PREVALENCE OF LOW BIRTH WEIGHT AND ASSOCIATED RISK FACTORS IN KISUMU COUNTY HOSPITALS.

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DECLARATION

This dissertation is my original work and has not been presented for the award of a degree in any other university.

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ABBREVIATIONS

ANC-antenatal care

BMJ-British medical journal

CART- combined anti-retroviral therapy.

BMI-Body mass index

ELBW-extreme low birth weight

ERC-Ethics and research committee

GBD - gestation by date

INTERGROWTH 21st-The international fetal and newborn growth consortium for the 21st century.

KNH - Kenyatta National Hospital.

LBW-low birth weight.

LNMP -Last normal monthly period

MUAC-mid upper arm circumference.

NCPAP-nasal continuous airway pressure

PMTCT-prevention of mother to child transmission.

SGA-Small for gestational age.

SSA-Sub- Saharan Africa

UoN- University of Nairobi.

VLBW-very low birth weight

DEFINITION OF TERMS

Anemia: Hemoglobin level of less than 11.0g/dl in pregnant women. Mild anemia is defined as hemoglobin level of between 9.0-10.9g/dl, moderate is between 7.0-8.9g/dl and severe is less than 7.0g/dl.

Intimate partner violence: Any behavior within an intimate relationship that causes physical, psychological or sexual harm to those in the relationship.

Neonate: An infant who is less than 28 days of life.

Neonatal death: Death of a live born baby within 28 days of life.

Low birth weight: LBW has been defined by the World Health Organization as a weight of less than 2500g at birth irrespective of gestational age. Very low birth weight (VLBW) is birth weight of <1500g and birth weight of <1000g is defined as extreme low birth weight (ELBW).

Small for gestational age: fetal weight less than the 10^{th} percentile. This classification was developed by a 1995World Health Organization (WHO) technical committee, and it is based on a birthweight-for-gestational -age measured compared to a gender-specific reference population.

ABSTRACT

INTRODUCTION: The World Health Organization (WHO) defines low birth weight (LBW) as birth weight below 2500g. LBW is associated with poor neonatal outcomes (like respiratory distress syndrome and necrotizing enterocolitis) and long-term complications for survivors like growth delay, neuropsychological disturbance and development of non-communicable diseases. Preventable causes of LBW can be reduced by measures that identify high risk women pre-pregnancy, and increase availability and quality of antenatal care.

OBJECTIVES: The objectives were to determine the prevalence of LBW among neonates who were born in three high volume health facilities in Kisumu County and to determine the associated risk factors.

METHODOLOGY: This was a cross-sectional study conducted in three hospitals in Kisumu County. It included 227 mothers with their live newborns. Pretested questionnaires, MOH mother and Child health booklets and patient files were used to obtain information. Neonatal birth weight, maternal left-mid-upper-arm circumference and height were recorded. Data were entered and cleaned in Microsoft excel and analyzed using STATA vs 13.

RESULTS: The prevalence of low birth weight was 17.5%. The mean birthweight was 3.0kg. 57% of newborns were males. The median maternal age was 24 years (IQR 19,31) with 63% being between 20-35 years. Among the new mothers, 74% were married, 60% had post-primary education and only 8% had a formal employment. Maternal demographic, socio-economic and nutritional factors were not associated with low birth weight. Being unmarried(P=0.011), experience of intimate partner violence (P=0.025), less than 2 antenatal visits(P=0.042) and

previous history low birth weight(P=0.001) remained significant in increasing the risk of low birth weight in a multivariable logistic regression model.

CONCLUSION: The prevalence of low birth weight was 17.5%. Marital status, intimate partner violence, number of antenatal visits were independently associated with low birth weight.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

The definition of Low birth weight (LBW) as per the World Health Organization (WHO) is a weight below 2500g at birth irrespective of the gestational age. A weight of between 1000g and 1499g at birth is termed as very low birth weight(VLBW) whereas 999g and below is termed as extreme low birth weight (ELBW) .(1) Birthweight is an indicator of intrauterine fetal growth. It is a good predictor of short-term neonatal survival.(2)

LBW is often used in neonatal health programs because weight can be accurately measured. Additionally, the prevalence of LBW has been adopted as a World Health Assembly (WHA) nutrition indicator. A global reduction target of 30% of LBW prevalence by 2025 has been set by the WHA. This is in recognition of the importance of birth weight for survival, development and general health in the human lifespan.(3)

LBW infants can fall under either of the three categories: preterm, appropriate for gestational age (AGA) and LBW or preterm, small for gestational (SGA) and LBW or Term, SGA and LBW as illustrated in figure 1. LBW is largely preventable. It needs measures put in place to identify high risk women during pre-pregnancy period, increase access and quality of early antenatal care and mounting a preventive public information campaign as well as directing resources towards research on low birth weight.

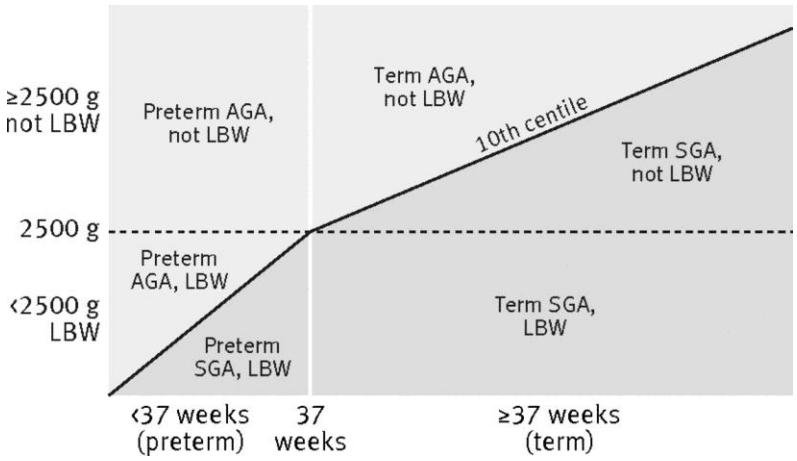

Figure 1: The different domains of low birth weight. (4)

In 2012, 19% of infants (approximately 23 million infants) were born with intrauterine growth restriction. In middle- and low-income countries 22% of neonatal deaths were associated with small for gestational age. The highest prevalence of SGA was in South Asia accounting for 34% with 289 700 neonatal deaths attributable to SGA.(4).The weight at birth is a determinant of outcome of all neonates. For each 20–25% decrease in birth weight, the risk of major morbidity and mortality almost doubles.(5)

Hypothermia, hypoglycemia, asphyxia, respiratory distress, fluid and electrolyte imbalance, hyperbilirubinemia, infection and neurological problems, are more common in LBW neonates as compared to their normal weight counterparts. The outcomes are worse with decreasing birth weight.(6) LBW are associated with a higher risk of developmental delay and overweight related noncommunicable diseases in adulthood.(11,12) The outcome of the complications is however influenced by the level of care that is available for the newborn and young infant.(9)

The aim of this study is to establish the prevalence of low birth weight in three hospitals in Kisumu County and its associated risk factors.

