean delivery such as the fetal size, labour progress, patient counseling, and obstetrical decision-making and these might explain why obesity increases cesarean deliveries. This notwithstanding, obesity increases the risk of cesarean in all women irrespective of age, parity, socio-economic factors and other obstetric factors. This finding was reported by Sherrad et al. (2007) in a study of maternal anthropometric risk factors for caesarean delivery in a Canadian University Hospital.

Some scholars like Kalos, Saugstad, Daltveit, Nilsen and Qian (2006) and Eberle, Ganem, Modolo, Amorin and Nakamura (2006) put forward the claim that delivery mode does not have an effect on Apgar score. After excluding multiple births, preterm births, small for gestational age births and those delivered by women with select complications Fallah et al. (2011) found that newborns delivered by C-section were more likely to be admitted to an NICU/ICU within 28 days of birth than those delivered vaginally. Shamsa et al. (2013) also reported that caesarean section is associated with a higher rate of admission to NICU. Another study by Liston et al. (2007) on term singleton live-birth deliveries with no congenital anomalies found that NICU admission rates were higher for babies delivered by CS.

In the absence of contraindications, vaginal birth after cesarean section (VBAC) is a viable option for most women. However the success of vaginal birth after Caesarean section for obese women has been reported to be quite

low. Chauhan et al. (2001) found a 13% VBAC success rate in women > 136 kg. However the general consensus is that VBAC success decreases with obesity. In light of this practitioners need to caution overweight and obese women regarding attempts at vaginal birth after caesarean section.

Total number of antenatal visits

Maternal and perinatal outcomes have been found to be better in women who attended regular antenatal clinics (Tuladhar & Dhakal, 2011; WHO, 2011). The proportions of low birth weight and preterm babies have been reported to be higher in women with inadequate or no antenatal care (Tuladhar & Dhakal, 2011). Barros, Tavares and Rodrigues (1996) observed that adequate and intermediate (compared with inadequate) prenatal care was significantly associated with a lower risk of preterm (OR = 0-20, 95% Cl 0-12-0-32, and OR = 0-35, 95 % Cl 0-23-0-54, respectively). After adjusting for maternal age, social class, marital status, complications of pregnancy and type of hospital, the risk of preterm delivery remained significantly lower for women receiving adequate (OR = 0-18, 95 per cent Cl 0-11-0-28). Lack of prenatal care has been associated with an increase in neonatal deaths, which was greater for infants born at ≥36 weeks of gestation (Vintzileos, Ananth, Smulian, Scorza & Knuppel, 2002). Evidence from demographic and health surveys, show that four or more prenatal visits compared with none were associated with decreased neonatal mortality risk (AOR 0.68, 95% CI 0.59-0.79). This finding was arrived at in a study of prenatal care in Sub-Saharan countries by McCurdy, Kjerulff and Zhu (2011).

Maternal age

Maternal age has been a long known risk factor in pregnancy and has been shown to affect delivery type. Specifically women who are over the age of 35 years are at higher risk of experiencing a CS in relation to maternal age (Mealing, Roberts, Ford, Simpson & Morris, 2009). Kerrigan and Kingdon (2008) in a retrospective cohort study using maternal records investigated obesity in relation to age and came out with the following findings. Women under the age of 24 years showed the lowest levels of obesity, with 16.1% being obese. These levels increased in women between 25 and 34 years of age, with 19.7 % being obese. Women above the age of 35 years showed the highest levels of obesity, with 24.0% being obese. These findings positively reflect the connections between age and BMI. Ziraba et al., (2009) also found that young and unmarried women were less likely to be obese, a result that differs from that reported in another study by Rguibi and Belahsen (2004) which showed that younger women were more likely to be obese than older women. Kozuki et al. (2013) noticed that women above thirty five years had more preterm births. Previous studies (Yogev et al., 2010; Cleary- Goldman et al., 2005) have suggested similar results linking advanced maternal age to increased risk of preterm delivery.

According to Straube et al. (2010) a low Apgar score was reported to be more common for women aged >35 years compared to those aged 20–35 years (OR 1.35 (95% CI 1.16–1.58); $P < 0.001$). Lisonkova et al. (2010) indicate that older women are at an elevated risk of stillbirth, preterm birth, and NICU admission regardless of parity. When studying maternal age and risk of stillbirths throughout pregnancy in United States, Naddy (2006) found

that advanced maternal age conclusively increased the risk for stillbirths, with women 35 – 39 years having a relative risk of 1.3 and women 40 years a relative risk of 1.88

However it has been observed that adolescent obesity is also on the increase. It is worrisome to note that there is a rise in teenage pregnancy some of whom are obese teenagers (Catalano & Ehrenberg, 2006; Foresight, 2007). Interestingly adolescents who are obese prior to their first pregnancy often become even more obese on average 3.3 years following pregnancy (Segel & McAnarney, 1994). They are also likely to remain obese through their childbearing years (Eriksson et al., 2000). In the Central Region of Ghana it was reported that out of the pregnant 169 children the ages ranged between ten (10) – fourteen (14) years (Ghana News Agency, 2012). Statistics conducted by the Ghana Health Services (GHS) have revealed that about 750,000 teenagers between the ages of 15 and 19 became pregnant in 2013 (GHS, 2013). Close to 14,000 teenagers in the Central Region got pregnant in 2013 indicating a tremendous 62% increase in the region over the previous years.

Teenage pregnancy on its own comes with a myriad of problems which are further compounded by obesity. WHO (2014) reports that about 16 million women 15–19 years old give birth each year, contributing 11% of all births worldwide with more than 50% of adolescent pregnancies occur in Sub-Saharan Africa. Most studies demonstrated that being young does not ameliorate the effect of adverse neonatal outcomes associated with obesity (Sukalich et al., 2006; Ehrenberg et al., 2004). Eugene et al. (2007) found in Cameroon, adverse fetal outcome was about two fold in adolescent pregnancies as compared to others.

In a study of outcomes of teenage pregnancies by Liu and Cheung (2011) it was reported that low Apgar scores at 5 minutes (OR = 2.6; 95% CI, 0.9-7.4) occur more frequently among primigravid women aged less than 20 years. In a Chinese study it was reported by Haines, Rogers and Leung (1991) that there was a trend towards a higher rate of neonatal unit admission for infants delivered by younger women. Maternal age had no effect, however, on the Apgar score. A study by Cooper, Leland and Alexander (1995) examined the effect of maternal age on birth outcomes among young adolescents, ages 10 to 15. Univariate analyses indicated that the youngest adolescents were at greatest risk for negative birth outcomes including very preterm and preterm delivery, low birth weight, and neonatal mortality. Data yielded by some other authors pointed out that neonatal outcomes in babies born to teenage mothers are good and although more of the babies born to teenage mothers have a 5-minute Apgar score of <6, they were not more frequently admitted to the neonatal unit. Moreover, their rates for stillbirths, neonatal deaths, and perinatal mortality were not higher (Lao & Ho, 1997; Liu & Cheung, 2011). However on the other hand Lisonkova et al. (2010) observed the risk of NICU admissions to be elevated among infants born to women aged 40 even after additional adjustment for intermediate factors such as preterm birth and SGA, the risk of NICU admission decreased but remained higher than in younger mothers (a OR 1.16; 95% CI 0.99 to 1.46).

Place of residence

It is currently estimated that as much as 20-50% of urban populations in Africa are classified as either overweight or obese (Kamadjeu et al., 2006). To a large extent, overweight/obesity in Africa is concentrated in urban areas.

In line with other studies Abubakari et al. (2008) showed that women of higher socio-economic status (proxied by household wealth and women's education) living in urban areas were more likely to be overweight or obese than their poorer counterparts.

Abdel-Latif et al. (2006) studied neonatal outcomes in premature infants. Results showed a higher stillbirth rate among rural infants (OR 1.20, 95% CI 1.09 to 1.32, $p<0.001$). Larson, Hart and Rosenblat (1992) also studied rural residence and poor birth outcome in Washington State and concluded that rural residence was not associated with greater risk of poor birth outcome. Lisonkova et al. (2010) found no differences in preterm birth, or neonatal intensive care admission among older mothers in rural versus urban areas. In that same study rural women were at increased risk for perinatal death (OR = 1.5, CI: 1.1-2.1) and large-for-gestational-age (OR = 1.1, CI: 1.1-1.2) births. In an attempt to study the trends of obesity among urban women it was discovered that urban women were almost three times more likely to be overweight or obese compared to their rural counterparts (Ziraba et al., 2009).

Marital status

Marital status has also been found to be linked to obesity (Weng, Bastian, Taylor, Moser & Ostbye, 2004 ; Holdsworth, Gartner, Landias, Maire & Delpeuch, 2004). Compared to married women, being unmarried was associated with increased odds of obesity in urban and rural women (Konaan, 2010). Being married also increased the risk of obesity among women especially in Sub-Saharan African countries due to certain sociocultural

perceptions such as obese women being considered as beautiful. Men who have obese wives are also considered as being wealthy. Acoording to Balayla, Azoulay and Abenhaim (2011) compared with births from married women, births from unmarried women were at an increased risk of stillbirths (relative rise [RR], 1.24; 95% confidence interval [CI], 1.21-1.26). Many studies indicated that the unmarried status is associated with worse perinatal outcome as compared to married status (Luo,Wilkins & Kramer, 2004; Peacock, Bland & Anderson ,1995; Raatikainen et al., 2005). In a study by Lurie et al. (2010) using the Mann-Whitney *U*-test ($P = 0.043$) in an Israeli study found the Apgar score at 1 minute were higher in infants of married as compared to unmarried women. In contrast to previous studies, they did not detect increased risk of preterm delivery in the unmarried.

Education and employment

Obesity is negatively associated with education. Al- Tawil, Abdulla and Abdul Ameer (2007) in Iraq found no relation between educational level and obesity; while the Jordanian national study revealed a significant inverse relationship with the prevalence of overweight (Abbas et al., 2002). Overweight was more prevalent among illiterate people and those with lower levels of education. According to Yunis, Beydoun , Khogali, Alameh and Tamim (2003) neonates born to illiterate mothers had nearly 3-5 times the risk of NICU admission than a neonate born to a literate mother. Findings from some studies lend support to the claim that higher level education and non-manual occupation are linked with good Apgar scores. A Swedish study reported that mothers working in non-manual and self-employed occupations were less likely to have an infant with a low Apgar score than manual workers

(Odd et al., 2008). That study also found that the risk of a low Apgar score decreased with increasing maternal level of education (Odd et al., 2008).

Preexisting Medical Conditions Associated with Neonatal Outcomes

Researchers have in times past attempted to discern the relative influence of obesity and comorbid conditions with regard to pregnancy outcomes. Maternal obesity has long been correlated with an increased risk of chronic hypertension and diabetes prior to pregnancy (Isaacs, Magann, Martin, Chauhan & Morrison, 1994; American College of Obstetricians and Gynecologists. (ACOG), 2000; Kerrigan & Kingdon, 2008). Coexistence of hypertension and diabetes has been associated with worse obstetric and neonatal outcomes than either one alone (Potti et al., 2012). In their study neonatal outcomes were poor in women who had both hypertension and diabetes with high rate of preterm deliveries, neonatal intensive care unit (NICU) admissions (OR 2.14; CI 2.01–2.28), neonatal seizures (OR 2.30; CI 1.31–4.04), low 5-minute Apgar scores (OR 1.78; CI 1.57-2.01), and longer NICU stay (OR 2.30; CI 2.15-2.47). Stella et al. (2008) also found similar results. They reported Low Apgar scores, preterm deliveries and NICU admissions among women with comorbid conditions. According to Lawn et al. (2001) maternal disorders such hypertension and diabetes are the main risk factor for stillbirth. When assessing the magnitude and risk factors of stillbirth in a tertiary hospital by Akhter and Daisy (2009) hypertension contributed 16.2%.

