FACTORS ASSOCIATED WITH ADVERSE BIRTH OUTCOMES AMONG NEONATES IN KAJIADO COUNTY REFERRAL HOSPITAL, KENYA

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Factors Associated with Adverse Birth Outcomes among Neonates in Kajiado County Referral Hospital, Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

Signature ……Date…….

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This thesis has been submitted for examination with our approval as the University supervisors.

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DEDICATION

This study is dedicated to my wife Marion Mwai, Children Elvis Wachira , Elton King'ori and Elna Gakenia. The support and prayers they accorded me has been a key pillar in my study. I also dedicate the study to my parents Mr. and Mrs Wachira for their unwavering encouragement as I pursued the study.

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LIST OF ABBREVIATIONS AND ACRONYMS

ABO	Adverse Birth Outcomes
ANC	Antenatal Care
CDC	Centers for Disease Control
FAO	Food and Agriculture organization of the United Nations
HB	Hemoglobin
HIV	Human Immunodeficiency Virus
IUGR	Intrauterine Growth Retardation
KCRH	Kajiado County Referral Hospital
KDHS	Kenya Demographic Health Survey
KEMRI	Kenya Medical Research Institute
KHIS	Kenya Health information System
KNBS	Kenya National Bureau of Statistics
LBW	Low Birth Weight
MNCH	Maternal Newborn and Child Health
MoH	Ministry of Health
PB	Preterm Births
SB	Stillbirths
SDGS	Sustainable Development Goals
SES	Socioeconomic Status
UNICEF	United Nations Children's Education Fund
UN	United Nation
USA	United States of America
WHO	**World Health Organization**

DEFINITION OF TERMS

Adverse Birth outcome These are the unfavorable or unexpected results in a baby at birth. In this study, they include preterm birth, low birth weight and stillbirth.

Anaemia It is when the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs. In pregnancy one is considered to be anaemic when haemoglobin level is less than 11 grams/deciliter.

Diabetes Mellitus It's a condition in which the blood glucose levels are above the normal ranges of 2.3- 7.7 Millimoles / Litre.

Gravidity refers to the total number of confirmed pregnancies that a woman has had regardless of the outcome. This includes all abortions she may have had.

Hemoglobin is a protein in the red blood cells that binds oxygen through its iron component and helps in its transportation in the body.

Intrapartum period Period between the onset of labour and the delivery of placenta.

Interpregnancy interval is the period between the last date of delivery until the estimated date of the last menstrual period (that is the subsequent pregnancy), expressed in completed months.

Intrauterine growth retardation It's the failure of the fetus to gain weight corresponding to the gestational age.

Low birth weight birth weight which is less than 2500 grams. The weight is taken within the first hour of birth.

Multiple pregnancy is pregnancy that has more than one foetus resulting to birth of more than one baby.

Obstetric factors; they are factors related to pregnancy, including care a woman receives during pregnancy and childbirth,

Normal birth weight it is the expected weight of a neonate at birth that ranges from 2500grams-3500grams.

Pregnancy Induced Hypertension its development of arterial high blood pressure in pregnancy after 20 weeks gestation with symptoms of proteinuria ,oedema and a blood pressure ≥140/ 90 millimeters of mercury.

Parity is the number of births a woman has had after 24 completed weeks of gestation. It excludes the abortions.

Preterm birth are all births before 37 completed weeks of gestation or less than 259 days since a woman's first day of the last menstrual periods.

Severe illness this is a situation in which the person who is unwell is unresponsive and cannot even take instructions given.

Stillbirth is an infant born after 28 weeks of gestation with no signs of life with death occurring either in utero or intrapartum.

ABSTRACT

Adverse birth outcomes are unexpected results in a baby at birth. Even with the medical advancement in the recent times, adverse birth outcomes are still a problem across the globe and are associated with high mortality among the affected infants. Studies on these adverse birth outcomes and the associated factors are therefore needed. The objective of the study was to determine the prevalence and factors associated with adverse birth outcomes among neonates in Kajiado County Referral Hospital. A Cross sectional study was carried out among mother- neonate pair admitted at the Kajiado County Referral Hospital postnatal ward. A total of 163 study participants were recruited through systematic sampling. Semi-structured questionnaires were used to collect data from the respondents. Logistic regression was used to determine the significance of association between each outcome variable and the independent variables. Odds ratio (OR) and 95% CI were used to estimate the strength of association. The threshold for significance was set at $P<0.05$ at all levels of analyses. The overall prevalence of adverse birth outcomes was 32.5%. The prevalence of Low Birth Weight was 23.1%, preterm births was 23.1%, while stillbirth prevalence was 6.5%. The main socio demographic and socio economic factors associated with adverse birth outcome were; being single, [OR= 2.769; 95%CI = 1.06 – 7.17, P = 0.037] and residing in rural areas, [OR =3.18; 95%CI= 1.25 – 6.92, P=0.021]. Antenatal clinic visits were significantly associated with adverse birth outcomes,[OR=4.25; 95% CI= 1.91 – 10.38, P<0.001], the lesser the visits the higher the odds for adverse birth outcomes. Multiple births were significantly associated adverse birth outcome, [OR=10.44; 95% CI = 3.49 – 22.16, P = 0.001]. Previous history of low birth weight, [OR=2.82; 95%CI= 1.07 – 5.99, P=0.034] and previous history of preterm birth, [OR=2.14; 95% CI= 1.25 – 5.14, P=0.004] were significantly associated with recurrence of the same in the current neonate. In conclusion, the prevalence of adverse birth outcomes in Kajiado County Hospital Referral Hospital was found to be higher than prevalence in the country as per KDHS 2014. The factors that were found to be significantly associated with adverse birth outcomes were also significantly associated with ABO in other similar studies conducted elsewhere. The study recommended the following; prevention of teenage pregnancies, improving healthcare provision and access in rural areas, health education to all pregnant women on importance of the minimum four antenatal clinic visits.

CHAPTER ONE

INTRODUCTION

1.1 Background information

Health at birth is measured by the outcomes. Adverse birth outcomes are unexpected or unfavorable results in a baby at birth (Cherie &Mebratu, 2017). The most common adverse birth outcomes (ABO) are low birth weight (LBW), birth before full term (preterm births) and fetal stillbirths (SB) (Cherie & Mebratu, 2017). ABO is the most important vital statistics used to assess maternal and child health program. They are indicator of quality of medical services, antenatal care and general health services to the mother and children (Adhena *et al*., 2017).

LBW is the weight of less than 2500 grams at birth (up to and including 2499grams) irrespective of gestational age (WHO, 2018). Birth weight should be taken in the first hour of life prior to significant post natal weight loss. Prematurity is the leading cause of LBW globally. Birth weight is a strong indicator of maternal and newborn health and nutrition. LBW baby affects the family planning decisions, future expectations or desire for more children, status of the mother in the family and can cause elevated stress among parents. WHO has a target of reducing LBW birth by 30% by 2025? LBW is a great risk factor for neonatal and infant mortality (WHO-UNICEF 2018). LBW is considered as a key predictor of public health and a measure of progress toward sustainable development goals (SDG) in developing countries.

In Sub-Saharan Africa LBW rate is estimated at 15 percent with the proportions varying from country to country (UNICEF-WHO, 2018). In Kenya the prevalence of low birth weight births is 8% of total births (KDHS, 2014). LBW is associated closely with increased fetal and neonatal mortality, morbidity, and impaired growth and cognitive development. LBW babies at birth experience breathing difficulties, hypothermia,

neurologic disorders such as intraventricular hemorrhage and difficulties in feeding hence inability to gain weight which in turn results to increased morbidity (WHO, 2015).

Preterm births (PB) are births that occur before 37 completed weeks of gestation or less than 259 days since a woman's first day of the last menstrual periods (WHO). Globally 15 million babies are born prematurely annually, that is 1 in every 10 infants is born prematurely. About one million of those babies die shortly after birth; many others suffer some type of lifelong physical, neurological, or educational disability, which is a great cost to families and society (WHO, 2018). Across the globe prematurity is the leading cause of death in children under 5 years of age (WHO 2018). In Kenya 193 000 infants are born prematurely and out of this 13 300 die every year due to preterm birth complications. Prevalence of PB in Kenya is 12% (KDHS, 2014). According to KDHS 2014, under 5 mortalities in Kenya are 52 deaths per every 1000 live births. The survival of PB babies depends on where they are born. Ninety percent or more of extremely preterm babies (less than 28 weeks) born in low-income die within the first few days of life but less than 10% of extremely preterm babies die in high-income settings(WHO, 2018). Preterm babies born in developing countries face higher morbidity and mortality rates compared to developed countries. In low-income settings, half of the babies born as a preterm die due to a lack of feasible, cost effective care, like provision of basic warmth, supporting breathing difficulties and taking preventive and control measures of infection. In high-income countries, almost all of these babies survive.

Stillbirth according to WHO is an infant born after 28 weeks of gestation with no signs of life with death occurring either in utero life or during intrapartum. In 2015 2.6 million SB occurred across the globe with more than 7178 deaths a day. The majority of these deaths occur in developing countries with 98% occurring in low- and middle-income countries. Half of all stillbirths occur in the intrapartum period, representing the greatest time of risk (WHO 2015). The stillbirth rate in Kenya is 23 stillbirths per 1000 births (2.3%), which is almost eight times that of developed countries, which is at 3 per 1,000 births (UNICEF/KDHS). Prevalence in Iceland (1.3 per 1,000 births), Denmark (1.7

stillbirths per 1,000), Netherlands and Finland (both with 1.8 stillbirths per 1,000) and Croatia with 2.0 stillbirths per 1,000 births (de Bernis, 2016) have some of the lowest SB rates in the world. India has the highest still birth rate (Lawn, 2016). Birth outcomes are influenced by various factors during pregnancy such as access to antenatal care services, socio economic status of the woman, maternal age, nutrition status and medical conditions such as anaemia, malaria and hypertension. This is according to a study conducted in 2017 at Dessie Referral Hospital North East Ethiopia (Cherie & Mebratu, 2017).

1.2 Statement of the problem

Even with the medical advancement in the recent times,ABO are still a problem across the globe. Stillbirth, low birth weight and preterm birth constitute the highest rates of all the adverse birth outcomes and their prevalence in developing countries is higher than developed countries. The prevalence is higher in developing countries due to factors such as poverty, low educational level, multiparity, malaria, poor nutrition and anemia compared to developed world. ABO cause families psychological trauma, drain them financially and strain the resource limited health facilities in the developing countries (Cherie & Mebratu, 2017). Infant Mortality rate for LBW infants is about 25 times that of the infant mortality rate for normal weight babies. On the other hand, the infant mortality rate for PB babies is almost three times the infant mortality rate for term babies. LBW infants are more likely to have underdeveloped lungs and breathing problems; heart problems (which can lead to heart failure); immature and improperly functioning liver; too many or too few red blood cells hence increased morbidity in the first years of life (WHO, 2012).

Africa and South Asia contribute to 60 % of all PB; however, it is a global problem. Averagely in the lower-income countries 12% of babies are born too early compared with 9% in higher-income countries (WHO, 2014). Global prevalence of LBW is 15.5 % with 20 million LBW babies estimated to be born each year. The prevalence is higher in developing countries with South Asia recording prevalence of 28 %, Sub Saharan Africa

13 % and Latin America 9% (WHO 2014). Premature babies are likely to suffer lifelong effects such as Cerebral Palsy, mental retardation, visual and hearing impairment and delayed physical development. Globally prematurity is the leading cause of death in children under 5 years of age (WHO 2018).

There were 2.6 million SB globally in 2015 according to the WHO with more than 7178 deaths daily. Ninety eight percent of SB occurs in low and middle income countries. Half of all the SB occurs in the intrapartum period. Three quarters of SB occurs in South Asia and Sub Saharan Africa with 60% occurring in rural families (WHO 2014). In Sub-Saharan Africa LBW rate is estimated at 15 percent with the proportions varying from country to country (UNICEF-WHO, 2018). There are some factors that have been found to be associated with occurrences of ABO across the globe in various past studies which includes some demographic factors, socio economic factors, medical factors, obstetric and lifestyle factors. In Kajiado County teenage pregnancy prevalence is 20% (KDHS, 2014) while the County illiteracy level is 48 % (KNBS, 2018) with these factors featuring prominently as some of the leading factors associated with ABO in many studies. ABO's are associated with high morbidities and mortalities in the first five years of life. In Kenya the child mortality rate is 52 per 1000, neonatal mortality rate at 20.9 per 1000 and infant mortality rate 39 per 1000 (KDHS, 2014). The sustainable development goal number 3 aims to achieve good health for all which includes reducing the mortality rates (WHO, 2018).

1.3 Justification of study

The sustainable development goal number three aims at ensuring good health and wellbeing for all by 2030. One of the objectives in the SDG is to end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1000 live births and under 5 mortality to at least as low as 25 per 1000 live births (UN 2017). ABO's are associated with increased neonatal mortalities. To achieve the set targets, factors associated with ABO have to be

identified through studies that will also come with recommendations for preventing ABO which will in turn reduce neonatal and under 5 mortality.

The prevalence of ABO globally is high in Sub Saharan Africa compared to developed world. In Kajiado County Referral Hospital (KCRH) the prevalence of the three adverse birth outcomes is higher than the national prevalence rates. In 2018, the prevalence was 14.5%, 13.5% and 3.5% respectively (Kenya Health Information System, 2019) hence the need for a study to identify the associated factors while the national prevalence rates are; PB 12%, LBW 8% and stillbirth 2.3% (KDHS, 2014).The study is in line with Kajiado County Health Sector Strategic and Investment Plan 2018 which aims at reducing burden of morbidity and mortalities in neonates by identifying attributing factors and addressing them.

In the past very few studies have been done in the country on adverse birth outcomes and associated factors. In KCRH there is no documented study on the ABO and therefore the study will be useful in bridging the gap that has been there. The study findings will be used to create awareness among community members on the factors associated with ABO and hence know what they can do to reduce ABO. The study findings will be useful in decision making among health workers, community health volunteers and various stakeholders such as nongovernmental organizations to stimulate focused intervention programs.

High illiteracy level in Kajiado County at 48% (KNBS 2018), multiparit5y and poor ANC attendance among mothers delivering in KCRH are factors that can be associated with ABO. In 2017 only 25% of mothers who delivered in KCRH attended the recommended minimum 4 ANC while in 2018 it was only 31% (Kenya Health Information System 2019). Teenage pregnancy in Kajiado County has been a big problem, for example in 2017, 63% of all deliveries in KCRH were from teenage mothers while in 2018 it was 34%. The study findings will help in developing recommendations that will help in addressing these factors.

1.4 Research Objectives

1.4.1 General Objective

To determine prevalence and the associated factors of adverse birth outcomes among neonates in Kajiado County Referral Hospital (KCRH).

1.4.2 Specific Objectives

1. To determine the prevalence of adverse birth outcomes among neonates in KCRH.
2. To determine socio demographic and socio economic factors associated with adverse birth outcomes among neonates in KCRH.
3. To determine lifestyle factors associated with adverse birth outcomes among neonates in KCRH
4. To establish maternal medical and obstetric factors associated with adverse birth outcomes among neonates in KCRH.

.1.5 Research questions

1. What is the prevalence of adverse birth outcomes among neonates in KCRH?
2. What are the socio demographic and socioeconomic factors associated with adverse birth outcomes among neonates in KCRH?
3. What are the lifestyle factors associated adverse birth outcomes among neonates in KCRH?
4. What are the maternal medical and obstetric factors associated with adverse birth outcomes among neonates in KCRH?