CHAPTER 2: LITERATURE REVIEW

2.1 PREVALENCE OF LOW BIRTH WEIGHT

Globally, approximately about 14 million infants are born with low birth weight with the highest burden being in Asia (72%) and Africa (22%). (10) India accounts for nearly 40% of proportion of low birth weight births in resource-limited countries. According to WHO-Africa Health observatory, sub-Saharan Africa reports a 14% LBW each year. The proportion of LBW varies from region to region as demonstrated in the map below.

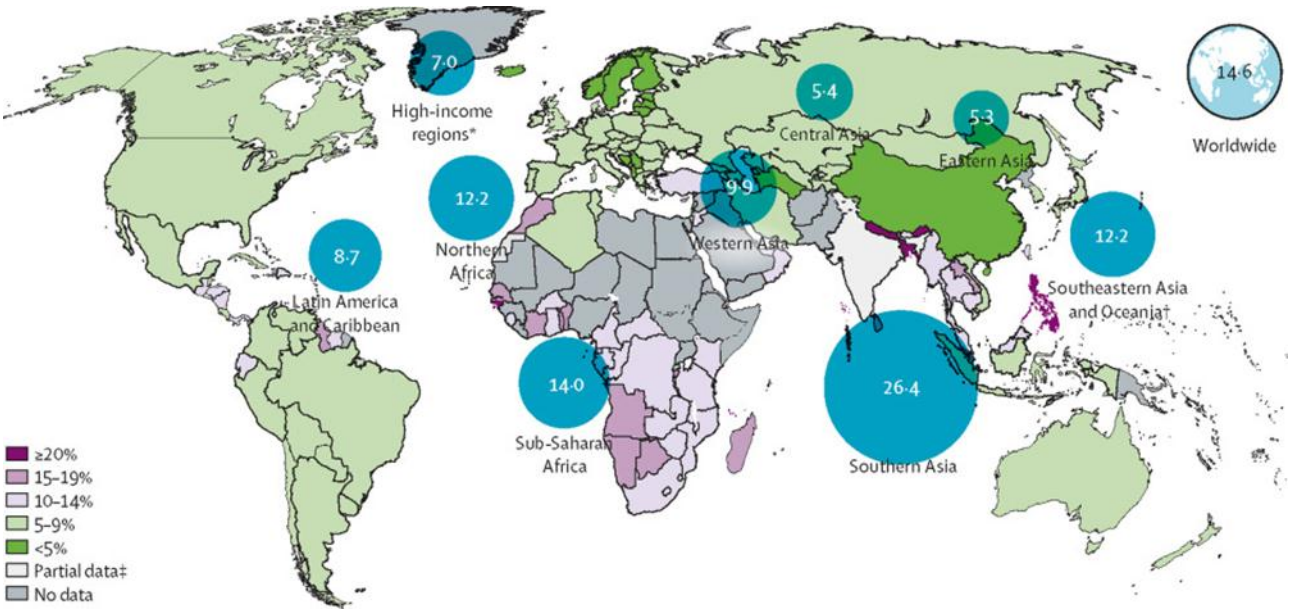

Figure 2:National and regional low birthweight prevalence, 2015.(11)

Regionally, the prevalence of low birth weight in Ethiopia was estimated to be 13% and that of Tanzania was estimated to be 7%. (12) (13) According to the Kenya Demographic Health survey (KDHS) of 2014, 8% of births reported were of LBW. This ranged from 4 % in the Nyanza region to 13 % in the Coast region.(14) Preterm births, a major contributor to LBW contributes

28% of the Kenyan national neonatal mortality.(15)A study by Migwi in Narok District in Kenya revealed a prevalence of 16.4%.(16).A similar study Conducted in Kenyatta National Hospital revealed a low birth weight prevalence of 10%.(17)

2.2 RISK FACTORS ASSOCIATED WITH LOW BIRTH WEIGHT

Preterm birth has been associated with low birth weight.(18) It is clear that babies born before 37 completed weeks due to whatever cause, be it medical, gynecological or otherwise are at higher risk of being low birth weight. Table 1 below gives a summary of the known risk factors for low birth weight among neonates.

Table 1: Summary table of maternal risk factors for low birth weight among neonates.

MATERNAL BIOMEDICAL	SOCIO-DEMOGRAPHIC	NUTRITIONAL AND BEHAVIORAL
Hypertension in pregnancy(19)	Extremes of maternal age(20)	Maternal malnutrition(21)
Urinary tract infection(22)	Low socio-economic status(23)	Anemia in pregnancy(24)
Previous history of LBW(25)	Low level of education(26)	Intimate Partner violence(27)
HIV in pregnancy(28)	Cigarette smoke exposure(29)	

2.2.1: MATERNAL DEMOGRAPHIC FACTORS

The mother's demographic features that are associated with delivering low birth weight neonates include extremes of maternal age, urban dwelling and multiparity, among others. The mother's age at delivery has been considered one of the most important risk factors for LBW. Several studies have shown a U-shaped relationship between maternal age and LBW among Caucasians. The younger women (those under 15years of age) and the older women (those over 40years of age) being at higher risk compared to their 25-29 years old counterparts.(30) Jannatul Ferdos *et*

al of Bangladesh showed that the mothers aged less than 20 years of age and those married before their 18th birthday had a higher risk of giving birth to LBW babies relative to the older mothers. (31) Yisak in Ethiopia in a similar study involving 424 mothers also revealed that mothers below 20 years old were more likely to deliver babies with the weight of less than 2500g.(32) Demelash H. *et al* in a study in south East Ethiopia noticed that maternal age under 20 years was a major contributing factor to low birth weight among neonates .(26) Maternal age under 19 years and over 30 years was noted to be associated with low birth weight in a study by Selina Khatoun *et al* in 2008.(33) A hospital based descriptive cross-sectional study design showed an association between birth weight and age of the mother to imply that birth weight increases with age up to the age of 38years,from where the weight starts declining again as the mother advances in age.(34) A study in Kenya by Wairimu Gathimba *et al* revealed that neonates of younger mothers (15-23years) and older mothers(35-49years) were more likely to be of LBW as compared to children of mothers aged between 23years and 35years.(35)

2.2.2 MATERNAL SOCIOECONOMIC FACTORS

A couple of maternal socio-economic factors have been postulated to contribute to the risk of low birth weight. They include: low level of education, unstable source of income and cigarette smoking.