Wahabi, Esmaeil, Fayed, Al Shaikh and Alzeidan (2012) studied the maternal and the neonatal outcomes of women with preexisting diabetes mellitus (PDM). Compared to non-diabetic women those with PDM were

significantly older and of higher parity. Furthermore they more frequently had Apgar scores <7 in 5 minutes, (OR 2.61, 95% CI (0.89-7.05), p 0.057) and more likely to be delivered at <37 gestation weeks, (OR 2.24, 95% CI (1.37-3.67), p 0.003). The stillbirth rate was 2.6 times more among the women with preexisting diabetes mellitus however the difference did not reach statistical significance, (p 0.084).

Asthma is another co morbid condition seen in women who have high BMI's. Studies suggest that asthmatic women are more at risk of low birth neonate, preterm delivery, Intra Uterine Growth Retardation (IUGR) and congenital deformities (Demissie, Breckenridge & Rhoads, 1998). Zubairi, Syed, Qureshi and Zafar (2008) when studying perinatal outcomes in pregnancy with asthma found that neonates born to asthmatic mothers had shorter mean gestational age with increased risk of premature birth and lower Apgar scores. Similarly, Perlow, Montogomery, Morgan, Towers and Porto (1992) reported preterm delivery occurred significantly more often among asthmatic women. Also they were significantly more likely to be admitted to the neonatal intensive care unit. Preterm birth was not associated with maternal asthma as reported by Enriquez et al., (2007). Low Apgar scores at one and five minutes have also been identified among neonates born to asthmatic mothers (Zubairi, Qureshi & Zafar, 2008). In an Australian study researchers found that the presence of maternal asthma during pregnancy increased the risk of stillbirth (Clifton et al., 2001).

Organizing framework

An eclectic framework was used to guide data collection and analysis. This diagram supports information in the literature review.

- **Sociodemographic factors**

Age, marital status, educational level, employment status, religion and residential location

- **Obstetric characteristics**

Parity, mode of delivery and total number of antenatal visits

- **Obstetric complications**

Meconium stained amniotic fluid, urinary tract infection, gestational diabetes, antepartum hemorrhage, pregnancy induced hypertension, hyperemesis gravidarum, premature rapture of membranes, postpartum hemorrhage, HIV, hepatitis B and syphilis.

- **Preexisting medical conditions**

Hypertension, diabetes, asthma, psychiatric disorders and sickle cell

- **Neonatal outcomes**

gestational age, birth outcome, Apgar scores at one minute and five minutes, admission to NICU

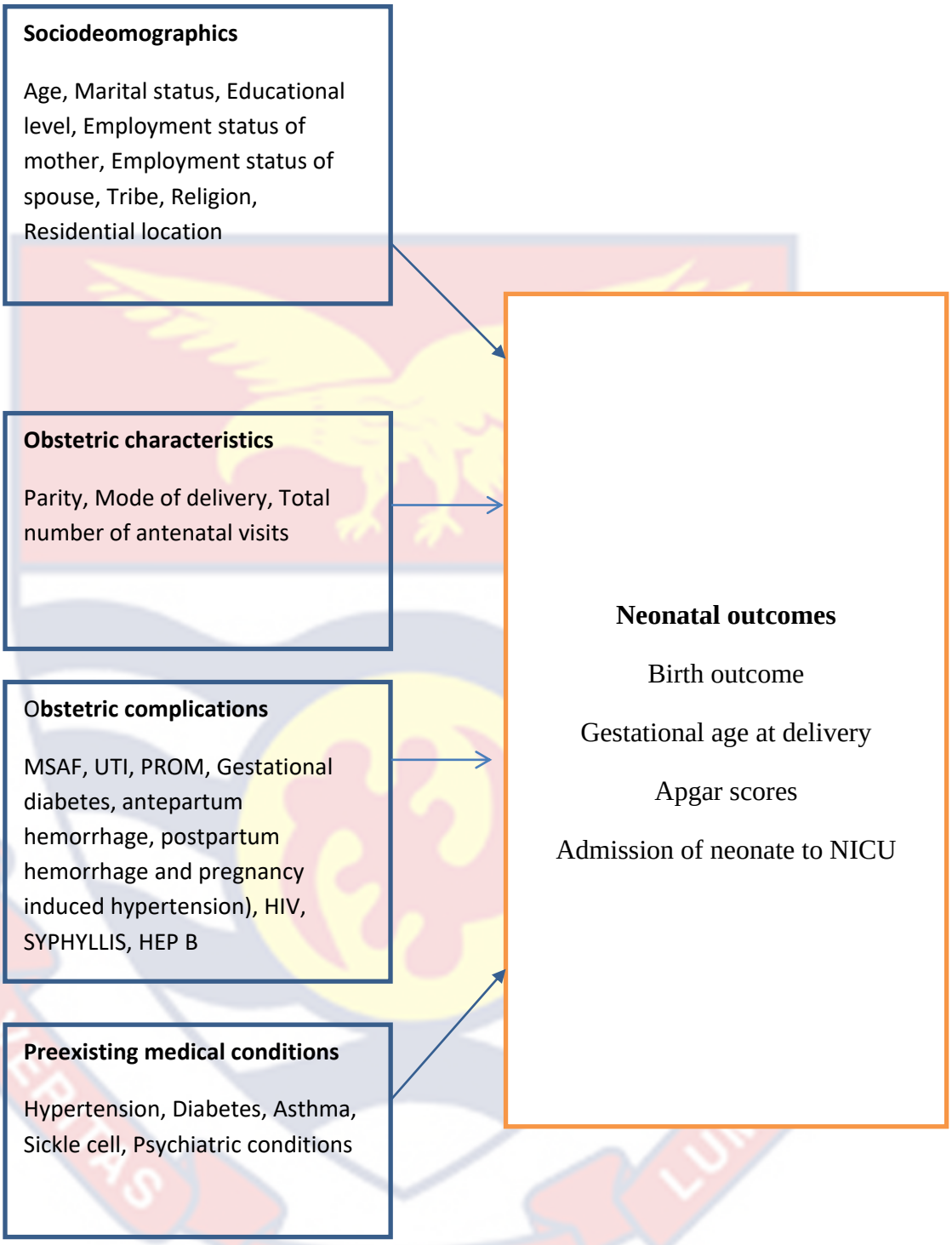

Figure 1: An eclectic framework on neonatal outcomes. Source: author's construct

In this framework four major factors were presented as the main factors that influenced neonatal outcomes. These were

a) Sociodemographic factors

b) Obstetric characteristics

c) Preexisting medical conditions

d) Obstetric complications.

All these factors were well documented in literature as having a bearing on neonatal outcomes (Anath & Basso, 2010; Tayade, 2012; Raatikainen et al., 2006; Potti et al., 2012, Akhter & Diasy, 2009).

Summary of Literature

The above literature suggested that maternal sociodemographic and obstetric characteristics as well as maternal preexisting medical conditions and obstetric complications all have an influence on neonatal outcomes. Prominent in the literature were post term delivery (Sebire et al., 2001), stillbirth (Chu et al., 2007), low Apgar scores (Chen et al., 2010) and higher incidence of neonatal intensive care admissions (Crane, Murphy, Burrage and Hutchens, 2013) as the commonly reported neonatal outcomes. This review also brought to light the influence of maternal overweight and obesity on neonatal outcomes. The next chapter will discuss the methodology used in conducting the study.

CHAPTER THREE

RESEARCH METHODOLOGY

The purpose of this chapter is to introduce the tools and methods used in the study. It includes information on research design, setting, study variables, study population, inclusion and exclusion criteria, sample and sampling procedure, data collection tool, pretesting, data collection and data analysis as well as ethical considerations.

Research Design

According to Polit and Beck (2008) a research design is the overall plan for obtaining answers to the questions being studied and for handling some of the difficulties encountered during the research process. Furthermore they indicated that selecting a good research design should be guided by whether the design does the best possible job of providing trustworthy answers to the research questions. In this study, the researcher considered the most suitable research design to be a quantitative nonexperimental methodology.

The study was a cross sectional retrospective survey. The term survey can be used to designate any research activity in which the investigator gathers data from a portion of a population for the purpose of examining the characteristics, opinions or intentions of that population (Polit & Beck 2008). Survey research is descriptive in nature, so unlike experimental designs, the researcher does not manipulate variables (Burns & Grove, 2005). Instead, the survey researcher describes and draws conclusions from frequency counts and other types of analysis. Cross sectional studies according to Polit and Beck (2008) are appropriate for describing the status of phenomena at a fixed point in time. A retrospective analysis of clinical records was conducted at the

Korle-Bu Teaching Hospital evaluating neonatal outcomes among obese women with singleton pregnancies who delivered at the facility between September and November 2013. Retrospective research often requires the analysis of data that were originally collected for reasons other than research (Hess, 2004).

Study Setting

The setting for this study is the Korle-Bu Teaching Hospital obstetric and gynecological department. Korle-Bu Teaching Hospital is a tertiary referral center and is located in the capital city. The hospital takes referrals from all over the country. The obstetric and gynecological department of the hospital has three units namely the obstetric, gynecological and family planning. The study was focused at the obstetric unit. As at 2012, a total of 10,278 deliveries were recorded in the unit with an average of 856 deliveries monthly. The obstetric database at the unit contains folders with prospectively collected data on all pregnant women delivering at the facility. The data contained in the folders are collected using standardized data collection sheets.

Study Population and Sampling

Polit and Beck (2008) defined a population as the entire aggregation of cases that meet a designated set of criteria. The study population included all pregnant women who were attendants and had delivered at the Korle-Bu Teaching Hospital between September and November 2013. The total number of deliveries was approximately 2700 during the study period. Census sampling was done thus the entire population was involved in the study. Census sampling is another non random sampling technique used in quantitative research. In census sampling, the researcher surveys from the

entire population (Lodico, Spaulding & Voegtle, 2006). The entire population was involved because it was of a manageable size, and also data were collected in a localized setting. The number of patients excluded from study was 1952 on the basis of exclusion criteria and or incomplete data. Seven hundred and forty eight of the folders were therefore included in the study. BMI was calculated as weight (kg) divided by height (m2). The height recorded at the booking visit and the very first weight checked during the first half of pregnancy (i.e. first 20 weeks) was used to calculate the BMI. Using the resulting BMI the sample was categorized into two groups of obese (BMI ≥30 kg/m²) and non-obese (BMI <30 kg/m²) according to the WHO classification. Thus 212 of the parturients were found to be obese.

Inclusion Criteria

Polit and Beck (2008) defined eligibility criteria as the criteria that specify the characteristics that people in the population must possess, to be considered for inclusion in a study. Thus women with singleton pregnancies whose first booked visit was before the 20th week of pregnancy, had height and weight measurements entered in the folder and had delivered between September and November 2013 were included in the study.

Exclusion criteria

Multiple gestations, non-attendants, late booking, women with missing data on height and weight were not included; as well as folders with missing antenatal record books. The number of patients excluded from study was 1952 on the basis of exclusion criteria and or incomplete data.

Variables

Dependent variables

Gestational age, birth outcome, Apgar score at 1 minute and 5 minutes, and admission of child to NICU

Independent variables

Maternal socio demographics, obstetric characteristics, obstetric complications and Preexisting medical disorders.

Pretesting

Pretesting of an instrument is done to determine its feasibility and validity (Brink & Wood, 1998). Pretesting of the data collection tool was carried out from the 3rd to the 6th of December 2013. Pretesting of the tool was done to determine the amount of time that would be spent in data collection and to determine the quality of data that the instrument would collect. In addition this was going to help with the validity of the data collection instrument. Lessons learnt from the pretest were used to make the necessary amendments to improve the validity of the data collection tool.

Validity

Validity refers to the degree to which an instrument measures what it is supposed to be measuring (Polit & Beck 2008). External validity is defined as the degree to which the study results can be generalized to other people and other research settings (Leedy & Omrod, 2010). In this study the entire population was used and it was therefore not necessary to generalize the findings to the population. Again, the researcher pre-tested the instrument prior to data collection to enhance its validity. The research assistants were thoroughly trained in the data collection process. Face validity refers to

whether the instrument appears as though it is measuring the appropriate construct (Polit & Beck, 2008). Content validity is defined as the sampling adequacy of items for the construct that is measured (Polit & Beck, 2008). In this study, the researcher submitted the data collection checklist to four experts in the field of obstetrics and gynecology, one of whom was a midwife. The checklist was refined by incorporating the suggestions of the experts. Most of the recommended changes related to minor grammatical errors.