1.6 Conceptual framework

In determining association between various factors and adverse birth outcomes among neonates in KCRH, a conceptual frame work close to the one developed by Adhena in a study to assess the magnitude and associated factors of ABO in Suhul Hospital ,Ethiopia was adopted (Adhena *et al*., 2017)

Independent variables

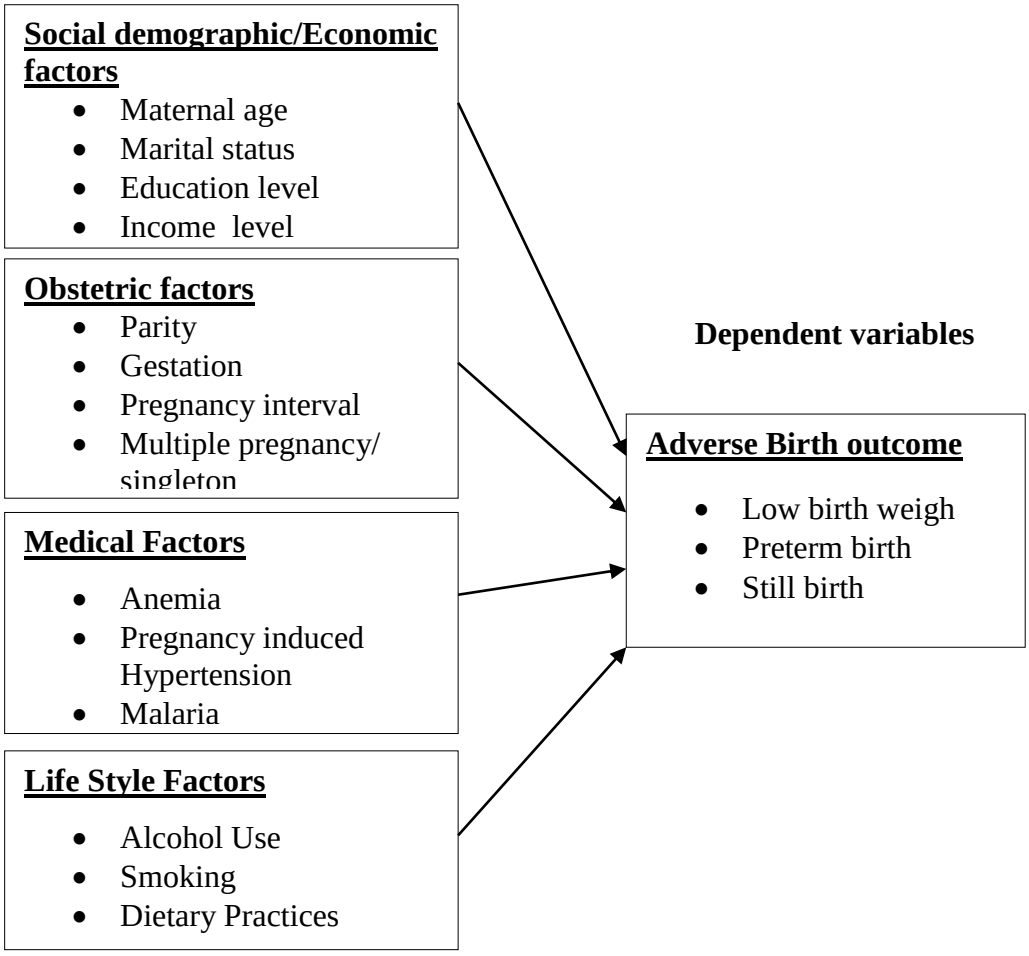

Figure 1.1 Conceptual framework ***Modified from Adhena 2017***

CHAPTER TWO

LITERATURE REVIEW

2.1Global and Sub Saharan Africa Situation of Adverse Birth Outcomes

The prevalence of ABO in developing countries has remained higher compared to developed countries despite the efforts to bridge the gap. Approximately 60% of preterm births occur in Africa and South Asia however, it is a global problem. In the lower-income countries, on average, 12% of babies are born too early compared with 9% in higher-income countries (WHO, 2018). The global prevalence of preterm births ranges from 5% - 18% across different countries. China and India are some of the countries with the highest rates of PB in the world while Malawi and Comoros leads in Africa (WHO, 2018).

Preterm birth complications are the single largest direct cause of neonatal deaths, responsible for 35% of the world's 3.1 million deaths a year, and the second most common cause of under five deaths after pneumonia (Blencowe *et al*., 2013). The world prematurity date is observed on every 17th November every year to raise the concerns of preterm babies and their families worldwide (WHO). Data on preterm birth rates are not routinely collected in many countries due to home deliveries and where available, are frequently not reported using a standard international definition hence the rates might even be higher (Blencowe *et al*., 2013). In 3 different studies conducted in Ethiopia the PB rates were found to be 35% (Cherie &Mebratu), 8.7% (Adhena *et al*., 2017) and 14.3% (Adane *et al.*, 2014).

Prevalence of LBW globally is 15.5 % with estimated 20 million LBW babies being born each year (UNICEF-WHO2018). The prevalence is higher in developing countries with South Asia recording prevalence of 28 %, Sub Saharan Africa 13 % and Latin America 9%(WHO 2012). LBW increases the risk of communicable and cardiovascular disease later in life. In 3 different studies conducted in Ethiopia the prevalence of LBW

was found to be 40% CITATION Che17 \l 1033 (Cherie & Mebratu, 2017) , 11.5% (Adhena *et al*.,2017) and 11.2% (Adane *et al*., 2014).

According to WHO in 2015 there were 2.6 million SB across the globe with more than 7178 deaths daily.SB rates are higher in developing countries than developed countries. Ninety eight percent occurred in low and middle income countries. Half of all the SB occurs in the intrapartum period. Three quarter of SB occur in South Asia and Sub Saharan Africa where 60% of these occur in rural families. Throughout the world the number of SB has been declining for example between the year 2000 and 2015 it has declined by 19.4% which represents annual reduction rate of 2% (WHO 2015). In 3 different studies conducted in Ethiopia the prevalence of SB was 14% (Cherie & Mebratu, 2017), 9.6% (Adhena *et al*.,2017) and 7.1% (Adane *et al*., 2014). CITATION Che17 \l 1033

2.2 Kenyan Situation of Adverse Birth Outcomes

Kenya is ranked among the developing countries in the world therefore it bears a big burden of ABO. In Kenya 193 000 infants are born as preterm every year and out of these 13 300 die each year due to preterm birth complications (KDHS, 2014). PB in Kenya contributes to more than quarter of deaths of newborns as it has not been able to meet interventions recommended by WHO. One in every eight deaths of children under five years die from complications of prematurity (UNICEF 2015). The National prevalence of PB in Kenya is 12% (KDHS, 2014). A study on the prevalence of PB in Kenyatta national hospital found the prevalence to be 18.3 % (Wagura *et al*., 2018) while a similar study in the same hospital in 2017 found prevalence to be 20.2% (Okube & Sambu 2017).

Low birth weight in Kenya is largely associated with PB. The National prevalence of LBW is 8%. Coast region has the highest prevalence of 12.7%, Central region 9.4%, Nairobi 8.9%. Eastern 8.4%, North Eastern 7.9%, Rift Valley 6.6%, Western 4.8% and lowest Nyanza 3.5% (KDHS, 2014). A study in Coast General hospital found prevalence

of LBW to be 29% (Jumbale *et al.*, 2018) while a similar one in Olkalou District Hospital, Central region found prevalence to be 12.3 % (Muchemi *et al.*,2015). In Pumwani Maternity Hospital, Nairobi a study found prevalence to be 32.8% (Mogire, 2014).

The national prevalence of SB is 23 per 1000 births (2.3%). A study in Nyeri Provincial Hospital found the SB prevalence to be 12.2 per 1000 births (1.22%) (Cheptum *et al.*, 2016) CITATION Che16 \l 1033 . Majority of the stillbirth in Kenya are fresh stillbirth meaning they occur in intrapartum period (KDHS, 2014).

2.3 Social demographic and social economic factors

Adverse birth outcomes may be dependent on maternal socio, economic and demographic characteristics such as maternal age, income levels, residence, marital status and education level (Diamond *et al.*, 2004).

2.3 .1 Maternal age

Teenage pregnancy is pregnancies by women aged below 20 years (WHO, 2020) while pregnancies above 35 years are termed as advanced maternal age pregnancy (WHO, 2001). Studies in the past have shown that pregnancies by teenagers, (< 20 years of age) and women of advance maternal age, (≥35 years of age) are at greater risk for stillbirth, preterm birth, and low birth weight. A study conducted in Taiwan found out that ABO was highest at ages of ≤14 years, which then declined to an age of 27 years, and then steadily increased to ages of ≥44 years. The study also noted that the highest risk for stillbirth was ≤ 14 years of age, and then declined in ages of 22 – 29 years with the risk increasing steadily at ≥ 44 years. For PB the study found the risk to be highest at ≤ 14 years. For LBW those at ≤14 years had the highest risk. Those aged < 27 years or > 32 years bore a greater risk compared to those between 28 and 31 years (Weng *et al.*, 2014). Women that have their first pregnancy at age ≤ 15 years or age of ≥39 years have higher chances of SB than the rest (KDHS, 2014). Advanced maternal age(>35 years) is

associated with risk of miscarriage and stillbirth. Multiple pregnancy is more common in advanced maternal age, which in turn is associated with preterm births (March of Dimes, 2018)

Young maternal age is an indicator for one or more other maternal risk factors associated with ABO and not just indication of incomplete maternal growth. Teenage mothers are more likely than older mothers to be less educated, unmarried and likely not to attend antenatal clinic early or attend less than 4 visits Studies done in the past suggested that a young gynecological age (conception within 2 years after menarche) and the effect of a teenager's becoming pregnant before her own growth has stopped might be associated with the increased risk of ABO in teenage pregnancy. A study conducted in the USA in 2007 found that teenage pregnancy increases the risk of ABO that is independent of important known confounders. This finding challenges the accepted opinion that ABO associated with teenage pregnancy is attributable to low socioeconomic status, inadequate prenatal care and inadequate weight gain during pregnancy (Chen *et al*., 2007).

Over the last 2 decades, the proportion of women who have been giving birth to their first child at an advanced age has been on the rise and subsequently the other births that follow are also at an advanced age. Advanced maternal age (≥ 35 years) has been associated with stillbirths according to a study conducted in Australia (Flenady *et al*., 2011). These findings were similar to the ones in a study conducted in the USA (Reddy *et al.,* 2010). The age of the mother as a risk factor of LBW has been identified in many hospital and population studies. In a cross-sectional analytic study that analyzed the 1993 KDHS data, mothers aged < 20 years were found to have the smallest babies at birth. In the same study mothers aged 35 years and older had higher LBW babies compared to those aged 20-34 years. The distribution of LBW by birth order appeared to follow a similar pattern to maternal age (Muchemi *et al.,* 2015).

2.3.2 Education and income level

Maternal socioeconomic status (SES) is a crucial determinant of inequity in maternal and fetal health (Luo *et al*., 2006). Women with higher education (from secondary level) have lower odds of experiencing LBW compared to those with no or lower education (primary school) It is believed that high maternal educational attainment improves birth outcomes by improving women's status and access to information and services however some studies link higher maternal educational attainment with increased incidence of ABO such as premature delivery. It is also possible that some of the background factors, such as maternal education, might influence birth outcomes indirectly through the intermediate factor (Diamond *et al*., 2014).

A study involving 1016 pregnant women in Ecuador found out that women of low social-economic status had low education levels hence limited knowledge on the indicators of quality antenatal care and were therefore at risk of receiving inadequate antenatal care unknowingly (Paredes *et al.,* 2005).

A study by Siza 2008 found that mothers without formal education were 4 times more likely to deliver LBW compared to those with formal education. In a similar study conducted in Kenya it was found that mothers with low level of education (lower than secondary school) were at risk of LBW than those with post primary school education (Wagura *et al.,* 2018). According to KDHS 2014, 69% women with higher education (post primary) attended 4 antenatal clinic visits compared to those with lower education (Primary and or no formal education) where only 44% attended 4 antenatal clinic visits hence higher chances of ABO. A study in Canada found that stillbirth rates were higher for mothers with fewer years of education at all gestational interval than those with many years of education (Auger *et al.,* 2012).

In another study, mothers with no formal education, those of rural residence, those of low socio-economic status, those who gave birth to a male infant and multiple births had higher chances of delivering low birth weight baby (Muchemi *et al*., 2015).

A study conducted in Ethiopia found that ABO were few in women from urban areas than in women from rural areas , this was attributed to inaccessibility of health facilities , long distances to health facilities, low education levels in rural areas, low income and poor referral mechanisms in rural areas (Abdo *et al.*,2016).

2.3.3 Marital status

Marital status refers to a state of being either single, married, widowed, divorced or separated. The risk for LBW and PB was high among the unmarried than the married women according to a study conducted in Canada CITATION Pra11 \l 1033 (Shah *et al*.,2011) . Lack of established paternity and being unmarried is significantly correlated with and may be important risk factors for PB and LBW deliveries. Health workers should be aware of the potential role of paternal presence and marital status may play with respect to preterm births and low birth weight CITATION Sab10 \l 1033 (Masho *et al*., 2010) . Being unmarried is a significant risk factor for LBW and PB however paternal presence may have a protective effect. Paternity in addition to marriage may be a proxy measure for paternal support. There is no biological relationship between marital status and birth outcomes however being married has been seen to have a protective effect. In a Study conducted in the USA, it was found out that those who are unmarried are more at risk of LBW and PTB than the married ones CITATION Sab10 \l 1033 (Masho *et al*., 2010) . In another study in Kenya it was found out that those who were not married had a higher risk of having LBW CITATION One15 \l 1033 (Muchemi *et al*., 2015) . In another similar study unmarried mothers were found to be more likely to give birth to LBW compared to their married counterparts CITATION JES08 \l 1033 (Siza, 2008) . According to a cohort study in the USA, births from unmarried women are at higher risk of SB as compared to births from married women CITATION Jac11 \l 1033 (Balayla *et al.*, 2011) .

2.3.4 Residence

Rural areas have been found to have poor health infrastructure, lack specialized medical personnel and high illiteracy level affecting health care services utilization associated with adverse birth outcomes .A study in Ethiopia showed that those mothers of urban residence less likely to develop adverse birth out come as compared to those of rural residence. This was due to factors such as inaccessibility of health services in rural areas, low income and low education levels in rural areas and cultural beliefs CITATION Abd162 \l 1033 (Abdo *et al*.,2016) . According to KDHS 2014, 68% of urban women attended at least 4 antenatal clinic visits compared with 51% of their rural counterparts hence more at risk of ABO.

2.4 Maternal medical and obstetric factors

2.4.1 Antenatal Care

Antenatal care (ANC) is the care provided by skilled health-care professionals to pregnant women in order to ensure the best health conditions for both mother and baby during pregnancy. Components of ANC include: risk identification, prevention and management of pregnancy-related or concurrent diseases, health education and health promotion (WHO, 2016). The baby's size at birth is influenced predominantly by maternal nutrition while premature delivery is predominantly influenced by the quality of antenatal care CITATION Mon00 \l 1033 (Magadi, 2000) .

Quality ANC is important in preventing PB, LBW, perinatal and maternal death. Antenatal care appropriateness is measured in terms of timing of the first visit and the total number of visits and their frequency CITATION Mon00 \l 1033 (Magadi, 2000) . Adequate and timely antenatal care is generally recognized to be an effective method of preventing ABO CITATION MEA07 \l 1033 (Alderliesten *et al*., 2007) . At the antenatal clinic a pregnant woman according to WHO is required to get daily iron and folic supplementation which helps prevent maternal anaemia, low birth weight, preterm birth and puerperal sepsis. In populations with low dietary calcium intake, daily oral

calcium supplementation (1.5-2.0 grams) is recommended at the ANC by WHO to reduce the risk of pregnancy induced hypertension.

In a study carried out in Ethiopia it was found out that pregnant woman who attended ANC are 83% less likely to have ABO than those who did not attend CITATION EYe19 \l 1033 (Yeshialem *et al*., 2019) . In another study conducted in Zimbabwe it was found out that those with less than 4 ANC visits had 34 % higher odds of experiencing LBW. Utilization of ANC has great potential in improving birth outcomes however utilization remains remarkably low in Sub Saharan Africa CITATION San17 \l 1033 (Yaya *et al*., 2017) .

The antenatal period is a crucial time for providing the expectant women with a variety of interventions by healthcare workers that may be important to their health and well-being and that of their developing foetus. The first antenatal clinic visit during the pregnancy is very important for the health of the mother and the foetus. WHO recommends the first visit to be during the first trimester, with a minimum of four antenatal visits (Cheptum *et al*., 2012).

Commencement of prenatal care early enough is important to prevent and treat obstetric and medical complications CITATION Ziy09 \l 1033 (Ziyo *et al*.,2009) . Late antenatal care or inadequate attendance at antenatal clinics has been associated with poor birth outcomes such as LBW and PB CITATION Hea08 \l 1033 (Heaman *et al.*,2008) . Adequate antenatal care is strongly and consistently associated with good birth outcomes. Late or lack of antenatal care is associated with a greater likelihood of having babies who are LBW, SB, or who die in their first year of life (Cheptum *et al*., 2012). The basic medical interventions at the ANC such as the taking of blood pressure and weight, testing of urine, haemoglobin level, assessment of fetal status, nutritional counseling and health education have been found beneficial for the health of pregnant women and foetus and influences birth outcomes (Cheptum *et al*., 2012).