A study in Bangladesh in 2008 revealed an increased risk of LBW with lower education level, being a house-wife vis a vis being employed as well as lower level of income.(33)A study by Khan however showed no relationship between mother's level of education with low birth weight.(34) Lin-Lin Dai in 2014 reveled a reduced risk of low birth weight with increased maternal education and more so synergistically with increased prenatal visits.(36)

Several studies have shown that that newborns to mothers with a prior history of physical trauma during pregnancy are more likely to have low birth weight.(37) The traumatic experience could either be accidental or incidental. Accidental injury can occur during forceful hard labor during pregnancy while incidental injury can occur in cases of sexual gender-based violence. According to WHO, hard physical labor during pregnancy is one of the factors that increase the risk of low birth weight particularly in low income countries. Higher incidence of LBW babies was observed in working class women compared to stay-at-home mothers .(38) Jannatul Ferdos *et al* showed an increased risk of low birth weight deliveries in cases of maternal lifetime history of physical and sexual intimate partner violence.(31)

Intimate Partner Violence (IPV) is a serious public health problem particularly in the under-developed countries. A study on IPV conducted by World Health Organization involving several countries established that between 15% and 71% of women reported an experience of both sexual and physical IPV in their lifetime.(39) Pregnant women were noted to be more vulnerable with prevalence ranging from 4% and 29%.The prevalence of IPV in pregnancy has been reported to be at 7.7% in china, with the prevalence in South Africa being higher at 15%.(27,32)

A study in Vietnam revealed a strong relationship between exposure to IPV and occurrence of LBW .The risk was especially higher when the expectant women experienced both physical and sexual types of IPV.(31) IPV during pregnancy impacts negatively on both the mother's and the newborn's health both at the neonatal period and beyond, posing a threat to child survival.(29,30) A hospital-based survey in Bangladesh involving 400women revealed that physical IPV posed a three-fold increased risk of having a child with low birth weight ,1.98 fold increase in case of lifetime experience of sexual IPV and four fold increase for both physical

and sexual IPV.(31) A similar study in Brazil revealed that couples who assaulted each other were almost four times more likely to have children with low birth weight vis a vis couples that had no violence between them. The risks of having a LBW child increases as severity of physical IPV increases, regardless of other contributing factors such as maternal age , prevailing environmental condition, maternal social network and support, gestational weight gain, hypertension and parity.(44)

2.2.3 MATERNAL BIOMEDICAL FACTORS

The maternal biomedical conditions implicated to increase risk for low birth weight include, but not limited to maternal malnutrition, maternal anemia, malaria and HIV in pregnancy. Maternal mid upper arm circumference (MUAC) changes very little during pregnancy hence it is an accurate marker of nutritional status. According to WHO, MUAC of less than 23cm has been associated with poor pregnancy outcomes, low birth weight being one of them. Body mass index (BMI) is used as a secondary measure of maternal nutrition status.(45) A meta-analysis on malnutrition , malaria and LBW by Cates J.E *et al* noted that the adjusted risk of delivering a LBW baby was 15.3% among women with MUAC of <23cm vis a vis 9.5% in women with MUAC of > 23cm.(46) Girsen A *et al* in a retrospective study in North Carolina noted that a lower maternal pre-pregnancy BMI increased the risk for preterm delivery at less than 37 weeks, hence a risk factor for low birth weight .Lasker J.N *et al* showed that maternal weight gain of less than 10 pounds increased the risk of LBW by five times as compared to the population as a whole. An increase of more than 30 pounds in body weight is associated with reduced prevalence of LBW by a half.(47) A study by Taddase Derfu from Nigeria noted that malnourished women taking meals with less than 4 food groups had an increased risk of LBW

compared to those women who took meals with more than 4 food groups at a time.(48) A contradicting study in Bangladesh ,however, showed that there existed no association between maternal BMI and neonatal birth weight.(31) A retrospective study in Zimbabwe revealed a 75% greater risk of delivering a LBW infant among women with a MUAC of <28.5cm.(49) A study by Migwi P. in Narok District in Kenya revealed that 24.5% of women with low MUAC had LBW babies as compared to 13.2% of women who had MUAC OF >23 CM.(16)

Studies have also shown a correlation between low birth weight and malaria infection in pregnancy. A study in Tanzania showed that the rate of LWB was high in malaria endemic areas like the rural lowlands. Low birth weight was also marked in high malaria transmission seasons.(50) A similar study in Nigeria showed that in babies of mothers infected with malaria during pregnancy, mean birth weight was reduced by 5.3% as opposed to babies whose mothers had no history of malaria infection.(51) A study by Phiri L.K *et al* from Malawi showed that mothers with malaria at delivery were at a significantly higher risk of delivering an infant with intra-uterine growth restriction (IUGR)compared to mothers with malaria at other times during pregnancy.(52) Likewise, a study on impact of malaria during pregnancy in Sub- Saharan Africa revealed a prevalence of 19% of LBW due to malaria infection in pregnancy.(53)

Anemia is a nutritional disorder associated with adverse effects on both mother and fetus when developed during pregnancy. A prevalence rate of up to 78 % has been reported. (38) Maternal anemia correlates positively with a greater risk of low birth weight. A meta-analysis of the mean difference in birth weight showed that the neonates of mothers with anemia had a lower weight at birth relative to those whose mothers did not develop anemia. (30) Kidanto H *et al* from Tanzania noted that the prevalence of LBW was 14% with that of preterm delivery being 17%.

The risk of LBW and VLBW increased significantly with severity of anemia with odds ratios of 1.2(95%C.I:0.85-1.7), 1.7(95%C.I: 1.2-2.6) and 3.8(95%C.I :2.3-6.3) and 1.5(95%C.I:0.6-3.9),1.9(95% C.I: 0.73-5.1) and 4.2(95%C.I:1.3-14)respectively for women with mild, moderate and severe anemia, compared with women without anemia.(24) Yisak also reported that anemic mothers had a greater risk of low birth weight deliveries compared to non-anemic mothers.(32) A study in Delhi ,however did not find any association of maternal anemia and birth weight.(54)

Maternal HIV infection is a known key contributor low birth weight. Untreated maternal HIV infection increases the risk of adverse pregnancy outcomes especially in Sub-Saharan Africa. The adverse outcomes include still births, intrauterine growth restriction (IUGR), preterm birth, low birth weight (LBW) among others. In Kenya ,the coverage for pregnant women who were receiving ARV for PMTCT was at 76% in 2017, a decline from 86% in 2016 and 2015,according to UNAIDS. (55)A study in china revealed a two- fold higher risk of LBW among HIV infected mothers in developing countries as compared to HIV-infected mothers developed countries.(56) A study in Brazil revealed a LBW prevalence of 20.2% among the HIV infected women as compared to a 9% prevalence in the entire Brazil population. (57) A study in Nigeria revealed a relative risk of 3.25 of having a LBW infants among the HIV reactive mothers.(19) A study in Ethiopia revealed that odds of delivering a LBW infant was reduced by 98.5% among the HIV non-infected mothers, relative to the HIV infected mothers.(58) A secondary retrospective study involving women attending antenatal clinics in Nairobi between 1999-2002 revealed that increasing cervical HIV-1 RNA levels was associated with a greater risk of LBW(OR-2.4,95% CI (1.5-6.7).(59) A prospective cohort study in Mozambique involving 1183 HIV sero-negative

and 561 HIV sero-positive mothers however contradicts the findings of the above studies and revealed that maternal HIV infection was not associated with neonatal birth weight.(60)

Table 2: Summary of the literature review.