Data Collection Tool

In order to facilitate data collection a checklist (Appendix A) determined to be a questionnaire was put into format to guide with data collection. According to Leedy and Omrod (2010) a checklist is a list of behaviors or characteristics or other entities that a researcher is investigating. The researcher simply checks whether each item on the list is observed, present or true or is not observed, not present or not true. A checklist is different from a questionnaire in the sense that a questionnaire is used for live participants. The checklist consisted of five segments. Namely, sociodemographic characteristics, obstetric characteristics, obstetric complications, preexisting medical conditions and neonatal outcomes.

Sociodemographic factors included age, height, weight, marital status, education of mother, employment status of mother, employment status of spouse, religion, tribe and residence. Obstetric characteristics included parity, total number of antenatal visits and mode of delivery. Obstetric complications included premature rapture of membranes, meconium stained amniotic fluid, UTI, HIV, Hepatitis B, Syphilis, PIH, APH, GDM and PPH. The third segment was on preexisting medical conditions which included hypertension,

asthma, diabetes, sickle cell and psychiatric conditions. Finally the last segment was on neonatal outcomes such as, gestational age, birth outcome, Apgar score at 1 minute, Apgar score at 5 minutes and admission to the neonatal intensive care unit.

Data Collection

Polit and Beck (2004) defined data collection as the gathering of information needed to address a research problem. Data was collected on maternal sociodemographic characteristics, obstetric characteristics, medical history, obstetric complications and neonatal outcomes using a structured checklist. The data were extracted from the patient's antenatal and delivery records. These data sources were pulled manually. Data abstractors need to be carefully selected and trained (Allison et al., 2000; Pan et al., 2005). It is preferable to select abstractors with experience in retrospective research or the area under investigation. To ensure inter-rater reliability it is imperative to have a minimum of two abstractors, but it has been recommended to have four (Allison et al., 2000). Four research assistants who were rotation midwives were trained to collect the data.

Data Collection Procedure

A retrospective evaluation was carried out on women with singleton pregnancies delivering at the Korle- Bu maternity labour ward over a period of three months commencing from September 2013 to November 2013. Data were collected with the help of three trained research assistants.

Information on maternal sociodemographic and prior medical history was obtained from the maternal health record. Data on maternal obstetric characteristics as well as obstetric conditions were obtained from the maternal

health record as well as the partograph and delivery summary sheet. Lastly neonatal characteristics were obtained from the baby form, the delivery summary and the partograph.

Data Analysis

The data were cleaned and coded and analysed according to the research questions. Analysis was performed using SPSS, version 21. Descriptive statistics described the demographic data. Descriptive statistics enable a researcher to reduce, summarize and describe quantitative data obtained from empirical evidence (Polit & Beck, 2008). Inferential statistics i.e. Chi-square tests and odds ratios (ORs) were also used to analyze the data. A p value of < 0.05 was accepted as statistically significant. Univariate logistic regression analyses were used to evaluate the differences in the study outcomes.

The first research question "Does maternal BMI influence neonatal outcomes?" was analyzed in two groups according to the BMI categories of obese and non-obese using Chi-square test and odds ratios. The second research question "What sociodemographic factors of obese mothers influence neonatal outcomes?" was also analyzed using Chi-square test and odds ratios for just the mothers who fell in the obese category. For the third research question "What obstetric characteristics of obese mothers influence neonatal outcomes?" the associations were examined between obstetric characteristics such as total antenatal (ANC) visits, mode of delivery, and parity with neonatal outcomes also using the Chi-square test and odds ratios. Similarly the fourth and fifth research questions "What preexisting medical conditions of obese mothers influence neonatal outcomes; What obstetric complications of

obese mothers influence neonatal outcomes?" were also analyzed with Chi square tests and odds ratio.

Ethical Considerations

The principles of beneficence, justice, non-maleficence and autonomy and confidentiality guided ethical considerations (American Psychological Association, 2002). Research assistants signed consent for confidentiality (Appendix B) before they were trained to ensure protection of confidentiality of materials of subject's information Institutional Review Board (IRB) approval was sought from the University of Cape Coast (Appendix C) and Korle-Bu Teaching Hospital. Introductory letters from the University were obtained to the institution where the study was to be carried out. Consent forms were not required since no active subjects were utilized. Furthermore the checklist used to collect the data contained numbers and no names were used to identify a patient. Data collected was maintained in a locked research cabinet.

Summary

This chapter has presented the tools and methods used to carry out this study. The chapter described cross sectional retrospective survey as the chosen methodology, a checklist as the data collection tool, convenience sampling, study variables and discussed how the sample size was determined. The entire data collection process was also described in detail as well as the various statistical tests employed in answering the research questions. Finally the chapter ended with the ethical considerations for the study. Results and discussion of findings are presented in Chapter 4.

CHAPTER FOUR

FINDINGS AND DISCUSSION

This chapter presents the results of the study. The primary purpose of this retrospective study was to determine neonatal outcomes among obese parturients at the Korle-Bu Teaching Hospital in Accra. It specifically sought to answer the following research questions:

1. Does BMI influence neonatal outcomes?
2. What sociodemographic factors of obese mothers influence neonatal outcomes?
3. What obstetric characteristics of obese mothers influence neonatal outcomes?
4. What preexisting medical conditions of obese mothers influence neonatal outcomes?
5. What obstetric complications of obese mothers influence neonatal outcomes?

Data were gathered on several variables from 748 mothers. The dependent variable in this study was neonatal outcomes such as birth outcome, gestational age of children, Apgar score at 1 minute, Apgar score at 5 minutes and admission to NICU, whilst the covariates were sociodemographic variables, maternal obesity, obstetric characteristics, preexisting medical conditions and obstetric complications of mothers. Chi-square tests and odds ratios (ORs) were used to analyze the data. Figure 2 presents the information on the body mass index (BMI) of mothers. It shows that a significant proportion 212 (28.3%) of the mothers were obese.

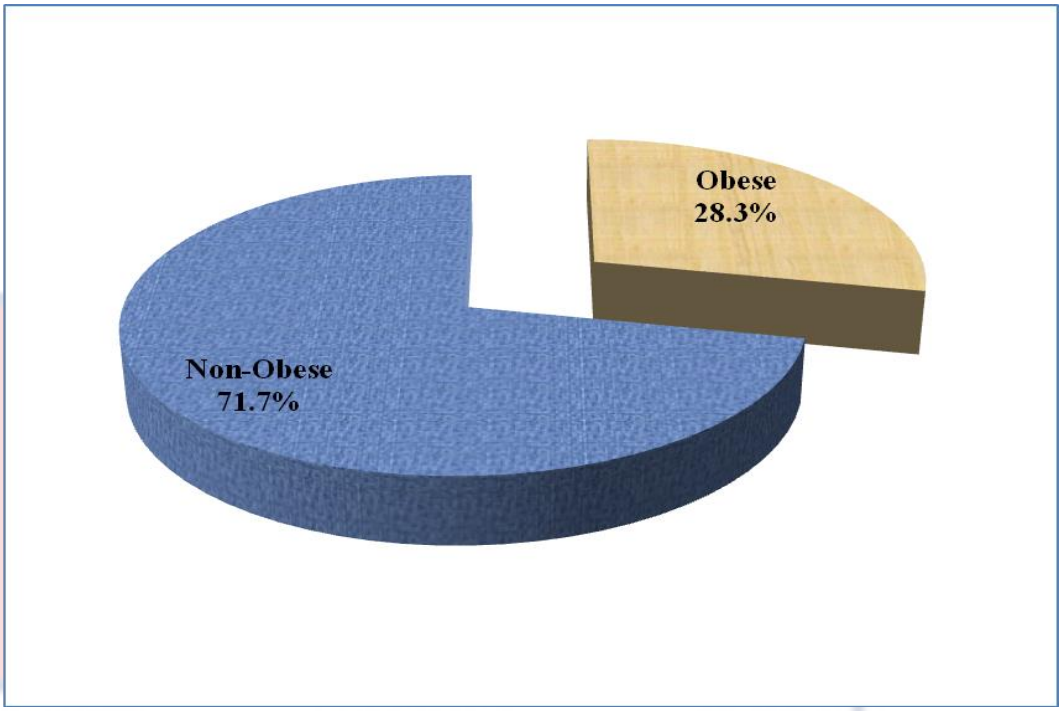

Figure 2: BMI of mothers

Table 1 presents the sociodemographic information of mothers (obese and non-obese) expressed in frequencies and percentages.

Table 1

Sociodemographic Characteristics of Mothers (n=748)

	N=748		Obese [n=212]	Non-obese [n=536]
Variables	No.	%	No. (%)	No. (%)
Age (in years)				
10 – 15	5	0.7	0 (0.0)	5 (100.0)
16 – 20	59	7.9	6 (10.2)	53 (89.8)
21 – 25	152	20.3	30 (19.7)	122 (80.3)
26 – 30	226	30.2	62 (27.4)	164 (72.6)
31 – 35	177	23.7	58 (32.8)	119 (67.2)
36 – 40	114	15.2	50 (43.9)	64 (56.1)
41 – 45	15	2.0	6 (40.0)	9 (60.0)
Marital Status				
Single	530	70.9	164 (30.9)	366 (69.1)
Married	208	27.8	43 (20.7)	165 (79.3)
Div/Sep/Wid	10	1.3	5 (50.0)	5 (50.0)

Table 1 continued.

Educational Level				
No Formal Education	108	14.4	34 (31.5)	74 (68.5)
Primary	102	13.6	30 (29.4)	72 (70.6)
JHS	285	38.1	76 (26.7)	209 (73.3)
SHS	160	21.5	47 (29.4)	113 (70.6)
Tertiary	93	12.4	25 (26.9)	68 (73.1)
Employment Status of Mothers				
Employed	649	86.8	194 (29.9)	455 (70.1)
Unemployed	99	13.2	18 (18.2)	81 (81.8)
Employment Status of Spouse				
Employed	667	89.2	204 (30.6)	463 (69.4)
Unemployed	81	10.8	8 (9.9)	73 (90.1)
Religion				
Christianity	655	87.6	183 (27.9)	472 (72.1)
Islam	92	12.3	29 (31.5)	63 (68.5)
Traditional	1	0.1	0 (0.0)	1 (100.0)
Tribe				
Ga	189	25.3	75 (39.7)	114 (60.3)
Akan	327	43.7	81 (24.8)	246 (75.2)
Ewe	126	16.8	29 (23.0)	97 (77.0)
Northerner	106	14.2	27 (25.5)	79 (74.5)
Residential location				
Rural	45	6.0	11 (24.4)	34 (75.6)
Urban	703	94.0	201 (28.6)	502 (71.4)

Table 1 revealed that 555 (74.2%) of the mothers were aged 21-35 years of which 150 (27.0%) were obese, whiles 64 (8.6%) were within age group of 20 years or less with 6 being obese. Also, out of the 129 (17.2%) who were at least 36 years, 56 representing (43.4%) were obese. It appeared that obesity could have a direct relationship with age as it had higher prevalence

rate among the older population than the relatively younger ones. Additionally, 530 (70.9%) of the mothers who were single, 164 (30.9%) were classified as being obese as 43 (20.7%) being obese among the married mothers. It can be seen that obesity had a higher prevalence rate among unmarried than the married ones. Half of the divorced (Div), separated (Sep) and widowed (Wid) participants were obese.

In terms of educational attainment, a substantial majority 640 (85.6%) were formally educated with about 93 (12.4%) having tertiary education. However, the remaining 108 (14.4%) never had any formal education. Out of the educated women, 178 (27.8%) were obese as against remaining 34 (16.0%) with no formal education, but with obesity. The results revealed that obesity was on the increase among the literates rather than the illiterate mothers.