A study by Muchemi in Kenya found that less than 4 ANC visits and poor nutritional status of pregnant mothers were significantly associated with LBW at term. However, in that study client satisfaction during antenatal care was not found to be significantly associated with birth weight. In the same study, it was found out that adequate use of antenatal care during pregnancy leads to higher birth weights among infants and by extension better health for infants CITATION One15 \l 1033 (Muchemi *et al.* ,2015) .

Inadequate ANC contributes significantly to poor birth outcomes. Studies done in the past have demonstrated the importance of antenatal care in reducing ABO such as low LBW and PB. .Antenatal care appropriateness is measured in terms of timing of the first visit and frequency of visits throughout pregnancy CITATION Mon04 \l 1033 (Magadi, 2000) .

Mothers who receive quality ANC in a health facility have a higher chance of having normal perinatal outcomes. It has been identified that the quality of service women receive in antenatal clinics is associated with the number of visits the same mother makes to the facility in the entire antenatal period. The more the visits a mother makes, the higher the chance of health workers identifying and mitigating pregnancy risks hence mitigating adverse outcome (Matiang'i , 2018).

According to a study conducted in Ethiopia, women with no ANC follow up were more likely to have stillbirth compared to those who attend. It also found that women who did not attend ANC had no formal education or had low level of education hence did not have good health seeking behaviour CITATION Ada14 \l 1033 (Adane *et al.*,2014) . A study in Mombasa Kenya found that less than 4 ANC attendances is a risk factor to LBW CITATION Cla18 \l 1033 (Jumbale *et al.*,2018) .

2.4.2 Bad obstetric history

Bad obstetric history refers to when a woman has had an adverse birth outcome in the past (WHO). Many previous studies have shown that those women who have had LBW babies, PB and SB in the past have high likelihood of the same occurring in subsequent

pregnancies. This is linked to mothers having same associated factors that that led to the outcome previously. In a study conducted in Mombasa, it was found out that womenwho gave births to LBW babies in the past had likelihood of giving LBW babies later CITATION Cla18 \l 1033 (Jumbale *et al*.,2018) . In Ethiopia a study at Suhul Hospital found that those with history of PB or LBW were likely to have PB or LBW than their counterparts without previous positive history (CITATION Tes17 \l 1033 Adhena *et al*., 2017) .

2.4.3 Interpregnancy interval

Interpregnancy interval is the period from the last date of delivery until the estimated date of the last menstrual period (that is the subsequent pregnancy), expressed in completed months. A short interpregnancy interval is the one less than 18 months (WHO, 2007). A short interpregnancy interval is associated with intrauterine growth retardation which is linked to low birth weight and preterm birth (Aman *et al.*, 2016).

A study by in the USA reported association of LBW, PB and small for gestation with mothers who has a short inter pregnancy interval of less than18 months CITATION Con06 \l 1033 (Conde- Agudelo *et al*., 2006) . A similar study in the same country found that risk of PB and its recurrence increases with short inter pregnancy interval CITATION DeF07 \l 1033 (DeFranco *et al.*, 2007) .

2.4.4 Multiple pregnancy

Multiple pregnancies are when there is more than one foetus in the uterus of a woman. Multiple pregnancies are risk factors for development of ABO which might be due to chorionicity, in monochorionic placentation and is associated with fetal mortality and morbidity (Cheptum *et al*. 2012).

Various studies have found that multiple pregnancies increase the risk of LBW, PB and SB. A study in Ethiopia found that those with multiple pregnancies are 7 times likely to have LBW and SB than those with singleton. In similar study in the same country it was

found that multiple pregnancy increases the risk of ABO CITATION Geb17 \l 1033 (Gebremeskel *et al*., 2017) .

2.4.5 Parity

Primiparity is the woman carrying the first pregnancy while multiple or grand multiparity is a woman who has had more than four pregnancies (WHO, 2015). A study in Australia found that primiparity contributed to 15% of the entire stillbirths. Primiparity is associated with prolonged labour due to high uterine muscle tone leading to stillbirth in intrapartum period CITATION Vic11 \l 1033 (Flenady *et al*., 2011) . A similar study in the USA found that increasing parity is associated with SB CITATION Ali05 \l 1033 (Aliyu *et al.,* 2005) while a study in Ethiopia found that multiparous were 7 times more likely to have ABO than parity of 1 or 2. Uterine tone reduces as the parity increases, the higher the parity the lesser the uterine tone hence posing risk of prematurity due to preterm labour CITATION Geb17 \l 1033 (Gebremeskel *et al*., 2017) .

2.4.6 Diabetes and Pregnancy induced Hypertension

Hypertension and diabetes in pregnancy have been associated with cardio-metabolic disorders that lead to PB and LBW babies. Women with diabetes have a higher risk for ABO than do women without diabetes. Diabetes in pregnancy is associated with risks to the woman and to the developing fetus. Miscarriage, pre-eclampsia and preterm labours are more common in women with pre-existing diabetes. Stillbirths, congenital malformations, macrosomia, birth injury, perinatal mortality and postnatal adaptation problems are also associated with diabetes (Cheptum *et al*., 2012).

Hypertension affects 6 - 8% of all pregnancies while chronic hypertension complicates 1-3% of all pregnancies. It is estimated that 11.5 – 30% of all pregnancies among women suffering from hypertension and eclampsia end up as stillbirths or perinatal deaths (WHO, 2011). Pre-eclampsia is a major cause of maternal and fetal mortality and morbidity. The disease not only affects pregnancy outcome, but also predisposes mother

and child to long-term health complications such as cardiovascular disease (Cheptum *et al*. 2012).

Besides putting the mother at a high risk of eclampsia, hypertension in pregnancy, also adversely affects the growth, development and survival of the fetus and newborn. This often manifests as IUGR, prematurity and in many instances stillbirths or neonatal deaths. Women with hypertension in pregnancy are at increased risk for maternal and perinatal morbidity. Hypertension in pregnancy leads to reduced placental blood flow causing reduced fetal growth which ends up in LBW babies. In a study conducted in Ethiopia it was found out mothers with Hypertension were 6 times more likely to have ABO than those without which was similar to a study conducted in Iran (CITATION Tes17 \l 1033 Adhena *et al*., 2017) .

2.4.7Anaemia

Haemoglobin (Hb) is an important oxygen carrying blood pigment that determines the health status of a placenta and in extension the nutritional status of the foetus. Anaemia during pregnancy is considered severe when HB concentration is less than 7.0 g/dl, moderate when HB level is 7.0 - 9.9 g/dl, and mild when HB level is 10.0 - 10.9 g/dl.(WHO, 2011) Low HB level is a risk factor for placental infarcts (death of placental tissue) leading to preterm labour, IUGR and LBW babies. Substantial evidence shows that maternal iron deficiency anemia early in pregnancy can result in low birth weight subsequent to preterm delivery (Cheptum *et al*., 2012). In Low income countries 25% of LBW is associated with anaemia in pregnancy (WHO 2012).

In pregnancy, increase in plasma volume exceeds the increase in red cell volume, which causes a physiological hemodilution, resulting in reduced HB concentration. In normal pregnancy without iron supplementation, Hb concentration decreases from an average of 12.5–13.0 g/dL to an average of 11.0–11.5 g/dl. A study in Iran found that the mean birth weight was less in anemic mothers (HB < than mothers with normal Hb levels CITATION Ali14 \l 1033 (Alizadeh *et al*., 2014) . Studies on the association between

maternal HB level and ABO have been inconsistent. Some studies showed a significant association between abnormal level of HB concentration and adverse pregnancy outcomes including stillbirth, pregnancy induced hypertension, LBW, PB, and perinatal death, while some of them do not confirm such a correlation CITATION Ali14 \l 1033 (Alizadeh *et al*., 2014) . In Ethiopia a study found that women with anaemia were 7 times more likely to have ABO (CITATION Abd162 \l 1033 (Abdo *et al*., 2016) .

2.4.8 Malaria

An estimated 30 million women each year become pregnant in malarious areas of Africa, with most living in areas of stable malaria transmission. A large number of women with malaria remain asymptomatic however the infection increases the risk of maternal anemia and delivering a low-birth-weight baby. Malaria infection during pregnancy is a significant public health problem with substantial risks for the pregnant woman, her fetus, and the newborn child. Malaria-associated maternal illness and low birth weight is mostly the result of *Plasmodium falciparum* infection and occurs predominantly in Africa (CITATION Hel04 \l 1033 Guyatt & Snow 2004) .

Malaria in pregnancy can affect the developing foetus resulting in PB and IUGR and is believed to a contributor to spontaneous abortion and SB. IUGR results from poor nutrient transport to the foetus as a result of high malaria parasite infection in placental blood CITATION Ste17 \l 1033 (Taylor &Ter Kulie, 2017) .

2.4.9 HIV infection

HIV infection has been reported to have little effect on pregnancy outcome in the developed world however early studies from sub-Saharan Africa suggest that infants of HIV-infected mothers may be at increased risk of ABO such as LBW, prematurity, and SB and neonatal death .In a study carried out in South Africa there was association of LBW with maternal HIV infection (Rollins *et al*., 2017).

In a study which compared the outcomes of perinatally HIV unexposed infants with HIV-exposed infants, higher occurrence of LBW was found among HIV exposed infants than HIV unexposed infants compared to infants not exposed CITATION Sof14 \l 1033 (Sofeu *et al*., 2014) .

A similar study in Malawi which assessed the trends of birth weight and gestational age for infants born of HIV infected mothers who had not received ARV prophylaxis during pregnancy found that they were significantly associated with higher odds of low birth weight and preterm births (Taha *et al*., 2012).

2.5 Lifestyle factors

2.5.1 Maternal smoking and Alcohol Consumption

Maternal smoking is associated with LBW and PB CITATION HPo00 \l 1033 (Pollack *et al*.,2000) . Smoking during pregnancy impairs foetal growth and shortens gestation causing premature birth with significant foetal and infant mortality and morbidity. Nicotine and Carbon monoxide are the main ingredients in cigarette smoke associated with adverse foetal effects according to various studies (Mogire, 2014).

Cigarette smoking in pregnant women makes them twice likely to have a LBW baby compared to women who do not smoke. Smoking slows fetal growth and increases the risk of PB. Alcohol and illicit drugs can limit foetal growth and cause ABO such as LBW and PTB. Consumption of alcohol is associated with health problems that adversely affect the mother and fetus; no level of alcohol consumption during pregnancy has been determined to be safe (Mogire, 2014). Maternal smoking according to an Australian study contributes to 20% SB in disadvantaged populations (CITATION Vic11 \l 1033 Flenady et al., 2011) . In a study conducted in the USA it was found that smoking and alcohol use increases the risk of SB CITATION Red10 \l 1033 (Reddy *et al*., 2010) . A similar study in Kenya found alcohol use and smoking to be associated with LBW and PB CITATION Pet18 \l 1033 (Wagura *et al*.,2018) .

2.5.2 Nutrition

Nutritional status of women prior to pregnancy and in early pregnancy plays an important role in determining early developmental processes and ensuring successful pregnancy outcomes. Available data indicate the importance of women's nutrition prior to and during the first trimester of pregnancy, but there is a need for well-designed prospective studies and controlled trials in developing country settings that examine relationships with LBW, PB and SB CITATION Ush12 \l 1033 (Ramakrishnan *et al*. 2012) .

A pregnant woman is required to take extra meals to cater for the increased nutritional requirements. The availability and supply of nutrients to the growing fetus depends on maternal nutritional status which in turn depends on her nutrient stores, dietary intake and obligatory requirements which in turn determines the birth outcomes (Ramakrishnan *et al*., 2012). The health status of a woman and her nutritional status directly impact on her quality of life, productivity and the life of her newborn. Poor nutrition is closely associated with intrauterine growth retardation and PB in both the developing and the developed countries CITATION One15 \l 1033 (Muchemi, *et al*.,2015) .

Dietary diversity is the number of different food groups that are consumed over a specific reference period. To ensure adequate nutrient intake, dietary diversification has been recommended as one of the best strategies. It's particularly highly recommended among pregnant women since they have increased nutrient requirement. To achieve minimum dietary diversity a pregnant woman must consume food items from at least five of the ten food groups (FAO 2016).

Poor nutrition status during pregnancy has been associated with adverse birth outcomes such as low birth weight, IUGR and preterm delivery. The more the food groups are included in a person's daily diet the higher the chances of meeting nutrient requirements. Dietary diversity is therefore important in improving nutrient intake (Kiboi *et al*., 2017). Nutrition education counseling is important in improving nutritional status of pregnant

women by focusing on maternal diet quality, diversity and amounts of foods consumed. A study found out that nutritional education counseling helped in reducing risk of preterm births and increased the birth weight (Girard & Olude, 2012).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study site

The study was carried out in Kajiado County Referral Hospital (KCRH)Postnatal Ward. The hospital is located in Kajiado Central Sub-County, Kajiado County, and 80 kilometers South East of Nairobi. KCRH is the main referral hospital and serves as the referral hospital for all the sub county hospitals, dispensaries, health centers, and private hospitals in Kajiado county.

3.2 Study Design

Cross sectional study design was used.

3.3 Study Variables

3.3.1 Dependent Variable

Adverse birth outcomes which include; low birth weight, preterm births and stillbirth.

3.3.2 Independent Variables

Maternal sociodemographic and economic factors such as maternal age, marital status, income level, residence, education level, occupation. Maternal obstetric and medical factors such as parity, birth intervals, previous history of adverse birth outcome, type of pregnancy, antenatal clinic attendance, malaria, hypertension, and diabetes mellitus. Lifestyle factors such as smoking, alcohol use and nutrition practices.

3.4 Study Population

The study population was mother-neonate pairs admitted in post-natal ward at Kajiado County Referral Hospital having delivered within 24 hours. The study population was 475 mother -neonate pairs in the study conducted for 75 days.

3.4.1 Inclusion Criteria

1. Mother-neonate pairs for whom the neonates had been delivered within 24 hours.

2. Mother-neonate pairs for whom the mothers were mentally sound.

3.4.2 Exclusion criteria

1. Mother-neonate pairs whom mothers were not mentally sound.

2. Mother-neonate pairs whom mothers were severely ill.

3.5 Sample Size Determination

The sample size was determined using Fishers et al formula of 1998, with a confidence interval of 95% and a sampling error of 5%,

n=sample size

Z=Statistic for a confidence at 95% which is 1.96

p= prevalence of the 3 adverse birth outcomes was considered where the ABO with the highest prevalence which was preterm birth at 12% was selected (12% was the national prevalence of preterm birth as per KDHS 2014)

d=precision with 95 % confidence interval with margin error of QUOTE 0.05

Total sample was 163

3.6 Sampling Technique

KCRH was selected purposively being the only referral hospital in Kajiado County,Kenya and with no other recent study of similar nature in the recent past. Systematic sampling was used to select the study participants. Data from the hospital indicated that an average of 190 births was recorded every month. The study was conducted for 75 days giving an estimated 475 births as the sampling frame within the study period.

The sampling interval was calculated each day where the total number of deliveries over the last 24 hours was used as the sampling frame for each day. The sample size (n) for each day was calculated as 163/75 = 2.2 that is 3 mothers-neonate pairs. To get Kth mother-neonate pair for each day=N/n (N being the total number of deliveries in 24 hours). This meant that every K^{th} mother-neonate pair was interviewed. The first respondent was selected by randomly blind picking one of pieces of paper with a "Yes" and the others with a "No ".The respondent who picked a "Yes "became the first participant to be interviewed. After getting the starting point, every K^{th} respondent was interviewed randomly and if she did not meet inclusion criteria or withdrew the next respondent was sampled.

3.7 Data Collection Tools

Interviewer administered questionnaire was developed by the researcher and some parts adopted from other past studies and used for data collection (Appendix I). In developing the questionnaire an expert opinion was also sought so as to formulate questions that were in tandem with the study. Questionnaire development was also guided by the objectives of the study.

3.8 Pretesting of Data collection Tools

Pre testing of the questionnaires was conducted in Loitoktok Sub County Hospital, Kajiado County. Loitoktok Sub County Hospital was chosen since it sits within the county and its clients have similar characteristics with the ones in KCRH. Questionnaires representing 10 % of the sample size were pretested two weeks before commencing the study.

Validity was ensured by seeking an expert opinion in developing the questionnaire to reduce ambiguity before development of the final one. Relevant parts were added from the expert's feedback and the parts that were also unnecessary removed after pretesting. Pretesting of the questionnaires also helped in validating the study.