AUTHOR AND YEAR OF STUDY	TITLE	METHODOLOGY	RESULTS
Akilew Awoke Adane1*, Tadesse Awoke Ayele1, Leta Gedefaw Ararsa2, Bikes Destaw Bitew3 and Berihun Megabiaw Zeleke Feb 2013 (61)	Adverse birth outcomes among deliveries at Gondar University Hospital, Northwest Ethiopia	Institution based cross-sectional study. Data were collected by interviewing 490 women using a questionnaire. Birth weight measured. Multiple L.R were fitted, O.R with their 95% confidence interval were computed to identify associated factors.	The mean age of women was 26.2 (±5.2 SD) years.23% had adverse birth outcomes (14.3% preterm, 11.2% LBW and 7.1% still births). History of delivering preterm or small baby (AOR: 8.4, 95% CI 2.4-29.4), preterm birth (AOR: 5.5, 95% CI 2.6- 11.6) and HTN (AOR: 5.8, 95% CI 1.8- 19.6) were associated factors with LBW.
Meresa Gebremedhin1*, Fentie Ambaw2, Eleni Admassu2 and Haileselassie Berhane1(18)	Maternal associated factors of low birth weight: a hospital based cross-sectional mixed study in Tigray, Northern Ethiopia	A cross-sectional mixed study design in 3 zonal hospitals among 308 mothers -baby dyads.	The prevalence of low birth weight was found to be 14.6 % (95 % CI = 12.56-16.61) and the mean birth weight was 3094.9 ± 587.6 grams. LBW was associated with rural place of residence AOR = 4.34, preterm birth/gestational age less than 37 weeks AOR = 18.5, presence of any chronic medical illness AOR = 5.3 and maternal weight <50 kg AOR = 2.26
Shafiqul Islam Khan, Diruba Easmin Jhorna, Atul Chakma,Abu	Socio-demographic and nutritional determinants of birth	A hospital based descriptive cross-sectional study involving 200 women.	Prevalence of LBW was 17%. Maternal hemoglobin concentration and maternal age were associated with birth outcome and one-unit increased hemoglobin denoted

Tareq, Musammet Rasheda Begum January-June 2016.(34)	weight.		0.050-unit increased birth weight and a unit increased age denoted 0.017-unit increased BWT.
Getnet Asmare, Nigusie Berhan, Mengistu Berhanu and Animut Alebel March 20th-April 30th 2017(62)	Determinants of LBW among neonates in Amhara Regional State Referral Hospital	Unmatched case-control study involving 429 mother-baby dyads from March 20th - April 30th 2017.	Mothers who delivered female infants AOR: 1.7, occurrence of health problems during current pregnancy AOR: 2.8 ,absence of antenatal care AOR: 2.3, lack of iron supplementation AOR: 2.8,maternal MUAC below 23 cm AOR: 1.7 and gestational age below 37 completed weeks AOR: 3.3 were found to be determinants of low birth weight
Mutugi M *et al* September to October 2011.(16)	Prevalence of Low Birth weight deliveries and associated factors.	Cross-sectional descriptive study involving 348 live births.	LBWT prevalence-16.4%. Logistic regression showed significant association between low birth weight and religion(p=0.017), mother's weight(p-0.045), gestation period(p-0.000) and plurality (p-0.000). High maternal weight and Christian religion were protective.
Bayo Louis, Buyungo Steven, Nakiwala Margret, et al(63)	Prevalence and Factors Associated with Low Birth Weight among Teenage Mothers in New Mulago Hospital: A Cross Sectional Study	An analytical cross-sectional study among teenage mothers who delivered from new Mulago Hospital Complex labor suite from August 2013 to August 2014.	The prevalence of LBW was 25.5%. Pre-term delivery (OR = 3.3032 P = 0.0001) and multiple pregnancies (OR = 0.165 P = 0.039) were associated with LBW.

Kidanto H. L *et al* Labour Ward, Muhimbili National Hospital, Dar es Salaam, Tanzania,between Nov 2002 and Feb 2003.	Risks for preterm delivery and low birth weight are independently increased by severity of maternal anemia	A cross -sectional study	The severity of anemia increased the risk of preterm birth with odds ratios of 1.4, 1.4 and 4.1 respectively for mild, moderate and severe anemia. The corresponding risks for VLBW and LBW were 1.5 ,1.9 ,4.2 and 1.2, 1.7 ,3.8respectively.
Ferdos J *et al* July 2015-April 2016.	Maternal experience of IPV and LBW of children.	Hospital-based survey involving 400 women.	Prevalence of LBW was 29.2%. Risk was higher in younger women <20years, women married before 18years, and women who experienced either physical or sexual IPV or both.
Mezzavilla R.S *et al* Four primary health care units in Rio de Janeiro, Brazil-June 2005-Dec 2009	Physical intimate partner violence and low birth weight in newborns from primary health care units of the city of Rio de Janeiro	Cross-sectional study involving 604 children at 30 days of age.	7.1% of babies had LBW. 33.6% of mothers had experienced physical IPV. Physical IPV was associated with >3 times higher risk for LBW.
Mahamud R. A *et al* January 2010 to December 2013.	Distribution and determinants of low birth weight in developing countries.	Analysis of secondary data from DHS from developing counties. (indoesia, Pakistan, TZ, UG)	Prevalence of LBW was 15.9% (9-35.1). Higher risk was noted in older mothers (35-49yrs), lower level of education, lower SES inadequate ANC visits, low maternal BMI, primiparity and rural residence

2.3: CONCEPTUAL FRAMEWORK OF THE STUDY

Several studies have revealed factors which influence low birth weight both directly and indirectly. Maternal medical conditions like anemia and malnutrition have been shown to be closely linked to maternal socio-economic conditions like low levels of education and low levels of income, which are equally associated with maternal socio demographic features like extremes of age and urban dwelling. The inter-relationship has been demonstrated in the figure 2 below.