Furthermore, majority (86.8%) of the mothers were employed as well as 667 (89.2%) of their husbands. Out the mothers who were employed, 194 (29.9%) were obese as against 18 (18.2%) who were unemployed. It, therefore, stands to reason that obesity has higher prevalence rate among mothers with employment than those without employment. Similarly, as many as 204 (30.6%) of women with employed husband were found to be obese, whereas only 8 (9.9%) of those with unemployed husbands were obese. In terms of their religious affiliations, the results also showed that 655 (87.6%) of the mothers were Christians, Muslims (12.3%) and a traditionalist. About 28% of the Christians were obese and 27 (31.5%) of the Muslims were also obese. Similarly, 327 (43.7%) of them were Akans of which 81 (24.8%) were diagnosed as being obese, 189 (25.3%) were Gas among which 75 (39.7%)

were obese, 126 (16.8%) were Ewes including 29 (23.0%) being obese and northerners (14.2%) with 27 (25.5%) being obese. The prevalence rate of obesity was relatively higher among the Gas compared to other tribes.

Additionally, 703 (94.0%) of the mothers resided in urban areas as against only 6% from rural localities. Obesity was found to be more prevalent among the urban dwellers than the rural ones as the results indicated that out of the 703 urban residents, 201 (28.6%) were obese as against 11 (24.4%) of the rural dwellers.

Research Question 1: Does maternal BMI influence neonatal outcomes?

This research question sought to investigate the influence of obesity on neonatal outcomes such as birth outcome, gestational age of children, Apgar scores, and admission to NICU.

Table 2

Influence of BMI on Neonatal Outcomes n= (748)

		Birth Outcome							
		Live birth	Stillbirth	Chi-		*p*-	Odds	**95% C.I.**	
Variable	Response	(n=703)	(n=45)	Square	df	value	Ratio	Lower	Upper
BMI	**Obese**	**194**	**18**	**3.204**	**1**	**.043**	**0.6**	**0.31**	**1.06**
	Non-obese	509	27						

		Gestational Age								
		Pre-term	Term	Post-term					**95% C.I.**	
Variable	Response	(n=114)	(n=510)	(n=124)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
BMI	Obese	28	148	36	0.947	2	.623	-	-	-
	Non-obese	68	362	88						

		Apgar Score at 1 Minute							
		<7	≥7	Chi-		*p*-	Odds	**95% C.I.**	
Variable	Response	(n=748)	(n=0)	Square	df	value	Ratio	Lower	Upper
BMI	Obese	212	0	0.000	3	1.000	-	-	-
	Non-obese	536	0						

		Apgar Score at 5 Minutes							
		<7	≥7	Chi-		*p*-value	Odds	**95% C.I.**	
Variable	Response	(n=748)	(n=10)	Square	df		Ratio	Lower	Upper
BMI	Obese	209	3	0.014	1	.907	0.9	0.24	3.60
	Non-obese	529	7						

		Admission to NICU							
		Yes	No	Chi-		*p*-	Odds	**95% C.I.**	
Variable	Response	(n=158)	(n=590)	Square	df	value	Ratio	Lower	Upper
BMI	Obese	46	166	0.051	1	.809	1.0	0.71	1.55
	Non-obese	112	424						

Table 2 revealed that BMI was statistically significant in relation to birth outcomes (*p*-value 0.043, OR 0.600). Specifically obese mothers were 40% less likely to have live births compared to those who were non-obese. BMI in relation to gestational age, Apgar scores and admission to NICU were not statistically significant. Also, although admission to NICU as well as gestational age, Apgar score at 1 minute and 5 minutes were not significantly influenced by BMI, they had relatively high odds ratio. Among the mothers, 46 (29.1%) obese neonates were admitted to the NICU compared to 112 (70.9%) non-obese. An odds ratio of 1.00 was obtained; implying that there was an equal likelihood of having live births among the two categories of mothers. In conclusion, the BMI of obese mothers significantly influenced their birth outcomes only.

Research Question 2: What sociodemographic factors of obese mothers influence neonatal outcomes?

The aim of this research question was to identify the personal factors of the obese mothers who delivered at the Korle-Bu Teaching Hospital that influenced their neonatal outcomes. These outcomes included birth outcome, gestational age, Apgar scores and admission to NICU. As shown in Table 3, out of the 212 obese mothers, 91.5% had live births as against 8.5% with stillbirths.

Table 3

Influence of Sociodemographic Characteristics on Birth Outcome of Obese Mothers n= (212)

		Birth Outcome							
		Live birth	Stillbirth	Chi-			Odds	95% C.I.	
Variable	Response	(n=194)	(n=18)	Square	df	p-value	Ratio	Lower	Upper
Age	**10 – 15**	**0**	**0**	**2.270**	**6**	**.044**	-	-	-
	16 – 20	5	1				2.0	0.13	29.81
	21 – 25	29	1				11.6	0.88	-
	26 – 30	59	3				7.9	1.06	58.63
	31 – 35	55	3				7.3	0.98	54.74
	36 – 40	41	9				1.8	0.30	10.93
	41 – 45 (reference)	5	2						
Marital Status	Single (reference)	152	12	2.406	2	.300			
	Married	37	6				50.7	23.57	-
	Divorced/Separated/Widowed	5	0						
Educational Level	No Formal Education	29	5	4.365	4	.359	0.2	0.03	2.21
	Primary	26	4				0.3	0.03	2.60
	JHS	70	6				0.5	0.06	4.25
	SHS	45	2				0.9	0.08	10.88
	Tertiary (reference)	24	1						
Employment status of mothers	Employed	177	17	0.218	1	.641	0.6	0.08	4.89
	Unemployed (reference)	17	1						

Table 3 continued.

Employment status of spouses	Employed	187	17	0.172	1	.678	1.6	0.18	13.54
	Unemployed (reference)	7	1						
Religion	Christianity	167	16	0.109	1	.947	0.8	0.17	3.55
	Islam (reference)	27	2						
	Traditional	0	0						
Tribe	Ga	69	6	0.513	3	.916	1.4	0.33	6.20
	Akan	75	6				1.6	0.36	6.73
	Ewe	26	3				1.1	0.20	5.89
	Northerner (reference)	24	3						
Residential location	**Rural**	**8**	**3**	**5.268**	**1**	**.022**	**0.2**	**0.05**	**0.90**
	Urban (reference)	186	15						

From Table 3, it can be seen that out of the nine sociodemographic characteristics, only two were significantly associated with neonatal outcome (birth outcome) at 5% significance level. These were the age of the mothers (*p*-value 0.044) and their residential locations (*p*-value 0.022). Specifically, with respect to their ages, it was revealed that out of the 148 obese mothers aged 10-35 years, 8 (5.4%) had stillbirths. Similarly, among the older mothers, 11 (23.9%) also had stillbirths. A Chi-square value of 12.270 with a *p*-value of .044 was obtained; indicating that there was a significant association.

In terms of the odds ratio, obese mothers aged 16-20 years were 2.0 times (95% CI=0.13-29.81) more likely to have a live birth compared to those aged 41-45 years. Similarly, those aged 21-25, 26-30, 31-35, and 36-40 years respectively were 11.6, 7.9 (95% CI=1.06-58.63), 7.3 (95% CI=0.98-54.74) and 1.8 (95% CI=0.30-10.93) times more likely to deliver have live births than those aged 41-45 years. It can be seen that the odds ratios decreased as obese mothers advanced in age.

In terms of their residential locations, among the 11 rural residents, 3 (27.3%) had stillbirths. Also, obese mothers who resided in urban areas had 15 (7.5%) stillbirths as against 186 (92.5%) live births. This variable was a significant risk factor in birth outcome since its *p*-value was 0.02. The odds ratio also revealed that rural dwellers were as much as 80% less likely of having live births compared to those from the urban areas.

Other covariates, although insignificant associated with birth outcome, had important odds ratios. For example, highly educated obese mothers had higher chances of delivering live babies than their less educated or uneducated counterparts. Also, obese mothers with employed husbands were 1.6 times more hopeful of having live births than mothers with husbands without jobs. With reference to their tribes,

obese mothers from the Akan tribe had higher chance (1.6, 95% CI=0.36-6.73) vis-à-vis northerners. Similarly, Gas (1.4, 95% CI=0.33-6.20) and Ewes (1.1, 95% CI=0.20-5.89) were also more likely to have more live births compared to their northern counterparts.

Similarly, the relationship between gestational age at birth of obese mothers and their sociodemographic characteristics were examined. Table 4 presents a summary of the results. The results showed that none of the nine sociodemographic variables were significantly associated with gestational age. This is because their *p*-values were individually greater than the 5% significance level.

Table 4

Influence of Sociodemographic Characteristics on Gestational Age at delivery among Obese Mothers n= (212)

		Gestational Age at delivery					
Variable	Response	Pre-term (n=28)	Term (n=148)	Post-term (n=36)	Chi-Square	df	*p*-value
Age	10 – 15	0	0	0	18.111	12	.112
	16 – 20	0	5	1			
	21 – 25	2	25	3			
	26 – 30	5	40	17			
	31 – 35	7	40	10			
	36 – 40	13	32	5			
	41 – 45	1	5	0			
Marital Status	Single	24	113	27	3.087	4	.543
	Married	3	31	9			
	Divorced/Separated/Widowed	1	4	0			
Educational Level	No Formal Education	6	25	3	6.820	8	.556
	Primary	4	23	3			
	JHS	12	48	16			
	SHS	5	33	9			
	Tertiary	1	19	5			
Employment	Yes	27	133	34	1.786	2	.409
	No	1	15	2			

Table 4 continued.

Employment of spouse	Yes	27	144	33	2.532	2	.282
	No	1	4	3			
Religion	Christianity	25	126	32	0.586	4	.965
	Islam (reference)	3	22	4			
	Traditional	0	0	0			
Tribe	Ga	10	49	16	2.283	6	.892
	Akan	11	57	13			
	Ewe	3	22	4			
	Northerner	4	20	3			
Residential location	Rural	3	8	0	3.722	2	.156
	Urban	25	140	36			

Table 5

Influence of Sociodemographic Characteristics on Apgar Score at 1 minute among Obese Mothers n= (212)

		Apgar Score at 1 minute				
Variable	Response	< 7 (n=212)	≥ 7 (n=0)	Chi-Square	df	*p*-value
Age	10 – 15	0	0	0.000	6	1.000
	16 – 20	6	0			
	21 – 25	30	0			
	26 – 30	62	0			
	31 – 35	58	0			
	36 – 40	50	0			
	41 – 45	6	0			
Marital Status	Single	164	0	0.000	2	1.000
	Married	43	0			
	Divorced/Separated/Widowed	5	0			
Educational Level	No Formal Education	34	0	0.000	4	1.000
	Primary	30	0			
	JHS	76	0			
	SHS	47	0			
	Tertiary	25	0			
Employment status of mother	Yes	194	0	0.000	1	1.000
	No	18	0			
Employment status of spouse	Yes	204	0	0.000	1	1.000
	No	8	0			

Table 5 continued.

Variable	Response	<7 (n=212)	≥ 7 (n=0)	Chi- Square	df	*p*-value
Religion	Christianity	183	0	0.000	2	1.000
	Islam	29	0			
	Traditional	0	0			
Tribe	Ga	75	0	0.000	3	1.000
	Akan	81	0			
	Ewe	29	0			
	Northerner	27	0			
Residential location	Rural	11	0	0.000	1	1.000
	Urban	201	0			

Table 5 presents the nature of association between the sociodemographic characteristics of the obese mothers and the Apgar score of their babies a minute after delivery. The results revealed that there was no significant association between these factors and the Apgar scores at 1 minute after delivery. [Age (*p*-value 1.00), marital status (*p*-value 1.00), educational level (*p*-value 1.00), employment status of mother (*p*-value 1.00), employment status of spouse (*p*-value 1.00), religion (*p*-value 1.00), tribe (*p*-value 1.00) and residential location (*p*-value 1.00)].