To ensure reliability the weighing scale used for taking the neonates weight was taken for calibration at the Department of Weights and Measure. Calibration of the weighing scale would also be done every week to ensure consistency in its measurement readings. A test-retest correlation was done where the respondents interviewed initially were at a later point in time interviewed again and the responses compared.

3.9 Data Collection Procedure

Data was collected by the researcher with the assistance of two trained research assistants who were nurses by profession. Data collection was done using interviewer administered questionnaire between June 2019 and September 2019. Respondents that met the criteria and consented to participate in the study were interviewed in a private room within the post natal ward to ensure privacy. The research assistant would interview the participant as per the questionnaire and key in the participant's response and the session would last 20 minutes.

3.10 Data Management and Analysis

Questionnaires were checked at the end of each day for completeness and correction of any errors and stored in lockable cabinets. The principal investigator cleaned and stored

the data on a daily basis. Every questionnaire was checked for completeness at the end of each day. Data accuracy and completeness was maintained by randomly picking questionnaires at intervals from the batch and cross-checking with the print data source. Data confidentiality was maintained by password protection.

Data was entered in SPSS software version 23 for analysis. Descriptive statistics was conducted for quantitative data while logistic regression was performed to assess the association between adverse birth outcomes and various independent variables. Data was cleaned and then exported to the statistical package (IBM SPSS) for analysis. To avoid data loss, back ups were done regularly and the questionnaires safely kept for confidentiality.

Exploratory data analysis techniques were performed to explore the distribution of the study variables and identify the outliers. Data analysis commenced with descriptive statistics which included analysing the means and standard deviations of continuous variables and the proportions for the categorical variables. At bivariate analyses, each outcome was fitted to each risk factor at a time. Pearson chi-square test was used to determine the significance of association between the each outcome variable and the independent variables. Odds ratio (OR) and 95%CI were used to estimate the strength of association. All significant risk factors of bivariate analyses were used in multivariable logistic regression models controlling for potential confounders and effect modifiers. Adjusted odds ratio (AOR) and 95%CI were used to estimate the strength of association. The threshold for significance was set at $P<0.05$ at all levels of analyses.

3.11 Ethical considerations

Ethical approval was obtained from University of Eastern Africa Baraton Research Ethics Committee before the study commenced (Appendix V). License to conduct research was obtained from National Commission For Science Technology and Innovation (NACOSTI)(Appendix VI). Administrative approval was obtained from the Kajiado County Health Directorate (Appendix VII) .Client informed consent (Appendix

II) was obtained from the respondents before collecting the data. Respondents who were aged below 18 years were considered as emancipated minors who were psychologically mature to give consent. To ensure privacy mothers were interviewed in a private room within the postnatal ward. Questionnaires were given unique code number that could not be associated with the client's identity to ensure confidentiality.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSIONS

4.1 Introduction

This chapter represents the findings, results and interpretation of the study variables. Data presentation is based on the specific objectives of the study.

4.2 Socio demographic and Socioeconomic Characteristics of Study Respondents

A total of 163 respondents with a mean age of 25 ± 5.6 years were recruited into the study. Most (38%) of the mothers were aged 20 – 24 while 7.4% were aged 35 years and above. Majority (84.7%) of the respondents was married while 15.3% were single (Table 4.1).

Table 4.1: Socio demographic characteristics of the study respondents

Variables	N=163	%
Age category of the mothers		
≤19 years	24	14.7
20 - 24 years	62	38
25 - 29 years	44	27
30 - 34 years	21	12.9
≥35 years	12	7.4
Marital status		
Single	25	15.3
Married	138	84.7
Level of Education		
No Formal Education	12	7.4
Primary School	52	31.9
Secondary School	63	38.7
College	33	20.2
University	3	1.8
Occupation		
Housewife	71	43.6
Employed (Formal Sector)	14	8.6
Employed (Informal Sector)	27	16.6
Business Lady	27	16.6
Farmer/Livestock Herder	3	1.8
Dependant	21	12.9
Residential area		
Rural	79	48.5
Urban	84	51.5
Family approximate income in Kshs.		
0-10,000	77	47.2
10,001-20,000	68	41.7
20,001-30,000	16	9.8
30,000 and above	2	1.2

4.3 Lifestyle characteristics of study respondents

Majority of the respondents (53.4%) consumed food from at least five food groups daily. (Table 4.2).

Table 4.2: Lifestyle characteristics of study respondents

Variable	N	%
Consumed food from at least five food groups daily		
Yes	87	53.4
No	76	46.7
Number of meals per day		
2 meals	5	3.1
3 meals	100	61.3
More than 3 meals	58	35.6
Snacks taken or additional food		
Yes	58	35.6
No	105	64.3
Smoking		
Yes	0	0
No	163	100
Take Alcohol		
Yes	5	3.1
No	158	96.9

4.4 Obstetric and Medical characteristics of Study Respondents

4.4.1 Obstetric characteristics of study respondents

Majority (98.8%) of the respondents attended antenatal clinic with 55.9% attending the recommended minimum 4 visits. All the respondents (100%) who used micronutrient supplement used Iron and Folic while none used Calcium (Table 4.3).

Table 4.3: Obstetric characteristics of study respondents

Variables	N	%
Attending antenatal clinic		
Yes	161	98.8
No	2	1.2
First attendance		
1st Trimester	36	22.4
2nd Trimester	88	54.6
3rd Trimester	37	23
Number of antenatal clinic visits		
1 visit	12	7.5
2 visits	18	11.2
3 visits	41	25.5
4 visits and above	90	55.9
Received nutritional counseling		
Yes	81	49.7
No	82	50.3
Used micronutrient supplements		
Yes	156	95.7
No	7	4.3
Supplements taken		
Iron And folic supplements	156	100
Calcium Supplement	0	0
Length of taking the supplements		
Less than a Month	17	10.9
1 Month	42	26.9
3 Months	63	40.3
3-6 Months	30	19.2
Throughout the pregnancy	4	2.6

4.4.2Medical characteristics of study respondents during pregnancy

Only 3.7% of respondents had pregnancy induced hypertension (Table 4.4).

Table 4.4 : Medical characteristics of study respondents during pregnancy

Variables	n	%
Had Malaria		
Yes	1	0.6
No	162	99.4
Diagnosed as HIV Positive		
Yes	8	4.9
No	155	95.1
Had Diabetes Mellitus		
No	163	100
Pregnancy Induced Hypertension		
Yes	6	3.7
No	157	96.3
Had Anemia		
HB Level ≥11.0 g/dl (No Anemia)	103	63.2
HB Level 10-10.9 g/dl (Mild Anemia)	38	23.3
HB Level 7.0-9.9 g/dl Moderate Anemia)	19	11.7
HB Level < 7.0 g/dl (Severe Anemia)	3	1.8
HIV+ and on ARVs		
Yes	7	87.5
No	1	12.5
Time Started taking ARVs		
Before Pregnancy	4	57.1
1st Trimester	2	28.6
2nd Trimester	1	14.3
Previous pregnancies including abortions		
None	56	34.4
1-4	100	61.3
5 and above	7	4.3
Inter-pregnancy interval		
Less than 18 months	13	8
More than 18 months	86	52.8
No previous birth	64	39.3
Attended KCRH as a referral		
Yes	32	19.6
No	131	80.4
Which health facility		
Dispensary	2	6.5
Health center	26	83.9
Sub-county hospital	1	3.2
Private or Faith based hospital	2	6.5
Previously had Preterm Birth		
Yes	4	2.5
No	159	97.5
Previously had Low birth weight baby		
Yes	4	2.5
No	159	97.5
Previously had still birth		
Yes	2	1.2
No	161	98.8

4.5 Characteristics of study respondents' neonates

More than half of the neonates, 52.7 % were male while 47.3 %were female. Only 3.7% of the respondents gave birth to twins while majority had singletons.

Table 4.5: Characteristics of study respondents' neonates

Variables	N	%
Sex of baby		
Male	89	52.7
Female	80	47.3
Gestation at birth		
< 37 weeks	39	23.1
≥37 weeks	130	76.9
Baby born as		
Singleton	157	96.3
Multiple	6	3.7
Birth weight		
<2500 gm	39	23.1
≥2500 gm	130	76.9
Status of baby at birth		
Alive	158	93.5
Stillbirth	11	6.5
Adverse birth outcome		
Adverse birth outcome	55	32.5
No adverse birth outcome	114	67.5

4.6. Prevalence of adverse birth outcome among the study respondents' neonates

The prevalence rate for preterm birth was 23.1 %, low birth weight was 23.1% while stillbirth prevalence was 6.5%. The overall prevalence of occurrence the adverse birth outcomes was 32.5% (Total number of neonates were 169 since we had 6 pair of twins; out of this those with ABO were 55). Among the 3 adverse birth outcomes, prevalence of preterm births was 43.8%, low birth weight was 43.8 while stillbirth was 12.4 % (Figure 4.1).

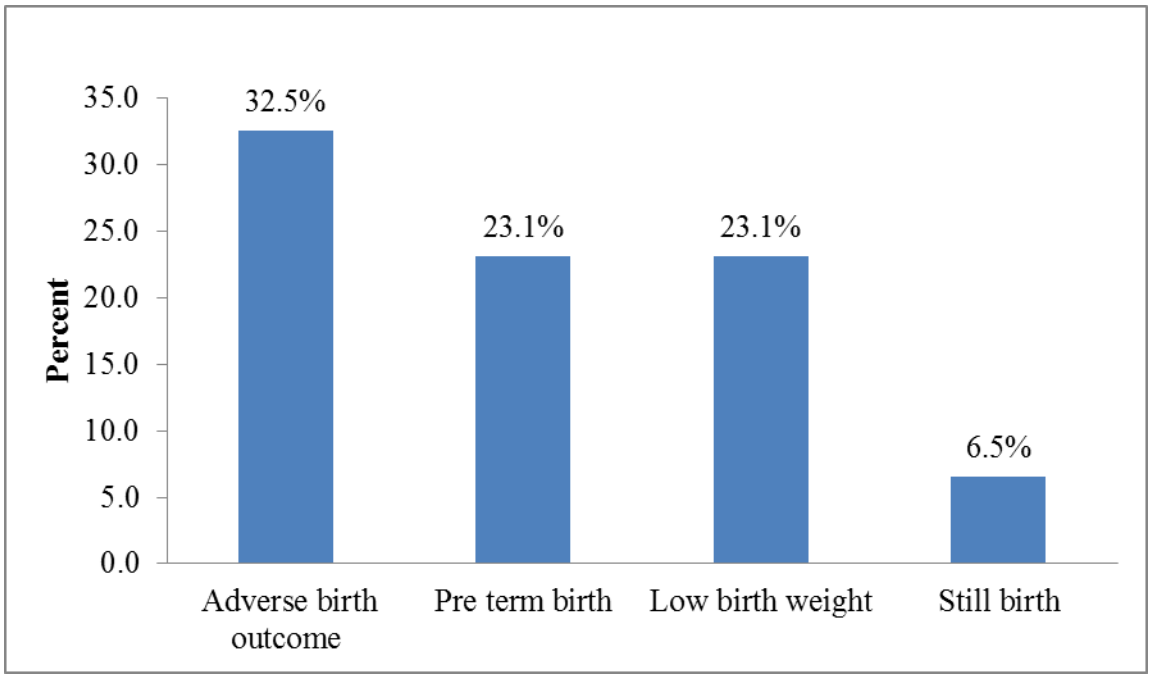

Figure 4.1: Prevalence of Any adverse birth outcome, Pre-term birth, Low birth weight and stillbirth

4.7: Factors associated with adverse birth outcomes among neonates in KCRH

4.7.1 Socio demographic and Socio-economic factors associated with adverse birth outcomes among neonates in KCRH

Marital status was significantly associated with occurrence of adverse birth outcome, P<0.05. Greater proportion of mothers having adverse birth outcome was observed among neonates whose mothers were single (50%) compared to those whose mothers were married (29.4%). Neonates whose mothers were single were 2.40[95%CI= 1.03 – 5.62, P= 0.043] times more likely to have an adverse birth outcome compared to those whose mothers were married. High proportion of mothers having adverse birth outcome was observed among neonates whose mothers resided in rural areas (49.3%) compared to mothers from urban areas (27.9%). Neonates whose mothers resided in rural areas were 2.52[95%CI= 1.33 – 4.77, P=0.004] times more likely to have an adverse birth outcome compared to those whose mothers resided in urban areas (Table 4.6).

Table 4.6: Socio demographic and Socio-economic factors associated with adverse birth outcomes among neonates in KCRH

ABO								
	Yes		**No**			**95%CI**		
Variables	**N**	**%**	**n**	**%**	**OR**	**Lower**	**Upper**	**P-Value**
Age category of the mothers								
≤19 years	10	40.00%	15	60.00%	1.5	0.36	6.23	0.577
20 - 24 years	23	37.10%	39	62.90%	1.33	0.37	4.8	0.666
25 - 29 years	11	23.40%	36	76.60%	0.69	0.18	2.67	0.589
30 - 34 years	7	31.80%	15	68.20%	1.05	0.24	4.62	0.949
≥35 years	4	30.80%	9	69.20%	Ref			
Marital status								
Single	13	50.00%	13	50.00%	2.4	1.03	5.62	**0.043**
Married	42	29.40%	101	70.60%	Ref			
Level of Education								
No Formal Education	4	33.30%	8	66.70%	0.25	0.02	3.66	0.311
Primary School	18	33.30%	36	66.70%	0.25	0.02	2.94	0.271
Secondary School	19	29.20%	46	70.80%	0.21	0.02	2.42	0.209
College	12	34.30%	23	65.70%	0.26	0.02	3.18	0.292
University	2	66.70%	1	33.30%	Ref			
ABO								
Occupation								
Housewife	18	25.00%	54	75.00%	Ref			
Employed (Formal Sector)	5	33.30%	10	66.70%	1.5	0.45	4.97	0.507
Employed(Informal Sector)	8	27.60%	21	72.40%	1.14	0.43	3.03	0.788
Business Lady	9	33.30%	18	66.70%	1.5	0.57	3.92	0.409
Farmer/Livestock Herder	3	75.00%	1	25.00%	9	0.88	92.06	0.064
Dependant	12	54.50%	10	45.50%	3.6	0.97	9.73	0.072
Residential area								
Rural	41	49.30%	42	51.70%	2.52	1.33	4.77	0.004
Urban	14	18.40%	62	81.60%	Ref			
Family approximate income in Kshs.								
0-10,000	33	40.70%	48	59.30%	0.34	0.03	3.95	0.391
10,001-20,000	14	20.60%	54	79.40%	0.13	0.01	1.53	0.105
20,001-30,000	6	35.30%	11	64.70%	0.27	0.02	3.67	0.327
30,000 and above	2	66.70%	1	33.30%	Ref			

UD : Undefined

4.7.2Lifestyle factors associated with adverse birth outcomes among neonates in KCRH

None of the selected nutrition characteristics was significantly associate with outcome of any adverse birth outcome, P>0.05(Table 4.7).

Table 4.7: Lifestyle factors associated with adverse birth outcomes among neonates in KCRH

ABO								
	Yes		No			95%CI		
Variables	n	%	N	%	OR	Lower	Upper	P-Value
Number of meals per day								
2 meals	2	40.00%	3	60.00%	1.47	0.23	9.56	0.684
3 meals	34	33.00%	69	67.00%	1.09	0.55	2.15	0.805
More than 3 meals	19	31.10%	42	68.90%	Ref			
Taking snacks								
Yes	20	31.30%	44	68.80%	0.91	0.47	1.77	0.779
No	35	33.30%	70	66.70%	Ref			
Consumed food from at least five food groups daily								
Yes	25	28.70%	62	71.30%	0.62	0.32	1.19	0.148
No	30	39.50%	46	60.50%	Ref			
Take alcohol								
Yes	5	100.00%	0	0.00%	UD	UD	UD	UD
No	50	30.5%	114	69.5%	Ref			

4.7.3 Obstetric factors associated with adverse birth outcomes among neonates in KCRH

Number of antenatal clinic visits was significantly associated with adverse birth outcome, P<0.05. Greater proportion of neonates having adverse birth outcome was observed among those whose mothers attended antenatal clinic once (61.5%) compared to those who had four or more visits (31.2%). Neonates whose mothers attended antenatal clinic once were 3.53[95%CI= 1.06 – 11.73, P= 0.039] times more likely to have adverse birth outcome compared to those who attended for 4 or more times (Table 4.8).