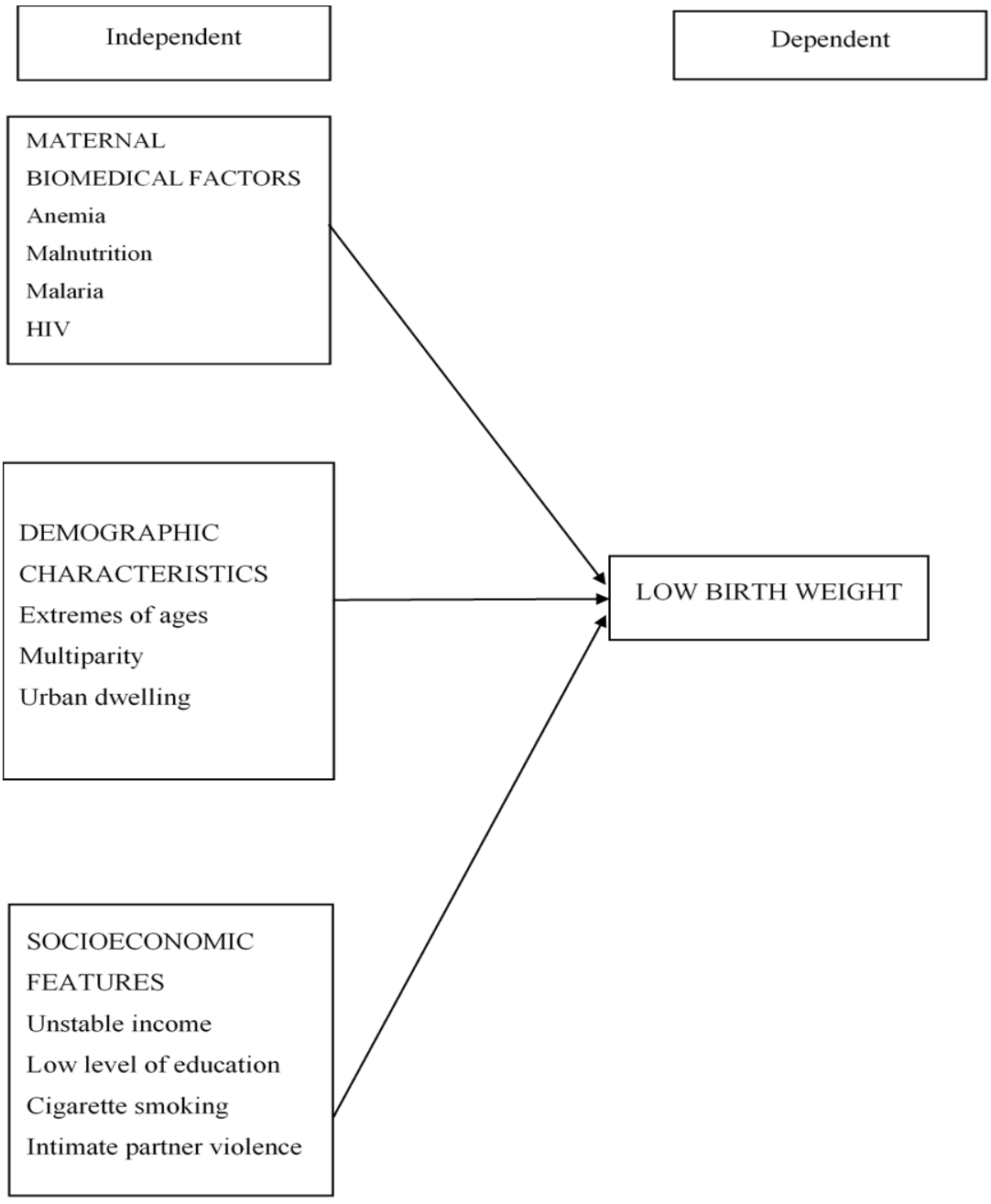

Figure 3: Conceptual framework visualizing the inter-relationship between potential Risk factors and low birth weight.

2.4 JUSTIFICATION AND UTILITY OF THE STUDY

Kisumu County, located in the lake-side region, western part of the country. It has a population of about 1.13Million people, with about 196,000 being under the age of 5 years and 41,000 being under the age of 1 year.(64) It is a malaria endemic area, with a malaria test positivity rate of 45%. This is higher than the country's malaria positivity rate of 41%.(65)Over 12.5 million expectant women globally are at a high risk of malaria infection , producing detrimental effects on maternal , newborn and infant health.(65)(46) Kisumu County also has a high HIV burden, with a prevalence rate of 16.3%, 3.4 times higher than the national prevalence.(60) Teenage pregnancy is also a menace, with 15% of girls age between 15-19 years having begun child bearing.Under-5 mortality rate is at 105 per 1000 live births, greater than the country's prevalence of 45.6 per 1000 live births.(66) Kisumu county has 98.4% of women receiving ante-natal care from a skilled healthcare worker,83% of pregnant women taking iron and folic acid supplements and 69.2% of women delivering in a health facility. Data that is available on low birth weight is reported based largely on maternal recall , with the former Nyanza region ,which Kisumu is part of having 69.2% of the reported birthweight.(14) Kisumu county is also one of the four pilot counties for Universal Health Coverage in the country hence there is an upsurge of facility-based deliveries. The prevention of low birth weight requires a better understanding of the factors associated with low birth weight. The study has therefore gone a long way in providing relevant data to bridge the knowledge gap that existed regarding these factors among women delivering in hospitals in Kisumu County. The findings of this study will contribute to the body of knowledge regarding factors associated with low birth weight and help policy makers to formulate relevant and practical measures to tackle this problem.

2.5 RESEARCH QUESTIONS

What is the prevalence of low birth weight among neonates born in three high volume health facilities in Kisumu County?

2.6 STUDY OBJECTIVES

2.6.1 PRIMARY OBJECTIVE

- To determine the prevalence of low birth weight among neonates who are born in three high volume health facilities in Kisumu County.

2.6.2 SECONDARY OBJECTIVE

- To determine the risk factors of low birth weight among neonates born in three high volume health facilities in Kisumu County.

CHAPTER 3: METHODOLOGY

3.1 STUDY DESIGN

This was a cross-sectional study conducted in three high volume health facilities in Kisumu County.

3.2 STUDY SETTING

The study was carried out in three health facilities in Kisumu County. According to the 2009 Kenya National Census, the county has a total population of approximately 1 million people with a land area of 2085.9 km. The Infant Mortality Rate (IMR) for the County is fairly high at 95/1000, a neonatal mortality rate (NMR) of 39/1000 live births and under-five mortality rate(U5MR) of 149/1000 live births. The county lies in a region endemic for malaria, with 46,444 cases per 100,000 people, compared against a national level of 20,252 per 100,000 people. Pregnant mothers are provided with Intermittent presumptive treatment (**IPT**) with sulphadoxine-pyrimethamine (SP) as well as insecticide-treated mosquito nets for free in the government health facilities. In addition, the county has relatively high rates of HIV infection (currently at 19%) and has high rates of child malnutrition.(67)

The study population involved all live neonates (and their mothers) who were born during the study period in Kisumu, Ahero and Kombewa County Hospitals. They were recruited from the post-natal ward, maternity and newborn units in the three facilities. The description of the various health facilities is summarized in the table below.