Table 6

Influence of Sociodemographic Characteristics on Apgar score at 5 minutes among Obese Mothers n= (212)

Variable	Response	Apgar Score at 5 minutes			Chi-Square	df	*p*-value	Odds Ratio	95% C.I.	
		< 7 (n=209)	≥ 7 (n=3)						Lower	Upper
Age	10 – 15	0	0		3.927	6	.687	-	-	-
	16 – 20	6	0					-	-	-
	21 – 25	30	0					-	-	-
	26 – 30	62	0					-	-	-
	31 – 35	57	1					2.4	0.21	27.0
	36 – 40 (reference)	48	2							
	41 – 45	6	0					-	-	-
Marital Status	Single	161	3		0.891	2	.641	-	-	-
	Married	43	0					-	-	-
	Divorced/Separated/Widowed	5	0					-	-	-
Educational Level	No Formal Education	33	1		3.458	4	.484	1.4	0.08	23.10
	Primary	30	0					-	-	-
	JHS	76	0					-	-	-
	SHS	46	1					1.9	0.11	32.01
	Tertiary (reference)	24	1							
Employment status of mother	Employed	191	3		0.402	1	.940	1.0	0.19	4.77
	Unemployed	18	0							
Employment status of spouse	Employed	201	3		0.199	1	.730	-	-	-
	Unemployed	8	0							

Table 6 continued.

Variable	Response	< 7 (n=209)	≥ 7 (n=3)	Chi-Square	df	*p*-value	Odds ratilo	**95%** Lower	**CI** Upper
Religion	Christianity	180	3	0.482	2	.786	-	-	-
	Islam (reference)	29	0				-	-	-
	Traditional	0	0						
Tribe	Ga	74	1	1.269	3	.736	2.6	0.16	43.71
	Akan	80	1				2.9	0.17	47.22
	Ewe (reference)	28	1				-	-	-
	Northerner	27	0						
Residential location	Rural	11	0	0.167	1	.683	-	-	-
	Urban	198	3						

Similar to the results in Table 5, Table 6 also shows that there were no sociodemographic characteristics which were statistically associated with Apgar score of babies of obese mothers 5 minutes after delivery. However, with reference to their educational attainment, those with no formal education were 1.4 (with 95% CI=0.08-23.10) times likely to have babies with low Apgar scores than those with tertiary education. Similarly, secondary school leavers had almost 2 times chance of having a neonate with a low Apgar score compared to those with tertiary education.

Table 7

Influence of Sociodemographic Characteristics on Admission to NICU among Obese mothers n = (212)

Variable	Response	Admission to NICU		Chi-Square	df	*p*-value	Odds Ratio	95% C.I.	
		Yes (n=46)	No (n=166)					Lower	Upper
Age	10 – 15	0	0	5.812	6	.446	-	-	-
	16 – 20	0	6				-	-	-
	21 – 25	5	25				0.5	0.16	1.61
	26 – 30	16	46				0.9	0.39	2.07
	31 – 35	11	47				0.6	0.24	1.48
	36 – 40 (reference)	14	36						
	41 – 45	0	6				-	-	-
Marital Status	Single	39	125	3.971	2	.137	0.5	0.08	2.90
	Married	5	38				0.2	0.03	1.48
	Divorced/Separated/Widowed (reference)	2	3						
Educational Level	No Formal Education	4	30	4.592	4	.332	0.3	0.09	1.34
	Primary	6	24				0.6	0.18	2.24
	JHS	15	61				0.6	0.22	1.79
	SHS	14	33				1.1	0.37	3.19
	Tertiary (reference)	7	18			……			
Employment status of mother	Employed	43	151	0.293	1	.588	1.4	0.39	5.15
	Unemployed	3	15						

Table 7
continued.

Employment status of spouse	Employed	43	161	1.222	1	.269	0.4	0.10	1.94
	Unemployed	3	5						
Religion	Christianity	42	141	1.236	2	.539	0.5	0.18	1.63
	Islam (reference)	4	25						
	Traditional	0	0				-	-	-
Tribe	Ga	15	60	0.893	3	.827	1.1	0.38	3.38
	Akan	18	63				1.3	0.42	3.79
	Ewe	8	21				1.7	0.47	5.95
	Northerner (reference)	5	22						
Residential location	Rural	2	9	0.084	1	.771	0.8	0.17	3.88
	Urban	44	157						

It can be said based on the results from Table 7 that admission to NICU was not determined by the sociodemographic variables of the obese mothers since none of these factors were significantly related to it. However, the odds ratios were important to explain.

With respect to their ages, the likelihood of those aged 21-25 years being admitted to NICU was half less than those aged 31-35 years. Also, those aged 26-30 years and 31-35 years were 10% (95% CI=0.39-2.07) and 40% (95% CI=0.24-1.48), respectively less likely of being admitted to NICU than the older obese mothers.

According to their marital status, 39 of the unmarried mothers had their babies admitted to the NICU as against 125 who were not. They, however, had less likelihood of admission to NICU compared to those who were divorced, separated or widowed. Those of the obese mothers who were married were 80% (OR=0.2, CI=0.03-1.48) less likely to have their babies admitted to the NICU at the hospital than those who were divorced, separated or widowed.

The employed obese mothers were at higher risk of having their babies being admitted to the NICU than those who were unemployed. This is because the odds ratio was 1.4 (95% CI=0.39-5.15). However, obese mothers with employed husbands were 60% less likely (OR=0.4, CI=0.18-1.63) to have their babies admitted to the NICU than those with jobless husbands. Also, northerners were less likely to have their babies being admitted to the NICU than other obese tribes.

Research Question 3: What obstetric characteristics of obese mothers influence neonatal outcomes?

This research question sought to identify those obstetric characteristics that influence neonatal outcomes (including birth outcome, gestational age, APGAR scores and admission to NICU) among obese mothers. The associations were examined between obstetric characteristics such as total antenatal (ANC) visits, mode of delivery, and parity and neonatal outcomes were estimated using the Chi-square test and odds ratios.

Table 8

Influence of Obstetric Characteristics on Birth Outcomes of Obese Mothers n= (212)

		Birth Outcomes						95% C.I.	
Variable	Response	Live birth (n=194)	Stillbirth (n=18)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
ANC visits	**1 – 2**	**8**	**8**	**40.568**	**2**	**.000**	**0.0**	**0.01**	**0.13**
	3 – 4	44	5				0.4	0.10	1.51
	5 and more	142	5						
Mode of delivery	SVD	101	13	4.198	2	.123	1.9	0.20	18.73
	C/S	89	4						
	AVD	4	1						
Parity	Zero	41	3	4.023	3	.260	0.8	0.21	3.19
	1 – 2	101	9				0.4	0.10	1.78
	3 – 4 (reference)	34	6						
	5 and more	18	0				-	-	-

From Table 8, ANC visits were seen to be significantly associated with birth outcomes (*p*-value 0.00, OR 0.00). Descriptively, among the 16 obese mothers who attended antenatal clinic between 1 and 2 times, half of them had live births, whiles the remaining half had stillbirths. Similarly, 44 of the 49 women who visited the antenatal for 3-4 times had live births as against 5 who had stillbirths. Also, as many as 142 (96.6%) of obese mothers who went to antenatal clinic for at least 5 times had live births, while the remaining had stillbirths. Furthermore, the Chi-square test produced an associated *p*-value of .000. From the odds ratios, obese mother who visited the antenatal clinic for 1-2 times were 100% less likely to have live births compared to those who attended 5 or more times. Similarly, those who attended between 3-4 times had 60% less chance of having live births compared to those who attended for 5 or more times.

Although the mode of delivery was insignificantly related to birth outcome (*p*-value 0.123) some modes of delivery had relatively higher chances of having live births than the others. Specifically, those who delivered through SVD were almost twice more likely to have live births compared to those who delivered by AVD. Also, there was a 5.6 times (CI=0.50-61.90) greater chance of having live births among those who went through C/S compared to those obese mothers who went through the AVD. Live birth was more common among those obese mothers with 5 or more children than first-time mothers, and those with 1-2 and 3-4 children.

Table 9

Influence of Obstetric Characteristics on Gestational Age at Delivery Among Obese Mothers n= (212)

Variable	Response	Gestational Age			Chi-Square	df	*p*-value
		Pre-term (n=28)	Term (n=148)	Post-term (n=36)			
ANC visits	**1 – 2**	**7**	**7**	**2**	**18.071**	**4**	**.001**
	3 – 4	9	34	6			
	5 and more	12	107	28			
Mode of delivery	SVD	13	83	18	1.257	4	.869
	C/S	14	62	17			
	AVD	1	3	1			
Parity	Zero	4	33	7	4.468	6	.614
	1 – 2	16	72	22			
	3 – 4	7	28	5			
	5 and more	1	15	2			

From Table 9 it can be seen that antenatal visits by obese mothers had significant impact on the gestational ages of their pregnancies (p-value 0.001). Other obstetric characteristics were not statistically significant. [Mode of delivery (*p*-value 0.869) and parity (*p*-value 0.614)].

Antenatal visits had a Chi-square value of 24.937 with *p*-value .001. Among those who visited the antenatal clinic between 1-2 times, were 7 pre-term deliveries as against 7 and 2 term and post-term deliveries, respectively. A larger number of those who visited the clinic more times had term deliveries.

Table 10

Influence of Obstetric Characteristics on Apgar Score at 1 Minute Among Obese Mothers n= (212)

		Apgar Score at 1 Minute						95% C.I.	
Variable	Response	<7 (n=212)	≥7 (n=0)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
ANC visits	1 – 2	16	0	0.000	2	1.000	-	-	-
	3 – 4	49	0						
	5 and more	147	0						
Mode of Delivery	SVD	114	0	0.000	2	1.000	-	-	-
	C/S	93	0						
	AVD	5	0						
Parity	Zero	44	0	0.000	3	1.000	-	-	-
	1 – 2	110	0				-	-	-
	3 – 4	40	0				-	-	-
	5 and more	18	0						

Table 10 shows that antenatal visits, mode of delivery and parity of obese mothers were not significant in determining the Apgar scores of their babies. They all had Chi-square value of 0.000 and an associated *p*-value of 1.000. This revelation implied that an obese mother could have her baby scoring below 7 or at least 7 after a minute of delivery regardless of the number of antenatal visits she attends. Similarly, regardless of the mode of delivery, an obese mother could have a baby scoring higher or lower than 7 after a minute of delivery. In the same vein, the parity of an obese mother would interfere in whether her neonate will have a low or high Apgar score after a minute of delivery.

Table 11

Influence of Obstetric Characteristics on Apgar Score at 5 Minutes Among Obese Mothers n= (212)

Variable	Response	Apgar Score at 5 Minutes <7 (n=209)	≥7 (n=3)	Chi-Square	df	*p*-value	Odds Ratio	95% C.I. Lower	95% C.I. Upper
ANC Visits	1 – 2	16	0	0.370	2	.831	-	-	-
	3 – 4	48	1				0.7	0.06	7.46
	5 and more	145	2						
Mode of Delivery	SVD (reference)	112	2	0.243	2	.886			
	C/S	92	1				1.6	0.15	18.44
	AVD	5	0				-	-	-
Parity	Zero	44	0	3.383	3	.336	-	-	-
	1 – 2	109	1				6.4	0.38	-
	3 – 4	39	1				2.3	0.14	38.87
	5 and more (ref)	17	1						

With respect to the influence of obstetric characteristics on the Apgar score of babies after 5 minutes, it can be seen from Table 11 that ANC visits (*p*-value 0.831), mode of delivery (*p*-value 0.886) and parity (*p*-value 0.336) were not significant predictors. However, those who visited the clinic more frequently had a higher likelihood of having babies that scored more than 7 in 5 minutes after delivery compared to those who visited less number of times. Also, the obese multiparous woman who had between 1-2 and 3-4 children already respectively were 6.4 and 2.3 (CI=0.14-38.87) times more likely of having babies who score below 7 in 5 minutes after delivery compared to mothers with 5 or more children.