Table 4.8: Obstetric factors associated with adverse birth outcomes among neonates in KCRH

ABO								
	Yes		No			95%CI		
Variables	**N**	**%**	**N**	**%**	**OR**	**Lower**	**Upper**	**P-Value**
Attending antenatal clinic								
Yes	55	32.90%	112	67.10%	Ref			
No	0	0.00%	2	100.00%	UD	UD	UD	1
First attendance								
1st Trimester	17	44.70%	21	55.30%	1.62	0.64	4.08	0.306
2nd Trimester	25	27.80%	65	72.20%	0.77	0.34	1.73	0.525
3rd Trimester	13	33.30%	26	66.70%	Ref			
Number of antenatal clinic visits								
1 visit	8	61.50%	5	38.50%	3.53	1.06	11.73	**0.039**
2 visits	4	22.20%	14	77.80%	0.63	0.19	2.08	0.449
3 visits	14	32.60%	29	67.40%	1.07	0.49	2.31	0.873
4 visits and above	29	31.20%	64	68.80%	Ref			
Received nutritional counseling								
Yes	27	31.80%	58	68.20%	0.93	0.49	1.77	0.828
No	28	33.30%	56	66.70%	Ref			
Used micronutrient supplements								
Yes	53	32.90%	108	67.10%	1.47	0.29	7.54	0.643
No	2	25.00%	6	75.00%	Ref			
Supplements taken								
Iron and folic supplements	53	32.70%	109	67.30%	UD	UD	UD	1
Length of taking the supplements								
Less than a Month	12	60.00%	8	40.00%	4.5	0.89	51.3	0.132
1 Month	15	34.90%	28	65.10%	1.61	0.15	16.83	0.692
3 Months	17	26.20%	48	73.80%	1.06	0.1	10.92	0.959
3-6 Months	8	26.70%	22	73.30%	1.09	0.1	12.07	0.943
Throughout pregnancy	1	25.00%	3	75.00%	Ref			

4.7.4 Medical factors associated with adverse birth outcomes among neonates in KCRH

None of the medical characteristics was significantly associated with occurrence of adverse birth outcome (Table 4.9).

Table 4.9: Medical factors associated with adverse birth outcome among neonates in KCRH

ABO								
	Yes		No			95%CI		
Variables	n	%	N	%	OR	Lower	Upper	P-Value
Had Malaria								
Yes	0	0.00%	1	100.00%	UD	UD	UD	1
No	55	32.70%	113	67.30%	Ref			
Diagnosed as HIV Positive								
Yes	2	25.00%	6	75.00%	0.68	0.13	3.48	0.643
No	53	32.90%	108	67.10%	Ref			
Had Diabetes Mellitus								
No	55	32.50%	114	67.50%	UD	UD	UD	1
Pregnancy Induced Hypertension								
Yes	4	66.70%	2	33.30%	4.39	0.78	24.76	0.094
No (Bp > 140/90 mmHg)	51	31.30%	112	68.70%	Ref			
Had Anemia								
HB Level ≥ 11.0 g/dl	31	32.30%	65	67.70%	0.24	0.02	2.73	0.249
HB Level 10-10.9 g/dl	10	25.00%	30	75.00%	0.17	0.01	2.04	0.161
HB Level 7.0-9.9 g/dl	7	33.30%	14	66.70%	0.25	0.02	3.25	0.29
HB Level < 7.0 g/dl	2	66.70%	1	33.30%	Ref			
HIV+ and on ARVs								
Yes	2	28.60%	5	71.40%	Ref			
No	0	0.00%	1	100.00%	UD	UD	UD	1
Time Started taking ARVs								
Before Pregnancy	1	25.00%	3	75.00%	Ref			
1st Trimester	0	0.00%	2	100.00%	UD	UD	UD	1
2nd Trimester	1	100.00%	0	0.00%	UD	UD	UD	1
Previous pregnancies including abortions								
None	6	42.90%	8	57.10%	0.52	0.1	2.59	0.425
1 – 4	30	33.30%	60	66.70%	0.7	0.15	3.28	0.646
5 and above	19	29.20%	46	70.80%	Ref			
Inter-pregnancy interval								
Less than 18 months	6	42.90%	8	57.10%	1.82	0.55	5.94	0.324
More than 18 months	30	33.30%	60	66.70%	1.21	0.61	2.42	0.588
No previous birth	19	29.20%	46	70.80%	Ref			
Previously had Preterm Birth								
Yes	2	50.00%	2	50.00%	2.11	0.29	15.41	0.461
No	53	32.10%	112	67.90%	Ref			
Previously had Low birth weight baby								
Yes	3	75.00%	1	25.00%	6.52	0.66	64.18	0.108
No	52	31.50%	113	68.50%	Ref			
Previously had still birth								
Yes	2	100.00%	0	0.00%	UD	UD	UD	1
No	53	31.70%	114	68.30%	Ref			

UD : Undefined

4.7.5 Neonatal factors associated with adverse birth outcomes among neonates in KCRH

Multiple births were significantly associated with adverse birth outcome. Greater proportion of adverse birth outcomes was observed among neonates born as multiples (twins) (83.3%) compared to neonates born as singletons (28.7%). Neonates born as multiple births were 12.44[95% CI=2.62-59.05, P=0.002] times more likely to have an adverse birth outcome compared to those born as singletons (Table 4.10).

Table 4.10: Neonatal factors associated with adverse birth outcomes among neonates in KCRH

ABO								
	Yes		No			95%CI		
Variables	**n**	**%**	**n**	**%**	**OR**	**Lower**	**Upper**	**P-Value**
Sex of baby								
Male	25	28.1%	64	71.9%	0.65	0.34	1.24	0.194
Female	30	37.5%	50	62.5%	Ref			
Baby born as								
Singleton	45	28.7%	112	71.3%	Ref			
Multiple	10	83.3%	2	16.7%	12.44	2.62	59.05	**0.002**

4.8 Predictors of adverse birth outcomes among neonates in KCRH

All significant risk factors at bivariate level were included in multivariable logistic regression to determine the significant predictors of adverse birth outcome controlling for confounders and risk modifiers. Backward conditional method was chosen to determine the reduced model. Four factors were retained at P<0.05.

Marital status was a significant predictor of adverse birth outcome, P<0.05. Neonates born to single mothers were 2.76[95%CI = 1.06 – 7.17, P = 0.037] times more likely to have an adverse birth outcome compared to those born to married mothers. Neonates born to mothers who resided in rural areas were 3.18[95%CI= 1.25 – 6.92, P=0.021] times more likely to have an adverse birth outcome compared to those whose mothers resided in urban areas.

Neonates whose mothers attended antenatal clinic once were 4.25[95%CI= 1.91 – 10.38, P<0.001] times more likely to have an adverse birth outcome compared to those who attended for 4 or more times. Likewise, neonate whose mothers attended antenatal clinic two visits and three visits were 3.14[95%CI= 1.15 – 7.29, P=0.025] and 2.55[95%CI= 1.09 – 5.24, P=0.042] respectively, times more likely to have adverse birth outcome compared to those whose mothers attended four or more times. Neonates born as multiple were 10.44[95%CI = 3.49 – 22.16, P = 0.001] times more likely to have an adverse birth outcome compared to neonates born as singleton (Table 4.11).

Table 4.11: Predictors of adverse birth outcomes among neonates in KCRH

		95%CI		
Variables	aOR	Lower	Upper	P-Value
Marital status				
Single	2.76	1.06	7.17	0.037
Married	Ref			
Residential area				
Rural	3.18	1.25	6.92	0.021
Urban	Ref			
Number of antenatal clinic visits				
1 visit	4.25	1.91	10.38	<0.001
2 visits	3.14	1.15	7.29	0.025
3 visits	2.55	1.09	5.24	0.042
4 visits and above	Ref			
Baby born as				
Singleton	Ref			
Multiple	10.44	3.49	22.16	0.001

4.9 Factors associated with Preterm Births among neonates in KCRH

4.9.1 Socio demographic and socioeconomic factors associated with preterm births

Age of the mothers was significantly associated with occurrence of pre-term births, P<0.05. Greater proportion of pre-term births was observed among neonates whose mothers were aged 19 years or less (60%) compared to those whose mothers were aged above 19 years. Neonates whose mothers were aged 19 years or less were 7.80[95%CI= 1.15 – 52.68, P<0.001] times more likely to have preterm birth compared to mothers aged more than 19.

High proportion of pre-term birth was observed among neonates whose mothers resided in rural areas (54.2%) compared to those whose mothers resided in urban areas (19.8%). Neonates whose mothers resided in rural areas were 2.74[95%CI= 1.71 – 4.39, P<0.001] times more likely to be preterm birth compared to those whose mothers resided in urban areas (Table 4.12).

Table 4.12: Socio demographic and socioeconomic factors associated with preterm births among neonates in KCRH

Pre-term birth								
	Yes		**No**			**95%CI**		
Variables	**n**	**%**	**n**	**%**	**OR**	**Lower**	**Upper**	**P-Value**
Age category of the mothers								
≤19 years	15	60.00%	10	40.00%	7.8	1.15	52.68	<0.001
20 - 24 years	9	14.50%	53	85.50%	4.53	0.55	37.58	0.161
25 - 29 years	8	17.00%	39	83.00%	2.84	0.33	24.78	0.344
30 - 34 years	6	27.30%	16	72.70%	4.5	0.48	42.5	0.189
≥35 years	1	7.70%	12	92.30%	Ref			
Marital status								
Single	9	34.60%	17	65.40%	1.99	0.81	4.92	0.134
Married	30	21.00%	113	79.00%	Ref			
Level of Education								
No Formal Education	3	25.00%	9	75.00%	Ref			
Primary School	10	18.50%	44	81.50%	0.68	0.16	2.98	0.611
Secondary School	16	24.60%	49	75.40%	0.98	0.24	4.07	0.977
College	8	22.90%	27	77.10%	0.89	0.19	4.09	0.88
University	2	66.70%	1	33.30%	6	0.39	92.28	0.199
Occupation								
Housewife	14	19.40%	58	80.60%	0.42	0.15	1.2	0.107
Employed (Formal Sector)	5	33.30%	10	66.70%	0.88	0.22	3.48	0.85
Employed (Informal Sector)	4	13.80%	25	86.20%	0.28	0.07	1.1	0.068
Business Lady	6	22.20%	21	77.80%	0.5	0.14	1.76	0.279
Farmer/Livestock Herder	2	50.00%	2	50.00%	1.75	0.21	14.93	0.609
Dependant					Ref			
	8	36.40%	14	63.60%				
Residential area								
Rural	25	30.10%	58	69.90%	2.21	1.06	4.64	**0.032**
Urban	14	16.20%	72	83.80%	Ref			
Family approximate income in Kshs.								
0-10,000	22	27.20%	59	72.80%	0.19	0.02	2.16	0.179
10,001-20,000	10	14.70%	58	85.30%	0.09	0.01	1.04	0.054
20,001-30,000	5	29.40%	12	70.60%	0.21	0.02	2.85	0.24
30,000 and above	2	66.70%	1	33.30%	Ref			

4.9.2 Lifestyle factors associated with preterm births among neonates in KCRH

None of the selected lifestyle factor was significantly associated with outcome of preterm birth, P>0.05(Table 4.13).

Table 4.13 Lifestyle factors associated with preterm births among neonates in KCRH

Preterm								
	Yes		**No**			**95%CI**		
Variables	**n**	**%**	**N**	**%**	**OR**	**Lower**	**Upper**	**P-Value**
Number of meals per day								
2 meals	4	28.60%	10	71.40%	1.77	0.47	6.6	0.397
3 meals	23	25.60%	67	74.40%	1.52	0.69	3.33	0.299
More than 3 meals	12	18.50%	53	81.50%	Ref			
Taking snacks								
Yes	15	23.40%	49	76.60%	1.08	0.47	2.21	0.514
No	24	22.90%	81	77.10%	Ref			
Consumed food from at least five food groups daily					Ref			
Yes	18	20.70%	69	79.30%	0.68	0.33	1.41	0.301
No	21	25.70%	61	74.30%	Ref			
Smoking								
Yes	0	0.00%	0	0.00%	UD	UD	UD	UD
No	39	23.1%	130	76.90%	Ref			
Take alcohol								
Yes	5	100.00%	0	0.00%	UD	UD	UD	UD
No	34	20.1%	130	79.9%	Ref			

4.9.3 Obstetric factors associated with preterm births among neonates in KCRH

Number of antenatal clinic visits was significantly associated with occurrence of pre-term births, P<0.05. Greater proportion of neonates who were preterm was observed among those whose mothers attended antenatal clinic once (53.8%) compared to those who attended 4 or more (20.4%) times. Neonates whose mothers attended antenatal clinic once were 4.54[95%CI= 1.37 – 15.11, P= 0.014] times more likely to be preterm birth compared to those who attended 4 or more times (Table 4.14).

Table4.14: Obstetric factors associated with preterm births among neonates in KCRH

Pre-term birth								
	Yes		**No**			**95%CI**		
Variables	**n**	**%**	**N**	**%**	**OR**	**Lower**	**Upper**	**P-Value**
Attending antenatal clinic								
Yes	39	23.40%	128	76.60%	Ref			
No	0	0.00%	2	100.00%	UD	UD	UD	1
First attendance								
1st Trimester	11	28.90%	27	71.10%	1.36	0.49	3.78	0.558
2nd Trimester	19	21.10%	71	78.90%	0.89	0.36	2.2	0.804
3rd Trimester	9	22.50%	30	77.50%	Ref			
Number of antenatal clinic visits								
1 visit	7	53.80%	6	46.20%	4.54	1.37	15.11	0.014
2 visits	4	22.20%	14	77.80%	1.11	0.33	3.77	0.864
3 visits	9	20.90%	34	79.10%	1.03	0.42	2.51	0.947
4 visits and above	19	20.40%	74	79.60%	Ref			
Received nutritional counseling								
Yes	22	25.90%	63	74.10%	1.38	0.67	2.83	0.385
No	17	20.20%	67	79.80%	Ref			
Used micronutrient supplements								
Yes	39	23.60%	123	76.40%	2.16	0.26	18.14	0.477
No	0	0.00%	7	100.00%	Ref			
Supplements taken								
Iron and folic supplements	39	23.10%	130	76.90%	UD	UD	UD	1
Length of taking the supplements								
Less than a Month	12	60.00%	8	40.00%	6	0.89	21.26	0.106
1 Month	9	20.90%	34	79.10%	1.06	0.33	3.37	0.923
3 Months	11	16.90%	54	83.10%	0.81	0.27	2.46	0.716
3-6 Months	6	20.00%	24	80.00%	Ref			
Throughout the pregnancy	0	0.00%	4	100.00%	UD	UD	UD	1

UD=UnDefined`

4.9.4 Medical factors associated with preterm birth among neonates in KCRH

Pregnancy induced hypertension was significantly associated with occurrence of pre-term birth. High proportion of pre-term births was observed among neonates whose mothers had pregnancy induced hypertension compared to those whose mothers did not have pregnancy induced hypertension. Neonates whose mothers had pregnancy induced hypertension were 7.05[95%CI= 1.24 – 40.09, P= 0.011] times more likely to be preterm compared those whose mothers who did not have.

Likewise, high proportion of preterm births was observed among neonates whose mothers previously had a preterm birth compared to those who did not have preterm birth previously. Neonates whose mothers had preterm birth previously were 3.34[95%CI= 1.78 – 6.29, P= 0.014] times more likely to have a preterm birth compared to mothers who did not have **(**Table 4.15).