Table 3: Summary of description of the three health facilities under study.

DESCRIPTIVE FEATURE	KISUMU COUNTY HOSPITAL	AHERO COUNTY HOSPITAL	KOMBEWA COUNTY HOSPITAL
Location	Kisumu Central sub-county, market Milimani ward.	Ahero town,20km east of the county capital, Kisumu	31 Km from Kisumu City along Kisumu Bondo road, near Kombewa Market
Total bed Space	180 bed capacity, NBU has 9 beds.	42 bed capacity,6 of them being paediatric beds.	75 bed capacity,25 of them are pediatric beds.
Average number of deliveries a year	2791 deliveries	1125 deliveries,	673 deliveries.

3.3 STUDY POPULATION

The target population for the study included all women who delivered live newborns in Kisumu County Hospital, Ahero County Hospital and Kombewa County Hospital during the period of the study, until the desired sample size was achieved.

3.4 STUDY OUTCOMES

1. The prevalence of low birth weight among neonates born in three health facilities in Kisumu County.
2. Factors associated with low birth weight among neonates born in three health facilities in Kisumu County.

3.5 ELIGIBILITY

3.5.1 INCLUSION CRITERIA

- All mothers who had live births and delivered in the three health facilities together with

their newborn babies.

- Neonates whose mothers consented to participating in the study.

3.5.2 EXCLUSION CRITERIA

- Those referred from home or other health facilities.
- Those mothers who did not give consent together with their babies.

3.5.3 SAMPLE SIZE DETERMINATION

Sample size calculation to be used is the fischers formula below:

$$n = \frac{z^2\, p(1-p)}{d^2}$$

- n = Sample size
- z = standard normal deviate of the desired level of confidence (95% CI set at 1.96).
- p = estimated prevalence of low birth weight within the study population (18%).This was the prevalence of LBW in a similar hospital-based cross-sectional study.(17).
- d = study precision usually set at 5%.

N = $\frac{1.96^2\ 0.18(1-0.18)}{0.05^2}$=227

The distribution of the participants in the health facilities was determined by the ratio of annual number of deliveries in the three facilities. Kisumu County Referral: Ahero county: Kombewa

County=2791 :1125: 673This translated to a sample size of 138 from Kisumu County Hospital, 56 from Ahero County Hospital and 33 from Kombewa County Hospital.

3.5.4 SAMPLING AND PARTICIPANT RECRUITMENT

The sampling frame was the maternity delivery registers in the three health facilities. Sampling took place consecutively from the day of commencement of the study, till desired sample size for each of the facilities was reached, with the help of pre-trained research assistants.

All live neonates born in the health facilities during the study period, together with their mothers, who fulfilled the inclusion criteria were recruited into the study. This was done within 24hrs of delivery. They were traced from the post-natal ward, maternity and new born units.

The eligible patients were approached by the principal investigator and taken through the informed consent either in English or Kiswahili version depending on the patient's preference. They then signed the consent declaration form. A questionnaire was administered by the principal investigator or the trained research assistant. The process was repeated in each of the health facilities until the required sample size was achieved. Additionally, the MOH mother and child booklet and the intrapartum records were perused to obtain further information which were filled into the questionnaire. The mothers' height was then be taken using a stadiometer and left mid upper arm circumference using a MUAC tape. The neonates were weighed and examined within 24 hours of birth.

3.6 RESEARCH INSTRUMENTS

3.6.1 ELIGIBILITY SCREENING FORM

This form was used by the research assistant to identify the mother -newborn dyads who had met the eligibility criteria.

3.6.2 INFORMED CONSENT FORM AND CONSENT DECLARATION FORM

The informed consent form was used to inform the patients about the study, either in English or Kiswahili languages. Those eligible and voluntarily willing to participate in the study were required to sign the consent declaration forms available in both English and Kiswahili.

3.6.3 QUESTIONNAIRE

The questionnaire was developed based on the maternal demographic features, biomedical and socio-economic features that play a key role in the contribution to low birth weight. The questions were adapted from Kenya Demographic and Health Survey 2014 questionnaire. The questionnaire was pretested on eligible patients before the study commenced to ensure that the language used is clear and well understood to both the patients and the principle investigator. The questions and responses were revised accordingly. Validity was ensured by formatting the questionnaire in an objective based structure as per the study. The questionnaire questions were made short, concise, clear with simple language. The questionnaires were standardized to enable the principal investigator to obtain consistent data from patient that is usable.

The questionnaire was pre-tested at the same time in eligible patients to determine internal reliability. In case of any errors, corrections were made to ensure that reliability was sustained, before the actual data collection.

3.7 QUALITY ASSURANCE OF THE DATA

The admission numbers of those participating in the study were serialized to help avoid double participation. In case of noted double entry, both of the questionnaires were discarded. The sample size calculated was adequate to allow for description of the results as per the desired level of precision. Research assistants were trained on proper collection of data via administration of questionnaire, taking of weight of the newborns and left MUAC of the mothers so as to ensure consistency. The weighing scales for the neonates were calibrated by the Department of weights and measures to the nearest 0.1 grams.

3.8 DATA HANDLING AND ANALYSIS.

The questionnaires were identified using serial numbers to avoid double participation and for confidentiality. This was manually done. Questionnaire data was entered and cleaned in Microsoft excel database. Data entry was done in duplicate to check out any errors. Analysis was conducted using STATA version 13.

Descriptive analysis.

A descriptive analysis of the categorical variables included calculation of frequencies and percentages of participants with each level of the variables. These are presented as frequency distribution tables and charts. Continuous variables (e.g. age and weight) were summarized by measures of central tendencies (mean, median) and measures of dispersion (e.g. standard deviation).

Bivariate analysis.

Potential risk factors were compared to the outcome in bivariate analyses. Odds ratios with corresponding confidence intervals were calculated. A p-value of <0.05 was considered significant.

Multivariate analysis.

All factors that are found to be significant in the bivariate model were compared in a multivariate model to identify independent risk factors. A p-value of <0.05 was considered significant.

3.9 ETHICAL CONSIDERATIONS

Approval to conduct the study was obtained from Kenyatta National Hospital/University of Nairobi ERC as part of the thesis dissertation. Participants of the study were requested to give an informed consent, after careful explanation of what the study entails. Only those who consented were enrolled in the study. Strict confidentiality was observed. No patient names were used. Initials were used instead. No study findings were released to an unauthorized party without prior written approval from the ERC. No experimental investigations were used in the study. Mothers who participated gained by obtaining knowledge on well baby care and follow up, especially those with low birth weight neonates. They were also educated on potential complications of low birth weight to the neonates, and how, together with the health care personnel, these can be reduced. The findings will be presented to the County of Kisumu Health committee to add to the body of knowledge on low birth weight in the county as well as inform policies on prevention of some of the avoidable risk factors.