Table 12

Influence of Obstetric Characteristics on Admission to NICU Among Obese Mothers n= (212)

		Admission to NICU						95% C.I.	
Variable	Response	Yes (n=46)	No (n=166)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
ANC visits	1 – 2	4	12	1.112	2	.573	1.4	0.41	4.51
	3 – 4	13	36				1.5	0.69	3.12
	5 and more (ref)	29	118						
Mode of delivery	**SVD**	**17**	**97**	**7.020**	**2**	**.030**	**0.3**	**0.04**	**1.69**
	C/S	27	66				0.6	0.10	3.88
	AVD (reference)	2	3						
Parity	Zero	12	32	2.868	3	.412	1.3	0.36	4.79
	1 – 2	25	85				1.0	0.31	3.41
	3 – 4	5	35				0.5	0.12	2.14
	5 and more (ref)	4	14						

Table 12 shows that only the mode of delivery was statistically significantly associated with admission to NICU among the obese mothers (*p*-value 0.30). Here, of the 114 obese mothers delivered through SVD method, 17 of them had their babies been admitted to NICU. Also, 27 (29.0%) obese mothers taken through C/S had their babies admitted to the NICU, and 2 (40.0%) of the obese mothers delivered through the AVD method also had their babies admitted after the delivery. The results showed that obese mothers who were delivered via SVD and C/S were 70% (OR=0.3, 95% CI=0.04-1.69) and 40% (OR=0.6, 95% CI=0.10-3.88) less likely to have their babies admitted to the NICU, respectively. This means that less risk was associated with SVD and C/S modes of deliveries than AVD. In terms of odds ratios, those who attended antenatal clinic between 1-2 and 3-4 times respectively had 40% and 50% chances of having their babies admitted to the NICU compared to those who had 5 or more visits. Again, obese mothers with 1-2 paritys, respectively were associated with 30% (OR=1.3, 95% CI=0.36-4.79) and 0.0% (OR=0.0, 95% CI=0.31-3.41) likelihood of having their babies admitted to the NICU compared to those with 5 or more children already.

Research Question 4: What preexisting medical conditions of obese mothers influence neonatal outcomes?

The aim of this research question was to identify the preexisting medical conditions that might affect the neonatal outcomes such as birth outcome, gestational age, Apgar scores and admission to NICU. Preexisting medical conditions examined included hypertension, asthma, sickle cell, psychiatric disorders and diabetes among obese mothers.

Table 13

Influence of Preexisting Medical Conditions on Birth Outcome of Obese Mothers n= (212)

		Birth Outcome						95% C.I.	
Variable	Response	Live birth (n=194)	Stillbirth (n=18)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
Hypertension	Yes	18	1	0.270	1	.597	1.7	0.22	13.84
	No	176	17						
Asthma	Yes	6	1	0.313	1	.576	0.5	0.06	4.74
	No	188	17						
Sickle cell	Yes	6	1	0.313	1	.576	0.5	0.06	4.74
	No	188	17						
Psychiatric	Yes	0	0	0.000	1	1.000	-	-	-
	No	194	18						
Diabetes	Yes	0	0	0.000	1	1.000	-	-	-
	No	194	18						

Results from Table 13 revealed that none of the five preexisting medical conditions was significantly associated with birth outcomes. This is because their respectively *p*-values were greater than the significance level of 5%.

However, the odds ratio for hypertension obese mothers showed that those with hypertension were 1.7 times more likely to have live births compared to those without such a condition (95% CI=0.22-13.84). With respect to asthmatic and sickle cell obese mothers, they each had 50% less chances of having live births than those without asthma (OR=0.5, 95% CI=0.06-4.77) and sickle cell (OR=0.5, 95% CI=0.06-4.77).

Also from Table 14, there was no preexisting medical condition that significantly influenced the gestational age of pregnancies of the obese mothers. This means that these conditions might not seriously determine the duration of the pregnancies of the obese mothers.

Table 14

Influence of Preexisting Medical Conditions on Gestational Age at delivery among Obese Mothers n= (212)

		Gestational Age					
Variable	Response	Pre-term (n=28)	Term (n=148)	Post-term (n=36)	Chi-Square	df	*p*-value
Hypertension	Yes	3	13	3	0.129	2	.938
	No	25	135	33			
Asthma	Yes	1	4	2	0.745	2	.689
	No	27	144	34			
Sickle Cell	Yes	0	7	0	3.130	2	.209
	No	28	141	36			
Psychiatric	Yes	0	0	0	0.000	2	1.000
	No	28	148	36			
Diabetes	Yes	0	0	0	0.000	2	1.000
	No	28	148	36			

Table 15

Influence of Preexisting Medical Conditions on Apgar Score at 1 Minute among Obese Mothers n= (212)

		Apgar Score at 1 Minute						95% C.I.	
Variable	Response	<7 (n=212)	≥ 7 (n=0)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
Hypertension	Yes	19	0	0.000	1	1.000	-	-	-
	No	193	0						
Asthma	Yes	7	0	0.000	1	1.000	-	-	-
	No	205	0						
Sickle cell	Yes	7	0	0.000	1	1.000	-	-	-
	No	205	0						
Psychiatric	Yes	0	0	0.000	1	1.000	-	-	-
	No	212	0						
Diabetes	Yes	0	0	0.000	1	1.000	-	-	-
	No	212	0						

It can be seen from Table 15 that hypertension (*p*-value 1.000), asthma (*p*-value 1.000), sickle cell (*p*-value 1.000), psychiatric disorders (*p*-value 1.000) and diabetes (*p*-value 1.000) among the obese mothers did not significantly determine the Apgar score at 1 minute.

Similarly as seen in Table 16, no preexisting medical condition was seen to significantly influence the Apgar scores at 5 minutes of babies born to the obese mothers. Specifically, among those with hypertension, there was an 80% (OR=0.2, 95% CI=0.02-2.18) less likelihood of having an Apgar score less than 7 in 5 minutes compared to those without such condition.

Table 16

Influence of Preexisting Medical Conditions on Apgar Score at 5 Minutes among Obese Mothers n= (212)

		Apgar Score at 5 Minutes						95% C.I.	
Variable	Response	<7 (n=209)	≥ 7 (n=3)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
Hypertension	Yes	18	1	2.215	1	.137	0.2	0.02	2.18
	No	191	2						
Asthma	Yes	7	0	0.104	1	.747	-	-	-
	No	202	3						
Sickle cell	Yes	7	0	0.104	1	.747	-	-	-
	No	202	3						
Psychiatric	Yes	0	0	0.000	1	1.000	-	-	-
	No	209	3						
Diabetes	Yes	0	0	0.000	1	1.000	-	-	-
	No	209	3						

Table 17

Influence of Preexisting Medical Conditions on Admission to NICU among Obese Mothers n= (212)

		Admission to NICU						95% C.I.	
Variable	Response	Yes (n=46)	No (n=166)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
Hypertension	Yes	3	16	0.429	1	.513	0.7	0.18	2.35
	No	43	150						
Asthma	Yes	1	6	0.234	1	.629	0.6	0.07	5.05
	No	45	160						
Sickle cell	Yes	0	7	2.001	1	.157	-	-	-
	No	46	159						
Psychiatric	Yes	0	0	0.000	1	1.000	-	-	-
	No	46	166						
Diabetes	Yes	0	0	0.000	1	1.000	-	-	-
	No	46	166						

Again, the preexisting medical conditions were not significantly related to being admitted to the Neonatal Intensive Care Unit (NICU) as revealed in Table 17. Hypertension (*p*-value 0.513), asthma (*p*-value 0.629), sickle cell (*p*-value 0.157), psychiatric (*p*-value 1.000) and diabetes (*p*-value 1.000). In conclusion, the results showed that no preexisting medical condition was statistically significantly associated with any neonatal outcomes.

Research Question 5: What obstetric complications of obese mothers influence neonatal outcomes?

The study through this research question attempted to identify the various obstetric complications which significantly affect neonatal outcomes such as birth outcome, gestational age, Apgar scores and admission to NICU among obese mothers who had delivered at the Korle-Bu Teaching Hospital in Accra. The obstetric complications included premature rapture of membranes (PROM), meconium stained amniotic fluid (MSAF), urinary tract infection, HIV, syphilis, and hepatitis B, among others.

Table 18

Influence of Obstetric Complications on Birth Outcomes among Obese Mothers n= (212)

		Birth Outcomes						95% C.I.	
Variable	Response	Live birth (n=194)	Stillbirth (n=18)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
Premature Rapture of Membranes (PROM)	Yes	22	3	0.449	1	.503	0.6	0.17	2.39
	No	172	15						
Meconium Stained Amniotic Fluid (MSAF)	Yes	24	4	0.238	1	.238	0.5	0.15	1.63
	No	170	14						
Urinary Tract Infection	**Yes**	**48**	**1**	**3.412**	**1**	**.044**	**5.6**	**0. 72**	**43.11**
	No	146	17						
HIV	Yes	4	0	0.378	1	.539	-	-	-
	No	190	18						
Syphilis	Yes	2	0	0.187	1	.665	-	-	-
	No	192	18						
Hepatitis B	Yes	5	1	0.531	1	.466	0.4	0.05	4.07
	No	189	17						

Table 18 continued.

Gestation diabetes	Yes	5	0	0.475	1	.491	-	-	-
	No	189	18						
Antepartum hemorrhage	Yes	3	0	1.218	1	.269	-	-	-
	No	191	18						
Post-partum hemorrhage	Yes	4	1	0.873	1	.350	0.4	0.04	3.38
	No	190	17						
Hyperemesis gravidaruum	Yes	1	0	0.09	1	.760	-	-	-
	No	193	18						
Pregnancy Induced Hypertension (PIH)	Yes	33	5	1.298	1	.255	0.5	0.18	1.60
	No	161	13						

Table 18 shows that only one of the obstetric complications UTI significantly influenced the birth outcome among obese mothers. It had a relatively lower *p*-value of 0.044 compared to 5% significance level. Among those with urinary tract infection, 48 of them had live births as against a stillbirth. However, among the obese mothers who had no UTI, as many as 17 of them had stillbirths. The odds ratio indicated that those with UTI had as much as 5.6 times (OR=5.6, 95% CI=0.72-43.11) of having live births compared to those without UTI.

Although the other obstetric complications were statistically insignificantly associated with birth outcomes, there are some odds ratios that are intriguing to pinpoint. First, obese mothers with PROM had 40% chance of having live births compared to those without this complication. Similarly, those with meconium stained amniotic fluid (MSAF) were 50% less likely of having their babies alive relative to those without it. Also, hepatitis B infected obese mothers were 60% (OR=0.4, CI=0.05-4.07) less likely to have live births compared to their other counterparts.

With respect to those obese mothers with post-partum hemorrhage complication, there was a 60% (OR=0.4, CI=0.04-3.38) less chance of them giving birth safely compared to those without such complication. Similarly, mothers with PIH stood higher chances of having stillbirth compared to those without PIH.

Table 19

Influence of Obstetric Complications on Gestational Age at Delivery among Obese Mothers n= (212)

		Gestational Age					
Variable	Response	Pre-term (n=28)	Term (n=148)	Post-term (n=36)	Chi-Square	df	*p*-value
Premature Rapture of Membranes (PROM)	**Yes**	**4**	**18**	**3**	**6.975**	**2**	**.031**
	No	24	130	33			
Meconium stained amniotic fluid	Yes	2	19	7	2.138	2	.343
	No	26	129	29			
Urinary Tract Infection	Yes	4	36	9	1.422	2	.491
	No	24	112	27			
HIV	Yes	0	3	1	0.709	2	.702
	No	28	145	35			
Syphilis	Yes	0	2	0	0.873	2	.646
	No	28	146	36			
Hepatitis B	Yes	1	5	0	1.266	2	.531
	No	27	143	36			
Gestation diabetes	Yes	1	4	0	1.266	2	.533
	No	27	144	36			

Table 19 continued.