Table 4.15: Medical factors associated with preterm birth among neonates in KCRH

Pre-term birth								
	Yes	No		95%CI				
Variables	N	%	n	%	OR	Lower	Upper	P-Value
Had Malaria								
Yes	0	0.00%	1	100.00%	Ref			
No	39	23.20%	129	76.80%	UD	UD	UD	1
Diagnosed as HIV Positive								
Yes	2	25.00%	6	75.00%	1.12	0.22	5.77	0.895
No	37	23.00%	124	77.00%	Ref			
Had Diabetes Mellitus								
No	39	23.10%	130	76.90%	UD	UD	UD	1
Pregnancy Induced Hypertension								
Yes	4	66.70%	2	33.30%	7.05	1.24	40.09	0.011
No	35	22.10%	128	77.90%	Ref			
Had Anemia								
HB ≥11.0 g/dl	23	23.50%	75	76.50%	Ref			
HB 10-10.9 g/dl	10	23.80%	32	76.20%	0.98	0.4	2.36	0.958
HB 7.0-9.9 g/dl	3	13.60%	19	86.40%	0.56	0.15	2.08	0.387
HB < 7.0 g/dl	3	42.90%	4	57.10%	2.64	0.98	4.09	0.093
Yes	2	28.60%	5	71.40%	Ref			
No	0	0.00%	1	100.00%	UD	UD	UD	1
Time Started taking ARVs								
Before Pregnancy	1	25.00%	3	75.00%	Ref			
1st Trimester	0	0.00%	2	100.00%	UD	UD	UD	1
2nd Trimester	1	100.00%	0	0.00%	UD	UD	UD	1
Previous pregnancies including abortions								
None	9	15.80%	48	84.20%	0.47	0.08	2.8	0.406
1-4	28	26.70%	77	73.30%	0.91	0.17	4.96	0.912
5 and above	2	28.60%	5	71.40%	Ref			
Inter-pregnancy interval								
Less than 18 months	4	28.60%	10	71.40%	1.77	0.47	6.6	0.397
More than 18 months	23	25.60%	67	74.40%	1.52	0.69	3.33	0.299
No previous birth	12	18.50%	53	81.50%	Ref			
Attended KCRH as a referral								
Yes	6	17.60%	28	82.40%	0.66	0.25	1.74	0.403
No	33	24.40%	102	75.60%	Ref			
Which health facility								
Dispensary	0	0.00%	2	100.00%	UD	UD	UD	1
Health center	6	22.20%	21	77.80%	Ref			
Sub-county hospital	0	0.00%	1	100.00%	UD	UD	UD	1
Private or Faith based	0	0.00%	3	100.00%	UD	UD	UD	1
Previously had Preterm Birth								
Yes	2	75.00%	2	25.00%	3.34	1.78	6.29	0.014
No	37	22.40%	128	77.60%	Ref			
Previously had Low birth weight baby								
Yes	2	50.00%	2	50.00%	3.46	0.47	25.4	0.222
No	37	22.40%	128	77.60%	Ref			
Previously had still birth								
Yes	2	100.00%	0	0.00%	UD	UD	UD	1
No	37	22.20%	130	77.80%	Ref			

UD: Undefined

4.9.5 Neonatal factors associated with preterm births among neonates in KCRH

Neonates born as multiple babies were 8.13[95%CI= 2.30 – 28.74, P= 0.001] times more likely to be preterm birth compared those born as singleton baby (Table 4.16).

Table 4.16: Neonatal factors associated with preterm births among the neonates in KCRH

Pre term								
	Yes		No			95%CI		
Variables	n	%	n	%	OR	Lower	Upper	P-Value
Sex of baby								
Male	16	18.0%	73	82.0%	0.54	0.26	1.12	0.099
Female	23	28.8%	57	71.3%	Ref			
Baby born as								
Singleton	31	19.7%	126	80.3%	Ref			
Multiple	8	66.7%	4	33.3%	8.13	2.30	28.74	**0.001**

4.9.6 Predictors of pre-term birth among Neonates in KCRH

All significant risk factors at bivariate analyses were included in multivariable logistic regression to determine the significant predictors of pre-term birth controlling for confounders and risk modifiers. Backward conditional method was chosen to determine the reduced model. Four risk factors were retained at P<0.05.

Neonates whose mothers were aged 19 years or less were 3.72[95%CI= 1.21 – 8.10, P<0.001] times more likely to be preterm birth compared to mothers aged more than 34 years. Neonates whose mothers resided in rural areas were 2.01[95%CI= 1.16 – 6.85, P=0.015] times more likely to be preterm compared to those whose mothers resided in urban areas.

Neonates whose mothers had pregnancy induced hypertension were 4.20[95%CI= 1.31 – 9.37, P=0.003] times more likely to be preterm compared to those whose mothers did not have pregnancy induced hypertension. Neonates whose mothers had previous history of pre-term birth were 2.14[95%CI= 1.25 – 5.14, P=0.004] times more likely to be preterm compared to those whose mothers who did not have a previous history of pre-term birth. Neonates born as multiple births were 5.27[95%CI= 2.32 – 8.94, P< 0.001] times more likely to have be preterm compared to those born as singleton (Table 4.17).

Table 4.17 Predictors of Pre-term birth among neonates in KCRH

Variables	OR	95%CI Lower	Upper	P-Value
Age category of the mothers				
≤19 years	3.72	1.21	8.1	<0.001
20 - 24 years	1.23	0.55	7.14	0.963
25 - 29 years	1.14	0.33	4.78	0.617
30 - 34 years	0.92	0.21	2.5	0.189
≥35 years	Ref			
Residential area				
Rural	2.01	1.16	6.85	0.015
Urban	Ref			
Pregnancy Induced Hypertension				
Yes	4.2	1.31	9.37	0.003
No	Ref			
Previously had Pre-Term Birth				
Yes	2.14	1.25	5.14	0.004
No	Ref			
Baby born as				
Singleton	Ref			
Multiple	5.27	2.32	8.94	<0.001

4.10 Factors associated with Stillbirth among Neonates in KCRH

4.10.1 Socio demographic and socioeconomic factors of associated with still birth among neonates in KCRH.

Two socio-demographic characteristics were significantly associated with occurrence of stillbirth P<0.05. Age of the mothers was significantly associated with occurrence of still births, P<0.05. Greater proportion of still births was observed among neonates whose mothers were aged 19 years or below (24%) compared to mothers aged above 19 years. Neonates whose mothers were aged 19 years or less were 9.23[95%CI= 1.77 – 48.15, P=0.003] times more likely to be still birth compared to mothers aged more than 19 years.

High proportion of still birth was observed among neonates whose mothers resided in rural areas (13.5%) compared to mothers from urban areas (3.5%). Neonates whose mothers resided in rural areas were 10.16[95%CI= 3.37 – 27.78, P<0.001] times more likely to be still birth compared to mothers residing in urban areas (Table 4.18).

Table 4.18: Socio demographic and socioeconomic factors associated with stillbirth among neonates in KCRH

Still birth								
Variables	Yes n	%	**No n**	**%**	**OR**	**95%CI Lower**	**Upper**	**P-Value**
Age category of the mothers								
≤19 years	6	24.00%	19	76%	9.23	1.77	48.15	0.003
20 - 24 years	3	4.80%	59	95.20%	1.07	0.19	5.74	0.935
25 - 29 years	1	2.10%	46	97.90%	0.21	0.01	2.53	0.186
30 - 34 years	1	4.50%	21	95.50%	Ref			
≥35 years	0	0.00%	13	100.00 %	UD	UD	UD	1
Marital status								
Single	3	11.50%	23	88.50%	2.2	0.54	8.91	0.269
Married	8	5.60%	135	94.40%	Ref			
Level of Education								
No Formal Education	2	16.70%	10	83.30%	Ref			
Primary School	5	9.30%	49	90.70%	0.51	0.09	3.01	0.458
Secondary School	2	3.10%	63	96.90%	0.16	0.02	1.26	0.081
College	2	5.70%	33	94.30%	0.3	0.04	2.43	0.261
University	0	0.00%	3	100.00 %	UD	UD	UD	1
Occupation								
Housewife	2	2.80%	70	97.20%	Ref			
Employed (Formal Sector)	0	0.00%	15	100.00 %	UD	UD	UD	1
Employed (Informal Sector)	2	6.90%	27	93.10%	2.59	0.35	19.34	0.353
Business Lady	3	11.10%	24	88.90%	4.37	0.69	27.78	0.118
Farmer/Livestock Herder	1	25.00%	3	75.00%	11.67	0.81	167.48	0.071
Dependant	3	13.60%	19	86.40%	5.53	0.86	35.49	0.072
Residential area								
Rural	8	13.50%	51	86.50%	10.16	3.37	27.78	<0.001
Urban	3	3.50%	81	96.50%	Ref			
Family approximate income in Kshs.								
0-10,000	6	7.40%	75	92.60%	Ref			
10,001-20,000	5	7.40%	63	92.60%	0.99	0.29	3.4	0.99
20,001-30,000	0	0.00%	17	100.00 %	UD	UD	UD	1
30,000 and above	0	0.00%	3	100.00 %	UD	UD	UD	1

4.10.2 Lifestyle factors associated with stillbirth among neonates in KCRH

None of the selected lifestyle factor was significantly associated with outcome of stillbirths, P>0.05 (Table 4.19).

Table 4.19: Lifestyle factors associated with stillbirths among neonates in KCRH

Stillbirths								
	Yes		No			95%CI		
Variables	n	%	n	%	OR	Lower	Upper	P-Value
Number of meals per day								
2 meals	2	14.30%	12	85.70%	3.44	0.52	22.87	0.125
3 meals	6	6.70%	84	93.30%	1.48	0.36	6.13	0.592
More than 3 meals	3	4.60%	62	95.40%	Ref			
Taking snacks								
Yes	4	11.80%	30	88.20%	2.44	0.67	8.87	0.176
No	7	5.20%	128	94.80%	Ref			
Consumed food from at least five food groups daily								
Yes	5	5.70%	82	94.30%	0.711	0.21	2.43	0.586
No	6	7.90%	70	92.10%	Ref			
Smoking								
Yes	0	0.00%	0	0.00%	UD	UD	UD	UD
No	11	6.5%	158	93.50%	Ref			
Take alcohol								
Yes	5	100.00%	0	0.00%	UD	UD	UD	UD
No	6	3.8%	158	96.2%	Ref			

4.10.3 Obstetric factors associated with stillbirths among neonates in KCRH

None of the selected pregnancy history characteristic was significantly associated with still birth, P<0.05 (Table 4.20).

Table 4.20: Obstetric factors associated with stillbirths among neonates in KCRH

Still birth								
	Yes		No			95%CI		
Variables	n	%	n	%	OR	Lower	Upper	P-Value
Attending antenatal clinic								
Yes	11	6.60%	156	93.40%	Ref			
No	0	0.00%	2	100.00%	UD	UD	UD	1
First attendance								
1st Trimester	3	7.90%	35	92.10%	3.26	0.32	32.79	0.316
2nd Trimester	7	7.80%	83	92.20%	3.2	0.38	26.97	0.284
3rd Trimester	1	2.60%	38	97.40%	Ref			
Number of antenatal clinic visits								
1 visit	0	0.00%	13	100.00%	UD	UD	UD	1
2 visits	2	11.10%	16	88.90%	2.2	0.39	12.34	0.37
3 visits	4	9.30%	39	90.70%	1.81	0.46	7.09	0.397
4 visits and above	5	5.40%	88	94.60%	Ref			
Received nutritional counseling								
Yes	6	7.10%	79	92.90%	1.2	0.35	4.09	0.771
No	5	6.00%	79	94.00%	Ref			
Used micronutrient supplements								
Yes	10	6.20%	151	93.80%	0.46	0.05	4.15	0.492
No	1	12.50%	7	87.50%	Ref			
Supplements taken								
Iron and folic supplements	10	6.20%	152	93.80%	UD	UD	UD	1
Length of taking the supplements								
Less than a Month	1	5.00%	19	95.00%	1.53	0.09	25.9	0.77
1 Month	4	9.30%	39	90.70%	2.97	0.32	28.03	0.341
3 Months	4	6.20%	61	93.80%	1.9	0.2	17.78	0.573
3-6 Months	1	3.30%	29	96.70%	Ref			
Throughout pregnancy	0	0.00%	4	100.00%	UD	UD	UD	1

4.10.4 Medical factors associated with Stillbirth among neonates in KCRH

Pregnancy induced hypertension was significantly associated with stillbirth, P<0.05. High proportion of stillbirth was observed among neonates whose mothers had pregnancy induced hypertension (33.3%) compared to those who did not (5.5%).Neonates whose mothers had pregnancy induced hypertension were 8.56[95%CI= 1.38– 53.10, P= 0.021] times more likely to be still birth compared to those didn't **(**Table 4.21).

Table 4. 21: Medical factors associated with Stillbirth among neonates in KCRH

Still birth								
	Yes		No			95%CI		
Variables	n	%	N	%	OR	Lower	Upper	P-Value
Had Malaria								
Yes	0	0.00%	1	100.00%	UD	UD	UD	1
No	11	6.50%	157	93.50%	Ref			
Diagnosed as HIV Positive								
Yes	0	0.00%	8	100.00%	UD	UD	UD	1
No	11	6.80%	150	93.20%	Ref			
Had Diabetes Mellitus								
No	11	6.50%	158	93.50%	UD	UD	UD	1
Pregnancy Induced Hypertension								
Yes	2	33.30%	4	66.70%	8.56	1.38	53.1	0.021
No	9	5.50%	154	94.50%	Ref			
Had Anemia								
HB Level ≥11.0 g/dl	4	4.30%	92	95.70%	Ref			
HB Level 10-10.9 g/dl	1	2.50%	39	97.50%	0.33	0.04	2.74	0.302
HB Level 7.0-9.9 g/dl	5	20.80%	19	79.50%	6.05	0.78	24.66	0.105
HB Level < 7.0 g/dl	0	0.00%	3	100.00%				
HIV+ and on ARVs								
Yes	0	0.00%	7	100.00%	UD	UD	UD	1
No	0	0.00%	1	100.00%	UD	UD	UD	1
Time Started taking ARVs								
Before Pregnancy	0	0.00%	4	100.00%	UD	UD	UD	1
1st Trimester	0	0.00%	2	100.00%	UD	UD	UD	1
2nd Trimester	0	0.00%	1	100.00%	UD	UD	UD	1
Previous pregnancies including abortions								
None	3	5.30%	54	94.70%	0.33	0.03	3.73	0.373
1- 4	7	6.70%	98	93.30%	0.43	0.05	4.07	0.461
5 and above	1	14.30%	6	85.70%	Ref			
Inter-pregnancy interval								
Less than 18 months	2	14.30%	12	85.70%	3.44	0.52	22.87	0.2
More than 18 months	6	6.70%	84	93.30%	1.48	0.36	6.13	0.592
No previous birth	3	4.60%	62	95.40%	Ref			
Attended KCRH as a referral								
Yes	4	11.80%	30	88.20%	2.44	0.67	8.87	0.176
No	7	5.20%	128	94.80%	Ref			
Which health facility								
Dispensary	0	0.00%	2	100.00%	UD	UD	UD	1
Health center	4	14.80%	23	85.20%	Ref			
Sub-county hospital	0	0.00%	1	100.00%	UD	UD	UD	1
Private or Faith based	0	0.00%	3	100.00%	UD	UD	UD	1
Previously had Preterm Birth								
Yes	1	25.00%	3	75.00%	5.17	0.49	54.27	0.171
No	10	6.10%	155	93.90%	Ref			
Previously had Low birth weight baby								
Yes	2	50.00%	2	50.00%	11.78	0.95	14.1	0.054
No	9	5.40%	156	94.60%	Ref			
Previously had still birth								
Yes	1	50.00%	1	50.00%	15.7	0.91	269.95	0.058
No	10	6.00%	157	94.00%	Ref			

4.10.5 Neonatal factors associated with stillbirth among neonates in KCRH

None of the neonatal factors was significantly associated with still birth, P>0.05 **(**Table 4.22).

Table 4.22: Neonatal factors associated with stillbirth among neonates in KCRH

Still birth								
	Yes		**No**			**95%CI**		
Variables	**n**	**%**	**n**	**%**	**OR**	**Lower**	**Upper**	**P-Value**
Sex of baby								
Male	7	7.9%	82	92.1%	1.62	0.46	5.76	0.455
Female	4	5.0%	76	95.0%	Ref			
Baby born as								
Singleton	11	7.0%	146	93.0%	Ref			
Multiple	0	0.0%	12	100.0%	UD	UD	UD	1

4.10.6 Predictors of still birth among neonates in KCRH

All significant risk factors at bivariate analyses were included in multivariable logistic regression to determine the significant predictors of still birth controlling for confounders and risk modifiers. Backward conditional method was chosen to determine the reduced model. The factor that was significant was retained at p< 0.05, where neonates whose mothers had pregnancy induced hypertension were 2.35[95%CI= 1.25 – 7.36, P= 0.003] times more likely to have a still birth compared to those whose mothers did not have pregnancy induced hypertension (Table 4.23).

Table 4.23 Multivariable logistic regression for predictors of still birth

		95%CI		
Variables	**aOR**	**Lower**	**Upper**	**P-Value**
Pregnancy Induced Hypertension				
No	Ref			
Yes	2.35	1.25	5.48	0.003

4.11 Factors associated with low birth weight among neonates in KCRH

4.11.1 Socio demographic and socioeconomic factors associated with low birth weight among neonates in KCRH.

Two socio-demographic characteristics were significantly associated with low birth weight occurrences in neonates, P<0.05. Age category of the mothers was significantly associated with occurrence of low birth

weight, P<0.05. Greater proportion of low birth weight was observed among neonates whose mothers were aged 19 years or less (56%) compared to mothers aged more than 19 years (30.8%). Neonates whose mothers were aged 19 years or less were 2.86[95%CI= 1.12 – 11.82, P=0.013] times more likely to have a low birth weight compared to those aged more than 19 years.