3.10 STUDY APPLICATION AND IMPLICATION

Results may be useful to inform policy on budgeting for the relevant commodities necessary for implementation of LBW preventive programs for instance the purchase of long-lasting insecticide treated nets (LLITN) and iron and folic acid supplements (IFAS). The knowledge of the risk factors will aid in terms of anticipation of the complications and to implement the preventive measures. It will also be possible to educate the community on the risk factors and to encourage behavior modification like desisting from intimate partner violence and proper health seeking behavior including consistent ANC attendance.

CHAPTER 4: RESULTS

4.1: DESCRIPTION OF STUDY PARTICIPANTS

4.1.1: DESCRIPTION OF NEONATES ACCORDING TO GENDER AND BIRTH WEIGHT.

Majority (57%) of the neonates were male. There were no neonates weighing less than 1000g and none weighing more than 4000g.84% of them weighed between 2500g-3999g, with 0.4% of them weighing between 1000g-1499g.This is shown in table 4 below.

Table 4: Description of neonates according to gender and birth weight

CHARACTERISTICS	FREQUENCY	PERCENTAGE
Gender		
Female	96	42.67
Male	129	57.33
Birthweight		
<1000g	0	0
1000-1499g	3	1.33
1500-2499g	37	16.29
2500-3999g	187	83.26
>4000g	0	0

4.1.2 MATERNAL SOCIODEMOGRAPHIC CHARACTERISTICS.

A total of 227 participants were recruited. Majority (60%) ,137/227 were recruited from Kisumu County Hospital. The median maternal age was 24 years (IQR 19, 31) with majority (63%), being between 20-35 years. Most of the mothers (74%) were married. Sixty percent of the mothers had attained post-primary level of education and only eight percent had a formal

employment. Eight percent of the respondents were exposed to cigarette smoke during pregnancy,4% took alcohol and 8% experienced intimate partner violence as shown in table 5 below.

This is shown in table 5 below.

Table 5: Sociodemographic characteristics of the mothers

CHARACTERISTICS	FREQUENCY	PERCENTAGES
Mother's age		
<20 years	68	29.96
20-35 years	142	62.56
>35 years	17	7.49
Marital status		
Single	50	22.03
Separated	6	2.64
Married	170	74.89
Widow	1	0.44
Level of education		
Primary	92	40.71
Secondary	98	43.36
Tertiary	36	15.93
Occupation		
Formal employment	19	8.44
Self-employment	87	38.67
Housewife	78	34.67
Casual laborer	11	4.89
Student	30	13.33
Exposed to cigarette smoke	15	8.77
Alcohol intake in pregnancy	9	4.79
Intimate Partner Violence experience	16	8.08

4.1.3 BEHAVIORAL CHARACTERISTICS OF THE MOTHER- MATERNAL ILLNESSES, ANC, AND NUTRITIONAL FACTORS

Majority (79%) of the respondents were HIV seronegative. A number of them had various medical conditions in pregnancy.14% had pregnancy induced hypertension,36% had urinary tract infections,46 % were diagnosed and treated for malaria,8% experienced antepartum hemorrhage while 14% reported a previous history of a low birth weight delivery. Most of them (90%) reported to have used insecticide -treated mosquito nets, with 88% having used sulfadiazine-pyrimethamine for malaria IPT.94% attended antenatal visits with 70% of them having attended more than 4 visits. Most of the respondents (57%) had a MUAC of between 23.8-28.0cm and majority (61%) had a Hb level of >11g/dl.

Table 6: Maternal behavioral characteristics

CHARACTERISTICS	FREQUENCY	PERCENTAGES
Positive HIV infection	43	20.67
Hypertension in pregnancy	32	14.35
UTI in pregnancy	78	36.79
Malaria in pregnancy	101	46.76
Antepartum hemorrhage	19	8.44
Previous LBW history	26	13.82
Use of ITN in pregnancy	205	90.27
Use of IPT in pregnancy	198	88
Attended ANC	225	99.12
Number of ANC visits		
1-2	8	3.57
3-4	57	25.45
>4	159	70.98
HB level		
>11g/dl	140	61.67
9-10.9g/dl	72	31.72

7-8.9g/dl	10	4.41
<7g/dl	5	2.2
MUAC values		
<22.6	25	11.01
22.6-23.7	24	10.57
23.8-28.0	130	57.27
28.1-29.3	13	5.73
>29.4	35	15.42

4.2: PREVALENCE OF LOW BIRTH WEIGHT

The mean weight for the neonates was 3.0kg (SD +/- 0.5). Majority (84%) were delivered with a birthweight of > 2.5kg while approximately 18% had a birthweight of <2.5kg. This is shown in Figure 4.

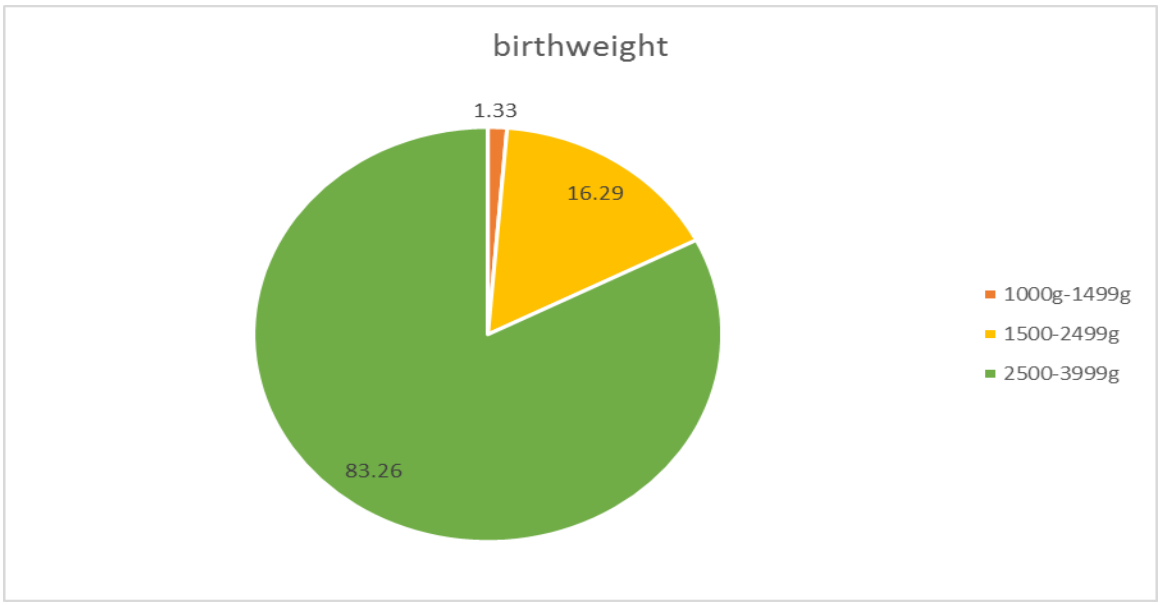

Figure 4: Pie chart showing the distribution of the neonates according to the birth weight.