Antepartum hemorrhage	**Yes**	**2**	**1**	**0**	**7.681**	**2**	**.022**
	No	26	147	36			
Post-partum hemorrhage	Yes	1	3	1	0.277	2	.871
	No	27	145	35			
Hyperemesis gravidaruum	Yes	0	1	0	0.435	2	.871
	No	28	147	36			
Pregnancy Induced Hypertension	**Yes**	**12**	**20**	**6**	**13.827**	**2**	**.001**
	No	16	128	30			

From Table 19, it can be seen that three obstetric complications among obese mothers significantly influenced the gestational ages of their pregnancies. These include premature rapture of membranes (*p*-value 0.031), antepartum hemorrhage (*p*-value 0.022) and pregnancy induced hypertension (*p*-value 0.001). Specifically, when an obese mother had premature rapture of membranes (PROM), it influenced her baby's gestational age at birth. Among the obese mothers with this complication, 4 of them had pre-term, term (18) and post-term (3), whiles those without the complication had as many as 130 having term gestational age.

Also from Table 20, none of the 11 obstetric complications was found to be significantly association with the Apgar score at 1 minute after delivery. Similarly from Table 21, the study found no significant association between Apgar score at 5 minutes and the obstetric complications investigated.

Table 20

Influence of Obstetric Complications on Apgar Score at 1 Minute among Obese Mothers n= (212)

		Apgar Score at 1 Minute						95% C.I.	
Variable	Response	<7 (n=212)	≥7 (n=0)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
Premature Rapture of Membranes (PROM)	Yes	25	0	0.000	1	1.000	-	-	-
	No	187	0						
Meconium stained amniotic fluid (MSAF)	Yes	28	0	0.000	1	1.000	-	-	-
	No	184	0						
Urinary Tract Infection	Yes	49	0	0.000	1	1.000	-	-	-
	No	163	0						
HIV	Yes	4	0	0.000	1	1.000	-	-	-
	No	208	0						
Syphilis	Yes	2	0	0.000	1	1.000	-	-	-
	No	210	0						
Hepatitis B	Yes	6	0	0.000	1	1.000	-	-	-
	No	206	0						
Gestation diabetes	Yes	5	0	0.000	1	1.000	-	-	-
	No	207	0						
Antepartum hemorrhage	Yes	3	0	0.000	1	1.000	-	-	-
	No	209	0						

Table 20 continued.

Post-partum hemorrhage	Yes	5	0	0.000	1	1.000	-	-	-
	No	207	0						
Hyperemesis gravidaruum	Yes	1	0	0.000	1	1.000	-	-	-
	No	211	0						
Pregnancy Induced Hypertension	Yes	38	0	0.000	1	1.000	-	-	-
	No	174	0						

Table 21

Influence of Obstetric Complications on Apgar Score at 5 Minutes among Obese Mothers n= (212)

Variable	Response	Apgar Score at 5 Minutes		Chi-Square	df	*p*-value	Odds Ratio	95% C.I	
		<7 (n=209)	≥ 7 (n=3)					Lower	Upper
Premature Rapture of Membranes (PROM)	Yes	25	0	0.407	1	.524	-	-	-
	No	184	3						
Meconium stained amniotic fluid	Yes	27	1	1.075	1	.990	0.3	0.03	3.38
	No	182	2						
Urinary Tract Infection	Yes	49	0	0.915	1	.339	-	-	-
	No	160	3						
HIV	Yes	4	0	0.059	1	.809	-	-	-
	No	205	3						
Syphilis	Yes	2	0	0.029	1	.865	-	-	-
	No	207	3						
Hepatitis B	Yes	6	0	0.089	1	.766	-	-	-
	No	203	3						
Gestation diabetes	Yes	5	0	0.074	1	.786	-	-	-
	No	204	3						

Table 21 continued.

Antepartum hemorrhage	Yes	3	0	0.044	1	.835	-	-	-
	No	206	3						
Post-partum hemorrhage	Yes	5	0	0.074	1	.786	-	-	-
	No	204	3						
Hyperemesis gravidaruum	Yes	1	0	0.014	1	.904	-	-	-
	No	208	3						
Pregnancy Induced Hypertension	Yes	38	0	0.665	1	.415	-	-	-
	No	171	3						

Table 22

Influence of Obstetric Complications on Admission to NICU among Obese Mothers n= (212)

		Admission to NICU						95% C.I.	
Variable	Response	Yes (n=46)	No (n=166)	Chi-Square	df	*p*-value	Odds Ratio	Lower	Upper
Premature Rapture of Membranes (PROM)	Yes	7	18	2.432	1	.119	1.5	0.90	2.52
	No	39	148						
Meconium stained amniotic fluid	**Yes**	**8**	**20**	**10.897**	**1**	**.001**	**2.2**	**1.36**	**3.54**
	No	38	146						
Urinary Tract Infection	Yes	13	36	0.016	1	.900	1.0	0.64	1.47
	No	33	130						
HIV	Yes	0	4	0.261	1	.609	0.7	0.15	3.08
	No	46	162						
Syphilis	Yes	0	2	1.077	1	.300	-	-	-
	No	46	164						
Hepatitis B	Yes	2	4	0.492	1	.483	1.8	0.33	10.38
	No	44	162						
Gestational diabetes	**Yes**	**3**	**2**	**4.422**	**1**	**.035**	**5.7**	**0.93**	**35.33**
	No	43	164						

Table 22 continued.

Antepartum hemorrhage	Yes	0	3	0.843	1	.358	0.0	-	-
	No	46	163						
Post-partum hemorrhage	Yes	2	3	1.009	1	.315	2.5	0.40	15.24
	No	44	163						
Hyperemesis gravidaruum	**Yes**	**1**	**0**	**3.626**	**1**	**.044**	-	-	-
	No	45	166						
Pregnancy Induced Hypertension	**Yes**	**14**	24	**6.250**	**1**	**.012**	**2.6**	**1.21**	**5.55**
	No	32	142						

***Key – no value**

Table 22 reveals that four of the 11 obstetric complications were significantly related to admission of the babies of the obese mothers to the Neonatal Intensive Care Unit of the hospital. These included meconium stained amniotic fluid (*p*-value 0.001), gestational diabetes (*p*-value 0.035), hyperemesis gravidaruum (*p*-value 0.044) and pregnancy induced hypertension (*p*-value 0.012) in the obese mothers.

Descriptively, as many as 8 (40.0%) of the 28 (20.6%) obese mothers with MSAF had their neonates being admitted to NICU compared to 38 out of the 184 obese mothers without the complication. Also, the odds ratio value of 2.2 confirmed the above. This means that those with MSAF complications were 2.2 times (95% CI=1.36-3.54) more likely to be admitted to the NICU compared to those without such complication.

Similarly, gestational diabetes was seen as influencing admission to the NICU among the obese mothers. The test revealed a significant association with an odds ratio of 2.6. This means that those obese mothers with PIH had higher risk of being admitted to the NICU than those without the complications (OR=2.6, CI=1.21-5.55).

Discussion

The main variables considered in this study included the influence of BMI, sociodemographic characteristics, obstetric characteristics, preexisting medical conditions and obstetric complications on obese mothers' neonatal outcomes. These were examined under five research questions. Similarly, this section is presented based on the findings obtained for each research question.

Influence of BMI on neonatal outcomes

The findings from this study revealed a significant association between the BMI of mothers and their birth outcomes only, but not for other neonatal outcomes. This means that BMI of the obese mothers was not associated with other neonatal outcomes including gestational age at delivery, Apgar scores, and admission to NICU.

In fact, there was an odds ratio of 0.6 (95% CI=0.31-1.06) for the obese mother to have live births as compared to the non-obese ones; meaning that obese mothers had a higher risk of stillbirths than the non-obese mothers. This finding was consistent with other studies including that of Sirimi and Goulis (2010), Chu et al. (2007), Kristensen et al. (2005), and Cnattingius et al. (1998). There was a higher risk of obese mothers losing their babies and this should be a great concern to women in general. Kristensen et al. (2005) in their study revealed that there was more than doubled risk of stillbirth (odds ratio = 2.8, 95% confidence interval [CI]: 1.5-5.3) and neonatal death (odds ratio=2.6, 95% CI: 1.2-5.8) among obese women compared with women of normal weight. In the same vain, Chu et al. (2007) revealed that obese pregnant women have an estimated risk of stillbirth that is twice that of normal weight pregnant women. Also, according to Sirimi and Goulis, (2010), still birth was associated with maternal obesity. A similar finding by Cnattingius et al. (1998) also showed that there was a greater risk of antepartum stillbirth among obese patients than among women who had a BMI of less than 20. However, results in this study about gestational age, APGAR at 1 minute and 5 minutes as well as admission to NICU were contrary to those of other authors.

With respect to the influence of BMI on gestational age at delivery, the study found no significant association unlike that of Hickey et al. (1997) who found that a low prepregnancy body mass index (BMI) has been associated with preterm delivery. This finding could not confirm the position of Sebire et al. (2001) and Kumari (2001) who found a significantly decreased risk for preterm delivery in obese patients.

All the Apgar scores were not significantly influenced by the BMI of the mothers. However, both the obese and non-obese mother had the same odds ratio of 1.0. Therefore, this finding is inconsistent with Crane et al. (2013), Minsart et al. (2013) and Jeremiah et al. (2011). Crane et al. (2013) revealed that extremely obese women were more likely to have neonates admitted to NICU as compared to non-obese, whiles Minsart et al. (2013) also reported a 38% increased need for intensive care among obese women. According to Jeremiah et al. (2011) there was a higher rate of admissions into the neonatal intensive care unit among the obese group (9.3%) than the non-obese group (4%).

Influence of sociodemographic characteristics on neonatal outcomes

Unlike the findings of many other researchers who have found several sociodemographic variables influencing neonatal outcomes, this study only saw obese mother's age and residential location as associated risk factors in birth outcomes. No other sociodemographic variable was significant. This finding disagreed with the finding of Cooper et al. (1995) who examined the effect of maternal age on birth outcomes among young adolescents, ages 10 to 15. Cooper et al. found that the youngest adolescents were at greatest risk for negative birth outcomes. In this study, younger obese mothers rather had

higher odds ratios of having life birth compared to the older ones. Obese mothers aged 16-20 years were 2.0 times (95% CI=0.13-29.81) more likely to have live birth compared to those aged 41-45 years. This finding is supported by Naddy (2006) who found that advanced maternal age conclusively increased the risk for stillbirths with women 35 – 39 years having a relative risk of 1.3 and women 40 years a relative risk of 1.88. However contrary results were reported by Baeten et al. (2001) as well as Eugene et al. (2007) who found adverse fetal outcome was about two fold in adolescent pregnancies.

Similarly, on the influence of residential location among obese mothers on birth outcome, the study finding was consistent with that Abdel-Latif et al. (2006) that there was a higher stillbirth rate among rural infants (OR=1.20, 95% CI= 1.09 to 1.32, $p<0.001$). However, this finding opposed Larson, Hart and Rosenblat's (1992) finding that rural residence is not associated with greater risk of poor birth outcome. Lisonkova et al. (2010) also found no differences in neonatal outcomes among mothers in rural areas.

The findings from this study showed an insignificant association between sociodemographic variables and other neonatal outcomes, namely, gestational age at delivery, Apgar scores, and admission to NICU. However, the odds ratios obtained in this study virtually confirmed the findings of previous researchers. For example, according to Yunis et al. (2003), neonates born to illiterate mothers had nearly 3-5 times the risk of NICU admission than a neonate born to a literate mother. Findings from some studies lend support to the claim that higher level education and non-manual occupation are linked with good Apgar scores. A Swedish study reported that mothers

working in non-manual and self-employed occupations were less likely to have an infant with low Apgar scores than manual workers. That study also found that the risk of low APGAR scores decreased with increasing maternal level of education (Odd et al., 2008).

Influence of obstetric characteristics on neonatal outcomes

This study showed the importance of ANC visits in influencing birth outcomes and gestational age at delivery among the obese mothers, just as the mode of delivery which was associated with admission to NICU. This study finding confirmed the position of Tuladhar and Dhakal (2011) and WHO (2011) that maternal and perinatal outcomes have been found to be better in women who attended regular antenatal clinics. Indeed, the odds ratios for 1-2 and 3-4 times of ANC visits were 0.0 (95% CI=0.01-0.131) and 0.4 (95% CI=0.10-1.51), respectively. This showed the lower incidence of live births among irregular ANC attendants compared to those who were regular.