High proportion of low birth weight was observed among neonates whose mothers resided in rural areas (28.9%) compared to mothers from urban areas (17.4%). Neonates whose mothers resided in rural areas were 1.93[95%CI= 1.13 – 4.00, P=0.009] times more likely to be low birth weight compared to those whose mothers resided in urban areas (Table 4.24).

Table 4.24: Socio demographic and socioeconomic factors associated with low birth weight among neonates in KCRH.

Low birth weight								
	Yes		**No**			**95%CI**		
Variables	**n**	**%**	**n**	**%**	**OR**	**Lower**	**Upper**	**P-Value**
Age category of the mothers								
≤19 years	14	56.00%	11	44.00%	2.86	1.12	11.82	**0.013**
20 - 24 years	14	22.60%	48	77.40%	0.66	0.18	2.46	0.532
25 - 29 years	4	8.50%	43	91.50%	0.39	0.09	1.64	0.2
30 - 34 years	3	13.60%	19	86.40%	0.84	0.19	3.8	0.825
≥35 years	4	30.80%	9	69.20%	Ref			
Marital status								
Single	8	30.80%	18	69.20%	1.61	0.64	4.04	0.315
Married	31	21.70%	112	78.30%	Ref			
Level of Education								
No Formal Education	6	50.00%	6	50.00%	1	0.07	14.64	0.999
Primary School	12	22.20%	42	77.80%	0.63	0.05	7.57	0.719
Secondary School	12	18.50%	53	81.50%	0.5	0.04	5.95	0.583
College	8	22.90%	27	77.10%	0.59	0.05	7.42	0.685
University	1	33.30%	2	66.70%	Ref			
Occupation								
Housewife	14	19.40%	58	80.60%	0.52	0.18	1.51	0.227
Employed (Formal Sector)	3	20.00%	12	80.00%	0.54	0.11	2.53	0.43
Employed (Informal Sector)	5	17.20%	24	82.80%	0.45	0.12	1.67	0.23
Business Lady	7	25.90%	20	74.10%	0.75	0.22	2.6	0.65
Farmer/Livestock Herder	3	75.00%	1	25.00%	6.43	0.56	73.35	0.134
Dependant	7	31.80%	15	68.20%	Ref			
Residential area								
Rural	24	28.90%	59	71.10%	1.93	1.13	4	**0.009**
Urban	15	17.40%	71	82.60%	Ref			
Family approximate income in Kshs.								
0-10,000	25	30.90%	56	69.10%	0.22	0.02	2.58	0.23
10,001-20,000	8	11.80%	60	88.20%	0.07	0.01	0.82	0.055
20,001-30,000	4	23.50%	13	76.50%	0.15	0.01	2.18	0.166
30,000 and above	2	66.70%	1	33.30%	Ref			

4.11.2 Lifestyle factors associated with low birth weight among neonates in KCRH

None of the selected lifestyle factors was significantly associated with outcome of low birth weight, P>0.05 (Table 4.25).

Table 4.25: Lifestyle factors associated with low birth weight among neonates in KCRH

Low Birth Weight								
	Yes		No			95%CI		
Variables	n	%	n	%	OR	Lower	Upper	P-Value
Number of meals per day								
2 meals	12	31.60%	26	68.40%	1.79	0.64	5.04	0.271
3 meals	19	21.10%	71	78.90%	1.04	0.41	2.62	0.939
More than 3 meals	8	20.50%	31	79.50%	Ref			
Taking snacks								
Yes	37	23.00%	124	77.00%	0.9	0.17	4.62	0.895
No	2	25.00%	6	75.00%	Ref			
Consumed food from at least five groups daily								
Yes	15	17.2	72	82.8	0.54	0.21	1.12	0.058
No	24	31.6	52	68.4	Ref			
Smoking								
Yes	0	0.00%	0	0.00%	UD	UD	UD	UD
No	39	23.1	130	76.90%	Ref			
Take alcohol								
Yes	5	100.00%	0	0.00%	UD	UD	UD	UD
No	34	20.1	130	79.9	Ref			

4.11.3Obstetric factors associated with low birth weight among neonates in KCRH

Antenatal clinic visits was significantly associated with low birth weight P<0.05.Greater proportion of neonates having low birth weight was observed among neonates whose mothers attended antenatal clinic once (46.2%) compared to those who attended 4 or more times (19.4%). Neonates whose mothers attended antenatal clinic once were 3.57[95%CI= 1.06 – 11.92, P= 0.003] times more likely to have low birth weight compared to those who had four or more antenatal clinic visits (Table 4.26)

Table 4.26: Obstetric factors associated with low birth weight among neonates in KCRH

Low birth weight								
	Yes		No			95%CI		
Variables	n	%	N	%	OR	Lower	Upper	P-Value
Attending antenatal clinic								
Yes	39	23.40%	128	76.60%	Ref			
No	0	0.00%	2	100.00%	UD	UD	UD	1
First attendance								
1st Trimester	12	31.60%	26	68.40%	1.79	0.64	5.04	0.271
2nd Trimester	19	21.10%	71	78.90%	1.04	0.41	2.62	0.939
3rd Trimester	8	20.50%	31	79.50%	Ref			
Number of antenatal clinic visits								
1 visit	6	46.20%	7	53.80%	3.57	1.06	11.92	**0.003**
2 visits	6	33.30%	12	66.70%	2.65	0.69	6.34	0.187
3 visits	9	20.90%	34	79.10%	1.85	0.56	3.05	0.725
4 visits and above	18	19.40%	75	80.60%	Ref			
Received nutritional counseling								
Yes	19	22.40%	66	77.60%	0.92	0.45	1.88	0.822
No	20	23.80%	64	76.20%	Ref			
Used micronutrient supplements								
Yes	37	23.00%	124	77.00%	0.9	0.17	4.62	0.895
No	2	25.00%	6	75.00%	Ref			
Supplements taken								
Iron and folic supplements	37	22.80%	124	77.20%	UD	UD	UD	1
Length of taking the supplements								
Less than a Month	8	40.00%	12	60.00%	2	0.18	22.8	0.577
1 Month	10	23.30%	33	76.70%	0.91	0.08	9.74	0.937
3 Months	11	16.90%	54	83.10%	0.61	0.06	6.43	0.682
3-6 Months	7	23.30%	23	76.70%	0.91	0.08	10.23	0.941
Throughout the pregnancy	1	25.00%	3	75.00%	Ref			

4.11.4 Medical factors associated with low birth weight among neonates in KCRH

Greater proportion of low birth weight was observed among neonates whose mothers had pregnancy induced hypertension (33.3%) compared to those who did not (22.7%). Those whose mothers had pregnancy induced hypertension were 1.7[95% CI = 1.13-9.67, P=0.048] times more likely to have low birth weight compared to those who did not. Neonates whose mothers had given birth to low birth weight babies previously were 3.46[95% CI =1.27-7.44, P=0.022] times more likely to be low birth weight compared to those whose mothers didn't have a previous history of low birth weight babies (Table 4.27).

Table 4.27: Medical factors associated with low birth weight among neonates in KCRH

Low birth weight								
	Yes		No			95%CI		
Variables	n	%	N	%	OR	Lower	Upper	P-Value
Had Malaria								
Yes	0	0.00%	1	100.00%	UD	UD	UD	1
No	39	23.20%	129	76.80%	Ref			
Diagnosed as HIV Positive								
Yes	1	12.50%	7	87.50%	0.46	0.06	3.88	0.477
No	38	23.60%	123	76.40%	Ref			
Had Diabetes Mellitus								
No	39	23.10%	130	76.90%	UD	UD	UD	1
Pregnancy Induced Hypertension								
Yes	2	33.30%	4	66.70%	1.7	1.13	9.67	0.048
No	37	22.70%	126	77.30%	Ref			
Had Anemia								
HB Level >= 11.0 g/dl	21	21.90%	75	78.10%	Ref			
HB Level 10-10.9 g/dl	7	17.50%	33	82.50%	0.76	0.29	1.96	0.566
HB Level 7.0-9.9 g/	6	28.60%	15	71.40%	1.43	0.49	4.14	0.511
HB Level < 7.0 g/dl	1	33.30%	2	66.70%	7.14	0.81	9.22	0.116
HIV+ and on ARVs								
Yes	1	14.30%	6	85.70%	Ref			
No	0	0.00%	1	100.00%	UD	UD	UD	1
Time Started taking ARVs								
Before Pregnancy	1	25.00%	3	75.00%	Ref			
1st Trimester	0	0.00%	2	100.00%	UD	UD	UD	1
2nd Trimester	0	0.00%	1	100.00%	UD	UD	UD	1
Previous pregnancies including abortions								
None	10	17.50%	47	82.50%	1.28	0.14	11.8	0.83
1- 4	28	26.70%	77	73.30%	2.18	0.25	18.93	0.479
5 and above	1	14.30%	6	85.70%	Ref			
Inter-pregnancy interval								
Less than 18 months	4	28.60%	10	71.40%	1.77	0.47	6.6	0.397
More than 18 months	23	25.60%	67	74.40%	1.52	0.69	3.33	0.299
No previous birth	12	18.50%	53	81.50%	Ref			
Attended KCRH as a referral								
Yes	9	26.50%	25	73.50%	1.26	0.53	2.99	0.6
No	30	22.20%	105	77.80%	Ref			
Which health facility								
Dispensary	0	0.00%	2	100.00%				
Health center	7	25.90%	20	74.10%	0.7	0.05	8.97	0.784
Sub-county hospital	1	100.00%	0	0.00%	UD	UD	UD	1
Private or Faith based	1	33.30%	2	66.70%	Ref			
Previously had Pre-Term Birth								
Yes	2	50.00%	2	50.00%	3.46	0.47	25.4	0.222
No	37	22.40%	128	77.60%	Ref			
Previously had Low birth weight baby								
Yes	2	50.00%	2	50.00%	3.46	1.27	7.44	0.022
No	37	22.40%	128	77.60%	Ref			
Previously had still birth								
Yes	2	100.00%	0	0.00%	UD	UD	UD	1
No	37	22.20%	130	77.80%	Ref			

4.11.5 Neonatal factors associated with low birth weight among neonates in KCRH

Neonates born as multiple babies were 22.07[95%CI= 4.59 – 52.16, P< 0.001] times more likely to have a low birth weight compared to neonates born as singleton babies (Table 4.29).

Table 4.28: Neonatal factors associated with low birth weight among neonates in KCRH

Low birth weight								
	Yes		**No**			**95%CI**		
Variables	**n**	**%**	**n**	**%**	**OR**	**Lower**	**Upper**	**P-Value**
Sex of baby								
Male	17	19.1%	72	80.9%	0.62	0.30	1.28	0.198
Female	22	27.5%	58	72.5%	Ref			
Baby born as								
Singleton	29	18.5%	128	81.5%	Ref			
Multiple	10	83.3%	2	16.7%	22.07	4.59	52.16	**<0.001**

4.11.6 Predictors of low birth weight among neonates in KCRH

All significant risk factors at bivariate analysis were included in multivariable logistic regression to determine the significant predictors of low birth weight controlling for confounders and risk modifiers. Backward conditional method was chosen to determine the reduced model. Five risk factors were retained at P<0.05.

Neonates whose mothers were aged 19 years or less were 3.12[95%CI= 1.27 – 7.38, P<0.001] times more likely to have a low birth weight compared those whose mothers were aged more than 19 years. Neonates whose mothers resided in rural areas were 3.52[95%CI= 1.64 – 8.22, P=0.008] times more likely to have a low birth weight compared to the ones who resided in urban areas. Neonates whose mothers had pregnancy induced hypertension were 3.16[95%CI= 1.33 – 8.19, P=0.012] times more

likely to have a low birth weight compared to those whose mothers who did not have pregnancy induced hypertension.

Neonates whose mothers attended antenatal clinic only once were 3.14[95%CI= 1.12 – 8.65, P= 0.001] times more likely to have a low birth weight compared to whose mothers who attended antenatal clinic 4 or more times. Neonates whose mothers who had previous history of low birth weight were 2.82[95%CI= 1.07 – 5.99, P=0.034] times more likely to have a low birth weight compared to those whose mothers who did not have previous history of low birth weight. Neonates born as multiple babies were 3.26[95%CI= 1.22 – 7.63, P= 0.015] times more likely to have a low birth weight compared to those born as singleton babies (Table 4.29).

Table 4. 29: Predictors of low birth weight among neonates in KCRH

		95%CI		
Variables	**aOR**	**Lower**	**Upper**	**P-Value**
Age category of the mothers				
≤19 years	3.12	1.27	7.38	<0.001
20 - 24 years	1.05	0.42	2.31	0.411
25 - 29 years	0.85	0.19	2.1	0.737
30 - 34 years	0.99	0.12	1.94	0.827
≥35 years	Ref			
Residential area				
Rural	3.52	1.64	8.22	0.008
Urban	Ref			
Pregnancy Induced Hypertension				
Yes	3.16	1.33	8.19	0.012
No	Ref			
Number of antenatal clinic visits				
1 visit	3.14	1.12	8.65	0.001
2 visits	1.55	0.84	5.71	0.081
3 visits	1.38	0.44	0.39	0.128
4 visits and above	Ref			
Previously had Low birth weight baby				
Yes	2.82	1.07	5.99	0.034
No	Ref			
Baby born as				
Singleton	Ref			
Multiple	3.26	1.22	7.63	0.015

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

5.1.1 Prevalence of Adverse Birth Outcomes among neonates in KCRH

The overall prevalence of adverse birth outcomes in the study was 32.5%, this was almost similar to studies conducted elsewhere in the past. In some studies, carried out in Ethiopia the overall prevalence of adverse birth outcome was 31.8% (Kassahun *et al*., 2019), 32.5% (Cherie & Mebratu, 2017) and 22.5% (Adhena *et al*., 2017). The close similarity with the past studies may be attributed to the fact that all the studies were hospital based and were carried in main referral hospitals which receive mothers who could have been referred from other facilities due to possible complications associated with adverse birth outcome.

The prevalence of low birth weight was 23.1% which was higher than for KDHS 2014 which was 8 % while the global prevalence is 15.5 % (WHO 2012). The difference may be due to the fact that in KDHS when determining prevalence of low birth weight, children with missing birth weights and those born as twins are left out unlike in this study where no child was left out. The difference in prevalence may also be due to the fact that KDHS is community based while this was a hospital-based study hence differences in population. In a study carried out in Coast General Hospital, Mombasa Kenya low birth weight prevalence was 29% (Jumbale *et al*., 2018) while in a study carried out in Olkalou Hospital, Nyandarua County it was 12.3% (Muchemi *et al*.,2015). In different studies conducted in Ethiopia preterm birth prevalence was 40%, 11.5% &11.2% (Cherie & Mebratu, 2017), (Adhena *et al*., 2017), (Adane *et al.,* 2014) respectively. The results differ slightly with this study due to the fact that KCRH is a referral hospital which may be receiving mothers with pregnancy complications from peripheral facilities.

Preterm birth prevalence in the study was 23.1%. This was higher compared to the KDHS survey 2014 which was 12 %. The difference may be due to the fact my study was hospital based while KDHS was community based. The prevalence was also higher

than studies conducted in Kenyatta National Hospital (Wagura *et al*., 2018 and (Okube &Sambu, 2017) which were 18.3% and 20.2 % respectively. The difference may be associated with high prevalence of teenage births in Kajiado County Referral Hospital.

The Stillbirth prevalence in this study was 6.7 %. This was higher than for KDHS 2014 which was 2.3% while in a study done at Nyeri Provincial Hospital stillbirth prevalence was 1.22 % (Cheptum *et al*., 2016). The difference in the prevalence maybe attributed to the differences in the study area.

5.1.2 Socio demographic and socio-economic factors associated with adverse birth outcomes among neonates in KCRH

The study found out that teenage pregnancy (giving birth at age ≤19 years) was significantly associated with preterm births and low birth weight. Neonates who were born by teenage mothers had higher odds of being preterm and low birth weight than those whose mothers were of higher ages. This concurs with another study in the USA (Chen *et al*., 2007) and KDHS 2014. Young maternal age is associated with the adverse birth outcomes due to the biological immaturity of the mothers body affecting growth of the fetus, low education level at that age, and possible inadequate antenatal care (Demirci *et al.* 2016).