Similarly, total number of ANC visits highly influenced the gestational ages at delivery among the obese mothers. In agreement with Barros, Tavares and Rodrigues's (1996) study which found that adequate and intermediate (compared with inadequate) prenatal care was significantly associated with a lower risk of preterm (OR=0.20, 95% CI=0.12-0.32, and OR=0.35, 95% CI=0.23-0.54, respectively). With respect to the influence of mode of delivery on admission to NICU, those delivered through SVD and C/S had less chance 70% and 90%, respectively of being admitted to NICU compared to those delivered via AVD. This finding disagreed with findings from a study by Igwegbe et al. (2010). They found that there was no significant difference in NICU admission rate for women who delivered by AVD. Similarly, other

authors Fallah et al. (2011), Liston et al. (2007) and Shamsa et al. (2013) also reported increased NICU admissions for neonates born through cesarean sections.

Preexisting medical conditions and neonatal outcomes

Although the study did not establish associations between the preexisting medical conditions and neonatal outcomes like those by Potti et al. (2012), Stella et al. (2008) and Lawn et al. (2001), it agreed with the odds ratio analyses by them. Whereas Potti et al. (2012) found that the coexistence of hypertension and diabetes had been associated with worse obstetric and neonatal outcomes than either one alone, this study disagrees. However, the odds ratios were similar to those obtained in this study. In the study by Potti et al. neonatal outcomes were poor in women who had both hypertension and diabetes, with high rate of preterm deliveries, neonatal intensive care unit (NICU) admissions (OR=2.14; CI=2.01-2.28), and low 5-minute Apgar scores (OR=1.78; CI=1.57-2.01). Stella et al. (2008) also found similar results. They reported low Apgar scores, preterm deliveries and NICU admissions among women with comorbid conditions. The findings from the study, however, were not in agreement with the above findings.

Obstetric complications and neonatal outcomes

The risk factors of gestational age of delivery included PROM, antepartum hemorrhage, and pregnancy induced hypertension (PIH). With respect to antepartum hemorrhage, Sheikh et al. (2010) also arrived at a similar finding. In their prospective descriptive study, Sheikh et al. (2010) revealed that 79.16% of women with antepartum hemorrhage had preterm deliveries. Habli, Levine, Qian and Sibai, (2007) similarly found higher rates

of neonatal intensive care unit admission among hypertensive pregnancies that delivered at 37 weeks of gestation.

Also, admission to the NICU had risk factors such as meconium stained amniotic fluid, gestation diabetes, hyperemesis gravidaruum, and pregnancy induced hypertension (PIH) that among the obese mothers. According to Berkus et al. (1994), meconium stained amniotic fluid (MSAF) increased admissions to NICU. In terms of the influence of gestational diabetes on NICU, Perveen and Saeed (1996) have shown that 15 (38%) of diabetic women delivered pre-term. Similarly, Al-Khalifah et al. (2012) who studied the neonatal short-term outcomes of gestational diabetes mellitus revealed that infants born to GDM mothers had significantly higher risk of NICU admissions (OR=2.7, 95% CI=1.5-4.9, p=0.0004). The findings here also confirmed that of Almarzouki (2013) who reported that neonatal intensive care unit (NICU) admissions are also significantly higher among pregnancies with gestational diabetes mellitus. Again, according to Gasim (2012), GDM is recognized to be associated with increased rates of adverse maternal and neonatal outcomes. Patients with GDM had a significantly higher incidence of preterm delivery (p=0.0226) and admission to the neonatal intensive care unit (p=0.0003) amongst others.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter summarizes the main findings of the study. Conclusions from all the facts are also presented. On the basis of the findings and conclusions, recommendations are made to mitigate the risk factors associated with neonatal outcomes among obese mothers. The chapter finally concludes with recommendations for future research.

Summary

The primary purpose of this study was to determine factors that influenced neonatal outcomes among obese parturients at the Korle-Bu Teaching Hospital. It specifically set out to (1) determine whether maternal BMI had an influence on neonatal outcomes, (2) assess the sociodemographic factors that influenced neonatal outcomes, (3) identify the obstetric characteristics that influenced neonatal outcomes, (4) identify preexisting medical conditions that influenced neonatal outcomes, and (5) identify obstetric complications that influenced neonatal outcomes.

This study was a retrospective study which assessed the medical records (folders) of 748 mothers who delivered at the Korle-Bu Teaching Hospital, Accra. A data collection checklist was designed and data collected spanning September 2013 to November 2013 after the Institutional Review Board (IRB) of the University and Korle-Bu Teaching Hospital gave approval. The SPSS (version 21.0) was used to analyze the data both descriptively and inferentially. Specifically, frequencies, percentages, Chi-square values and odds ratios were computed. The preliminary findings were that out the 748 mothers, 212 (28.3%) of them were obese. Also, obesity was more prevalent

among the older mothers compared to the younger ones. Single mothers were more at risk of being obese than married and divorced/separated/ widowed mothers. In terms of mothers educational levels, 34 (16.0%), 30 (14.2%), 76 (35.8%), 47 (22.2%) and 25 (11.8%) of them had no formal, primary, JHS, secondary and tertiary education, respectively. There were also more employed mothers (91.5%) who were obese than the unemployed ones (8.5%). Similarly, out the 212 obese mothers, majority (96.2%) of them had employed husbands, whiles the remaining did not.

Additionally, there were more Christians (86.3%) who were obese compared to their other religious counterparts. Also, there were more Akans than the Gas, Ewes, and Northerners who were obese.

Key Findings

The key findings are presented under the research questions as follows.

Research Question 1: Does maternal BMI influence neonatal outcomes?

The findings revealed that the body mass index (BMI) of mothers significantly influenced only one neonatal outcome, thus, birth outcomes. This means that the BMI can only determine whether a mother has a live birth or stillbirth but not the other neonatal outcomes such as gestational age at delivery, Apgar scores at 1 and 5 minutes and admission to the Neonatal Intensive Care Unit (NICU) of the hospital. Apgar scores were also low in all obese mothers

Research Question 2: What sociodemographic characteristics of obese mothers influence neonatal outcomes**?**

The results on the above showed that only the age of obese mothers and their residential locations were significantly associated with one neonatal

outcome (i.e., birth outcome). It was evident that all other sociodemographic variables to a large extent did not influence the neonatal outcomes among these categories of mothers.

Research Question 3: What obstetric characteristics of obese mothers influence neonatal outcomes?

With respect to this research question, the study revealed that ANC visits could significantly influence birth outcomes and gestational age at birth among the obese mothers. Specifically, the higher the total number of ANC visits, the more positive these neonatal outcomes. Similarly, the mode of delivery administered to an obese mother also statistically determined whether or not her baby should be admitted to the NICU.

Research Question 4: What preexisting medical conditions of obese mothers influence neonatal outcomes?

The study found that no preexisting medical condition was statistically significantly associated with any neonatal outcomes. This means that an obese mother's medical conditions would not influence any of her neonatal outcomes such as birth outcome, gestational age, Apgar scores at both 1 and 5 minutes and admission to NICU.

Research Question 5**:** What obstetric complications of obese mothers influence neonatal outcomes?

With this research question, the study revealed that premature rapture of membranes (PROM), antepartum hemorrhage, and pregnancy induced hypertension (PIH) were significant predictors (risk factors) in gestational age at delivery among the obese mothers. Also, these mothers had risk factors such as meconium stained amniotic fluid, gestation diabetes, hyperemesis

gravidaruum, and pregnancy induced hypertension (PIH) for having their neonates being admitted to the NICU.

Conclusions

Based on the findings, the following conclusions were drawn:

1. Maternal obesity was associated with higher risks of adverse neonatal outcomes
2. Older women who were obese as well as obese women from rural dwellings were at risk for adverse neonatal outcomes
3. Antenatal care reduced the risk of adverse outcomes among obese women
4. Obstetric complications in obese mothers put the neonates at risk for adverse outcomes

Recommendations for Further Studies

Based on the findings and the conclusions adduced, the following recommendations were made

1. The results of this study highlighted maternal obesity as an important public health concern in our country. More studies with larger sample sizes are required to further augment these results.
2. It is proposed that further research be conducted investigating birth weight and congenital abnormalities in relation to maternal obesity.

Recommendations for Practice

1. It is recommended that there be established guidelines and management protocols for obesity in pregnancy in prenatal care services offered to Ghanaian women.
2. In this study initial visit did not capture weight and height measurements. It is highly recommended that obstetric management policy be standardized to include height and weight measurements at every antenatal clinic visit.
3. All health care providers must have knowledge and understanding of expected pregnancy weight gains and the implications of abnormal BMI.
4. Curricula for nurses and physicians should include the importance of weight gains in prenatal care.

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APPENDICES

APPENDIX A

Data collection checklist

Tittle: Neonatal outcomes among obese parturients at Korle- Bu Teaching Hospital.

A. Sociodemographic characteristics

1. Age

……

2. Weight (kg)

……..

3. Height (m)

……

4. BMI

……..

5. Marital status

[ ] married

[ ] single

[ ] divorced / widowed/ separated

6. Educational level

[ ] no formal education

[ ] Primary

[ ] Junior high school

[ ] Senior high school

[ ] Tertiary

7. Employment status

[ ] Yes

[ ] No

8. Employment status of spouse

[ ] Yes

[ ] No

9. Religion

[ ] Christian

[ ] Moslem

[ ] Traditionalist

[ ] other please specify……..

10. Tribe

[ ] Ga

[ ] Akan

[ ] Ewe

[ ] Northern

11. Residential location

[ ] rural

[ ] urban

B. Obstetric characteristics

12. Total number of antenatal visits

[ ] 1

[ ] 2

[ ] 3

[ ] 4

[ ] 5 or more

13. Parity

[ ] 0

[ ] 1

[ ] 2

[ ] 3

[ ] 4

[ ] 5 or more

14. Mode of delivery

[ ] Spontaneous vaginal delivery

[ ] Cesarean section

[ ] Assisted vaginal delivery

C. Obstetric complications

15. Meconium stained amniotic fluid

[ ] Yes

[ ] No

16. Premature rapture of membranes

[ ] Yes

[ ] No

17. History of Urinary tract infection

[ ] Yes

[ ] No

18. HIV

[ ] Yes

[ ] No

19. Syphilis

[ ] Yes

[ ] No

20. Hepatitis B

[ ] Yes

[ ] No

21. Gestational diabetes

[ ] Yes

[ ] No

22. Antepartum hemorrhage

[ ] Yes

[ ] No

23. Postpartum hemorrhage

[ ] Yes

[ ] No

24. Hyperemesis gravidaruum

[ ] Yes

[ ] No

25. Pregnancy induced hypertension

[ ] Yes

[ ] No

D. Medical characteristics

26. Hypertension

[ ] Yes

[ ] No

27. Asthma

[ ] Yes

[ ] No

28. Diabetes

[ ] Yes

[ ] No

29. Sickle cell

[ ] Yes

[ ] No

30. Psychiatric

[ ] Yes

[ ] No

E. Neonatal outcomes

31. Birth outcome

[ ] live birth

[ ] still birth

32. Gestation

[ ] preterm

[ ] term

[ ] post term

33. Apgar score in 1 minute

[ ] below 5

[ ] 5

[ ] 6

[ ] 7

[ ] 8

[ ] 9

[ ] 10

34. Apgar score in 5 minutes

[ ] below 5

[ ] 5

[ ] 6

[ ] 7

[ ] 8

[ ] 9

[ ] 10

35. Admission to NICU

[ ] Yes

[ ] No

APPENDIX B

Staff confidential statement

I promise to keep all information regarding data collection private. I shall not discuss or reveal any information obtained to anyone other than the researcher and other staff in this project.

Name……

Date…….

Signature…….

APPENDIX C

Ethical clearance form