Neonates born to mothers who were single had higher odds of low birth weight and preterm births compared to those born to married mothers. The study concurrs with other similar studies conducted elsewhere by (Shah *et al*., 2011), (Masho *et al*., 2010) and (Muchemi *et al*. 2015). Being single is linked to teenage pregnancy, lack of paternal support and poor antenatal care. Paternal presence has been found to have to have protective effect against adverse birth outcomes (Masho *et al*., 2010).

Neonates whose mothers resided in rural area had higher odds of having low birth weight and preterm birth compared to the urban dwellers. This concurs with other studies in Ethiopia (Abdo *et al*. 2016 and Gebremeskel *et al*., 2017). The results are also in agreement with KDHS 2014. The association of rural residence with adverse outcomes has been seen to be due to inaccessibility of health services in rural areas, low

education levels in rural areas, low income and cultural beliefs that may have effect on nutrition status of women by prohibition of certain essential foods.

5.1.3 Medical and Obstetric characteristics associated with adverse birth outcomes among neonates in KCRH

Pregnancy induced hypertension was associated with all the three adverse birth outcomes. This was in tandem with other past studies (Okube &Sambu, 2017, Adhena *et al*., 2017 and Cheptum *et al*., 2012). Hypertension in pregnancy results in reduced blood flow through arterioles and decreased delivery of oxygen and nutrients to the placental which leads to intrauterine growth retardation, prematurity and stillbirth (Cheptum *et al*.,2016).

Neonates born to mothers who had past history of low birth weight and past history of preterm birth had higher odds of having the same than those whose mothers never had a past history of low birth neither weight nor pre-term births. The past history of an adverse outcome tends to recur due to similar past associated factors. This study was in tandem with previous studies by (Muchemi *et al*., 2015), (Adhena *et al*., 2017) and (Okube &Sambu, 2017).

The number of antenatal clinic visits were associated with adverse birth outcomes the, lesser the visits the higher the odds of having adverse birth outcomes. Neonates born to mothers who attended less than 4 ANC visits had higher odds of adverse birth comes. Antenatal clinic attendance is thought to have protective effect against since complications that can lead to ABO are identified early and corrected, foetal growth assessment, supplementation and nutritional counseling is done at the clinic hence preventing ABO. This is consistent with past studies in Ethiopia (Yeshialem *et al*.,2019), (Abdo *et al*., 2019) and past studies in Kenya (Cheptum *et al*., 2012) ,(Muchemi *et al*., 2015) and(Jumbale *et al*.,2018).

Multiple pregnancy was significantly associated with adverse birth outcomes. Neonates who were born as twins were 4 times more likely to be low birth weight, and 3 times more likely to be born as preterm compared to those born as singletons. Multiple pregnancies leads to excess distension of the amniotic cavity leading to preterm

prelabour rupture of membranes hence premature births. In multiple pregnancy there may be intra uterine growth retardation leading to low birth weight due to competition for nutrients by the growing foetus (Sabzehei *et al*., 2017). This study agrees with previous studies (Abdo *et al*., 2016) and (Gebremeskel *et al*., 2017)

5.1.4 Lifestyle characteristics associated with adverse birth outcomes among neonate in KCRH

None of the lifestyle characteristics was associated with adverse birth outcomes among the neonates in KCRH.In this study none of the mother smoked while only a very small proportion took alcohol hence it was not possible to establish the associations. Nutrition practices were not found to be associated with adverse birth outcomes unlike in other studies (Girrad&Olude, 2012).The difference may be to the fact that this was hospital based study unlike other studies that were community based.

5.2 Study limitations

The study participants in some instances were required to recall some past events making the study subject to recall bias. To minimize recall bias the respondents were asked the questions in a manner that will make them recall easily and also allowed enough time to recall what they have been asked before responding.

5.3 Conclusions

1. The overall prevalence of adverse birth outcome was 32.5%. The prevalence of the specific ABO; low birth weight (23.1%), preterm birth (23.1%) and stillbirth (6.5%) are higher than the global and national rates.

2. The socio demographic and economic factors associated with adverse birth outcomes among neonates in Kajiado County Referral Hospital were; age (<19 years), being single and living in rural areas.

3. The medical and obstetrical factors associated with adverse birth outcomes were; pregnancy induced hypertension, attending less than four antenatal clinic visits, multiple birth and previous history of low birth weight and preterm birth.

4. None of the lifestyle factors was found to be significantly associated with adverse birth outcomes.

5.4 Recommendations

There is need to lower the prevalence rates of the adverse birth outcomes which are higher than the global and national rates. This can be done by adopting of strategies that will help in addressing factors associated with the adverse outcomes. This includes;

1. Prevention of teenage pregnancies. This can be achieved by including sexuality and health education in the new competence-based curriculum, development of laws with stiffer penalties for punishing those responsible for impregnating teenage girls. Empowerment of girl child through access to education, sensitizing the community against retrogressive cultural practices that lead to early pregnancies such as early marriages and forced marriages.
2. The study recommends improvement of healthcare access and provision in rural areas, with a focus also on sensitizing the pregnant women in rural areas on importance of utilizing the existing health facilities despite them being located far from them.
3. Health education of the pregnant women on importance of the minimum four antenatal clinic attendances. This can be achieved by establishment of community health units where the Community health volunteers will be responsible for follow up of all pregnant women within the unit to make sure they attend all the antenatal clinic visits.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE

Date of Interview: ____/_____/_____

Questionnaire code: _____

Section A: Sociodemographic and socioeconomic characteristics.

1. Age of the mother in years _____
2. What is your marital status?

   ☐Single

   ☐Married

   ☐Widowed

   ☐ Divorced

   ☐ Separated

3. What is the highest level of Education attained?

   ☐ No Formal Education

   ☐ Primary School

   ☐ Secondary School.

   ☐ College.

   University.
4. What is your occupation?

   ☐ Housewife

   ☐ Employed (Formal Sector)

   Employed (Informal Sector)

   ☐ Business lady

   ☐ Farmer/ Livestock Herder

   ☐ Any other specify _____
5. What is your area of residence?

☐Rural

☐Urban

6. What is your family approximately income in Kenya Shillings?

☐ 0-10,000

☐ 10000-20000

☐ 20000-30000

☐ 30000 and above

Lifestyle factors

7. Do you smoke? ☐Yes ☐ No

If yes did you smoke during the pregnancy? ☐Yes ☐No

If yes for how long?

☐ 1st trimester ☐ 2nd trimester ☐ 1st& 2nd trimester ☐ 3rdTrimester Throughout pregnancy

8. Do you take alcohol? ☐Yes ☐ No

If yes did you take alcohol during the pregnancy? ☐Yes ☐No

If yes for how long? ☐ 1st trimester , ☐ 1st and 2nd trimester, ☐ 3rd trimester ☐ Throughout pregnancy.

Nutrition

9. How many meals were you taking per day (24hrs) during the pregnancy?

☐ 1meal

☐ 2 meals

☐ 3meals

☐ More than 3 meals

10. Did you take snacks or additional food during the pregnancy compared to non-pregnancy state ? ☐Yes ☐ No

11. Did you consume foods from the following food groups daily during pregnancy?
    a) Grains ,white roots and tubers and plantains ;example ,bread, maize, sorghum, millet, potatoes, wheat, maize ,rice, arrow roots, sweet potatoes, cassava.

       Yes----------No----------

    b) Pulses ;example beans, peas, lentils, cowpeas, black beans, green grams ,pigeon peas

       Yes----------No----------

    c) Nuts and seeds ;Example are ground nuts ,cashew nuts, macadamia.

       Yes----------No----------

    d) Dairy ;example are milk, butter and cheese

       Yes----------No----------

    e) Meat, poultry and fish ;Example include all meats, organ meat, poultry& other birds ,fish, sea food, wild birds and mammals.

       Yes----------No----------

    f) Eggs from domesticated and wild birds.

       Yes----------No----------

    g) Dark green leafy vegetables ;examples are sukuma wiki ,spinach , indigenous vegetables(Managu,terere,kunde).

       Yes----------No----------

    h) Other vitamin A rich fruits and vegetables ;examples include Ripe mango and pawpaw, passion fruit, carrots, pumpkin, French beans, cabbage, courgettes, bell pepper (hoho).

       Yes----------No----------

    i) Other vegetables ;example include cucumber, tomato, eggplant, fresh peas, snow peas, okra and onions,

Yes----------No----------

j) Other fruits :example ripe bananas, Pineapple, grapes, avocado, apple, oranges

Yes----------No----------

12. Did you attend antenatal clinic? ☐Yes ☐ No

If yes, when did you attend your first antenatal clinic?

☐ 1st trimester

☐ 2nd trimester

☐ 3rd Trimester

13. How many antenatal clinic visits did you attend? (Confirm with ANC booklet) .

☐ 1 visit

☐ 2 visits

☐ 3visits

☐ 4 visits and above

14. Did you receive nutritional counseling during ☐Yes ☐No.

15. Did you use micronutrients supplements during this pregnancy? ☐Yes ☐ No

.If yes what did you take? (Sample of supplement will be used as prompt)

☐ Iron & folic supplements

☐ Calcium Supplements

☐ Multivitamins

☐ Any other supplements specify……...

If yes for how long did you use the supplements ?

☐ Less than a month

☐ 1 Month

☐ 3 Months

3 -6 Months

☐ Throughout the pregnancy

16. During the current pregnancy did you have the following conditions (confirm with ANC booklet)

(i) Malaria ☐ Yes ☐ No

(ii) Diagnosed as HIV Positive (Confirm with ANC booklet) ☐ Yes ☐ No

(iii) Diabetes Mellitus ☐Yes ☐ No

(iv) Pregnancy Induced Hypertension ☐ Yes ☐ No Bp >140/90 mmhg

(v) Anemia (Check HB level in the ANC booklet and the record)

☐ HB Level ≥11.0g/dl

☐ HB Level 10 ---10.9g/dl

HB Level 7.0-----9.9g/dl

HB Level <7.0 g/dl

Others specify----------

17. If HIV+ are you on ARV therapy ☐ Yes ☐ No

If Yes when were you started on them? ☐ Before pregnancy, ☐ 1st trimester ☐ 2nd trimester ☐ 3rd trimester ☐ After delivery

18. At what age did you get your first child? _____

19. How many pregnancies have you had previously including the ones that resulted to abortion?

☐ None

☐ 1-4

☐ 5 and above

20. When was your last delivery?

☐ (No previous birth)

☐(dd/mm/yyyy)

21. When was your last menstrual period? dd/mm/yyyy

22. What is the inter-pregnancy interval? (Period between last delivery and last menstrual period)

☐ Less than 18 months

☐ More than 18 months

No Previous Birth.

23. Did you attend KCRH as a referral from another facility? ☐ Yes ☐ No If yes from which health facility?

☐ Dispensary

☐ Health center

☐ Sub-country hospital

☐ Private or Faith based hospitals

24. Have you previously given birth to;

☐ Pre-term Birth (<37 weeks gestation) ☐Yes ☐ No

☐ Low birth weight baby (< 2500gms) ☐ Yes ☐ No

☐ Stillbirth (Born with no signs of life) ☐ Yes ☐ No

Neonatal Data

25. Date of delivery: dd/mm/yyyy

26. Sex of the baby ☐Male ☐Female

27. What is the baby's gestation at birth?

☐ < 37 weeks

☐ 37 weeks and above

28. Was the baby born as

☐Singleton

☐Multiple

29. What was baby's weight at birth?

☐Less than 2500gms

☐2500 gm- 3500gms

☐3500gm and above

30. Status of baby at birth

☐ Alive

☐ Fresh Stillbirth

☐ Macerated still birth

☐ Others specify_____

APPENDIX II: INFORMED CONSENT FORM

You are requested to participate in a research study conducted by Mr. Boniface Wachira, a Master of Public Health Student from Jomo Kenyatta University of Agriculture and Technology. You were selected as a possible participant in this study because the study is targeting women who have given birth in this hospital (KCRH)

PURPOSE OF THE STUDY - To determine the prevalence of adverse birth outcomes and factors associated with adverse birth outcomes namely; Low birth weight, preterm births and stillbirths.

Please read the information and if you require any clarification on any question, please feel free to ask the investigator prior to signing the consent form. If you cannot read the interviewer will read for you and explain it in a way you will understand and ask for clarification if need be.

POTENTIAL RISKS AND DISCOMFORTS

Your participation in this study is voluntary and you have the right to refuse to participate or to answer to any question that you feel uncomfortable with. If you change your mind, you have the right to withdraw at any time. If anything is not clear or if you need further information, we shall provide it to you. There may be potential risks and discomfort in the form of emotional distress during and after the study. If you experience discomfort in the form of emotional distress during and after the study you will be referred to a Counselor for counseling.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of use of code numbers and not names. Information collected from them will be treated confidentially with no invasion of privacy, kept under lock and key cupboard and only used for the purpose it was collected for.

POTENTIAL BENEFITS TO SUBJECTS OR TO THE SOCIETY

There is no monetary benefit for participating in this study. However, findings from this study will help in development of recommendations that will help reduce the adverse

birth outcomes which is beneficial to everyone including those who are not involved in the study.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also choose not to answer any question you feel you are not comfortable answering.

In case you have any questions or concerns related to this research, be free to contact:

Wachira Boniface Mwai: Principal Investigator cellphone 0721753508 / lusakaemali97@gmail.com or The Supervisors; Prof. Kikuvi cell phone 0725363151 or Dr. Magu cell phone 0722574388

Participation statement

I, _____, hereby give consent to Mr. Boniface Wachira to include me in the proposed study entitled **Prevalence and factors associated with adverse birth outcomes among neonates in Kajiado County Referral Hospital.**

I have read the information concerning this study, and I fully understand the aim of the study and what will be required of me if I accept to take part in the study. I understand that I can withdraw from this study any time if I so wish without giving any reason and this will not affect my access to normal health care and management. I therefore consent voluntarily to participate in this study.

Name of the respondent_____ Signature_____

Name of the investigator_____ Signature_____

Date_____

APPENDIX III: PRINCIPAL INVESTIGATOR CONFIDENTIALITY AGREEEMENT

Prevalence and Factors Associated with Adverse Birth outcomes Among Neonates in Kajiado County Referral Hospital.

I, **Boniface Wachira**, agree to maintain complete confidentiality while carrying out the tasks in this study.

Specifically, I agree to:

i. Keep all research information shared with me confidential by not discussing or sharing the information in any form or format (e.g., disks, tapes or transcripts).
ii. Hold in strictest confidence the identification of any individual that may be revealed during the course of performing the research tasks.
iii. Keep all raw data that contains identifying information in any form or format (e.g., disks, tapes, transcripts) secure while it is in my possession. This includes:
iv. Keeping all digitized raw data in computer password-protected files and other raw data in a locked file; closing any computer programs and documents of the raw data when temporarily away from the computer; permanently deleting any e-mail communication containing the data; and using closed headphones if transcribing recordings.

Name_____

Address_____

Telephone number_____

Signature_____ Date_____

APPENDIX IV: RESEARCH ASSISTANT CONFIDENTIALITY AGREEMENT

Prevalence and Factors Associated with Adverse Birth Outcomes Among Neonates in Kajiado County Referral Hospital.

I, _____, agree to assist the principal investigator with this study by _____

I agree to maintain full confidentiality when performing these tasks.

Specifically, I agree to:

1. Keep all research information shared with me confidential by not discussing or sharing the information in any form or format (e.g., disks, tapes, transcripts) with anyone other than the primary investigator.
2. Hold in strictest confidence the identification of any individual that may be revealed during the course of performing the research tasks.
3. Not make copies of any raw data in any form or format (e.g., disks, tapes, transcripts), unless specifically requested to do so by the primary investigator.
4. Keep all raw data that contains identifying information in any form or format (e.g., disks, tapes, transcripts) secure while it is in my possession. This includes:

i. keeping all digitized raw data in computer password-protected files and other raw data in a locked file; closing any computer programs and documents of the raw data when temporarily away from the computer; permanently deleting any e-mail communication containing the data.

ii. Using closed headphones if transcribing recordings;

iii. Give, all raw data in any form or format (e.g., disks, tapes, transcripts) to the principal investigator when I have completed the research tasks.

iv. Destroy all research information in any form or format that is not returnable to the primary investigator (e.g., information stored on my computer hard drive) upon completion of the research tasks.

Name _____

Signature _____ Date _____

Telephone number_____

Name of principal investigator_____ Signature_____

APPENDIX V: ETHICAL APPROVAL

APPENDIX VI: NACOSTI RESEARCH LICENCE

APPENDIX VII: COUNTY DIRECTORATE OF HELTH APPROVAL