4.3: MATERNAL SOCIODEMOGRAPHIC FACTORS

About 30% of both low birth weight and normal birth weight mothers were aged less than 20 years. Maternal age 20years or less was not associated with low birth weight (p=0.932). There was no difference between the low birth weight and normal birth weight groups in terms of marital status (p=0.073), maternal level of education (p=0.374) and maternal occupation (p=0.216). Approximately 8% of mothers were exposed to cigarette smoking during the pregnancy. Approximately 5% of the mothers took alcohol during the pregnancy and 8% were exposed to intimate partner violence. There was no difference between the low birth weight and normal birth weight groups in terms of cigarette smoke exposure(p=0.496), maternal alcohol intake(p=0.863) and intimate partner violence experience(p=0.694).As shown in table 7 below, none of the socio-demographic factors was significantly associated with low birth weight in this study.

Table 7: Association between low birth weight and maternal socio-demographic features.

Characteristics	**Normal n=191 (%)**	**Low n=36(%)**	**OR (95%CI)**	**P-value**
Maternal age				
<20years	57(29.8)	11(30.6)	1.034(0.477-2.242)	0.932
>20years	134(70.2)	25(69.4)		
Education level				

Primary level	75(39.3)	17(47.2)	1.383(0.676-2.831)	0.374
Post primary level	116(60.7)	19(52.8)		
Marital status				
Single	43(22.5)	14(38.9)	1.427(0.967-2.108)	0.073
Married	148(77.5)	22(61.1)		
Occupation				
Formal employment	173(90.6)	35(97.2)	3.641(0.470-28.18)	0.216
Informal employment	18(9.4)	1(2.8)		
Cigarette smoke exposure				
YES	58(30.4)	13(36.1)	1.296(0.614-2.734)	0.496
NO	133(69.6)	23(63.9)		
Alcohol intake in pregnancy				
YES	8(20.9)	1(22.2)	0.774(0.081-5.602)	0.715
NO	151(79.1)	28(77.8)		
IPV experience				
YES	37(80.6)	8(77.8)	0.366(0.046-2.888)	0.341
NO	154(19.4)	2822.2)		

4.4: MATERNAL BEHAVIORAL CHARACTERISTICS: MATERNAL ILLNESSES, ANC, AND NUTRITIONAL FACTORS

Majority of the mothers (99%) (both with low birth weight and normal birth weight babies) attended ante-natal clinics. Approximately 29% attended less than 2 visits.88% of the mothers

used intermittent preventive therapy(IPT) for malaria and 90% used insecticide- treated nets(ITN).14% of the mothers had a prior history of a low birth weight delivery .According to this study, there was a 3.5 times risk of having a low birth weight baby with a prior history of low birth weight delivery . There was a significant association between low birth weight and a prior history of a low birth weight delivery(p=0.001). There was no difference between the low birth weight and normal birth weight groups in terms of attendance of ANC(P=0.236), number of clinic visits(P=0.098), use of IPT(P=0.687) and use of ITN(P=0.761). Approximately 20% of the mothers in the study were infected with HIV. There was a 1.8 times higher risk of having a low birth weight baby with maternal HIV infection as compared to maternal HIV negative status. This was however not statistically significant(P=0.141). Approximately 37% of mothers reported having been treated for a urinary tract infection (UTI)during pregnancy,8% experienced vaginal bleeding,14 % had hypertension and 47 % were diagnosed and treated with malaria. There was no difference between the low birth weight and normal birth weight groups in terms of UTI in pregnancy(P=0.298), vaginal bleeding(P=0.058) and malaria infection (0.712).There was however a 2.5times higher risk of having a low birth weight baby with hypertension in pregnancy and was statistically significant(P=0.045). 33% of the mothers had a hemoglobin level of less than 11.0g/dl, while approximately 12% of the mothers had a MUAC<23cm.The HB level and MUAC were not significantly associated with low birth weight with P=0.503 and P=0.215 respectively. These findings are shown in table 8 below.

Table 8: Association between low birth weight and maternal behavioral factors.

Characteristic	Normal n=191 (%)	Low n=36 (%)	OR (95%CI)	P-value
Attended ANC				
YES	190 (99.5)	35(97.2)	0.184(0.111-3.014)	0.236
NO	1(0.5)	1(2.8)		
No. of clinic visits				
<2 visits	53(27.7)	15(41.7)	1.803(0.853-3.87)	0.098
>2visits	138(72.3)	21(58.3)		
Use of IPT				
YES	169(88.5)	31(86.1)	0.886(0.287-2.319)	0.687
NO	22(11.5)	5(13.9)		
Use of ITN				
YES	173(90.6)	32(88.9)	0.837(0.265-2.636)	0.761
NO	18(9.4)	4(11.1)		
Previous LBW deliveries				
YES	46(24.0)	19(52.8)	3.523(1.692-7.336)	**0.001**
NO	145(76.0)	17(47.2)		
HIV infection				
YES	33(17.3)	10(27.8)	1.870(0.812-4.105)	0.141
NO	26(82.7)	2672.2)		
UTI				

YES	64(33.5)	14(38.9)	1.505(0.696-3.252)	0.298
NO	127(66.5)	22(61.1)		
Malaria				
YES	86(45.0)	15(41.7)	0.872(0.424-1.794)	0.712
NO	105(55.0)	21(58.3)		
Hypertension				
YES	23(12.0)	9(25.0)	2.434(1.018-5.819)	**0.045**
NO	16(88.0)	27(75.0)		
Vaginal bleeding				
YES	13(6.8)	6(16.7)	2.707(0.955-7.675)	0.058
NO	178(93.2)	30(83.3)		
MUAC				
<23cm	25(13.1)	2(5.6)	0.390(0.088-1.727)	0.215
>23cm	166(86.9)	34(94.4)		
HB level				
<11.0g/dl	75(39.3)	12(33.3)	0.773(0.564-1.639)	0.503
>11.0g/dl	116(60.7)	24(66.7)		

4.5 MULTIVARIATE ANALYSIS RESULTS.

Hypertension in pregnancy and previous low birth weight were found to be significantly associated with low birth weight. However, on logistic regression, Marital status, intimate partner violence experience, antenatal visits and previous low birth weight remained significant. The risk of low birth weight increased 4 fold if the mother was single(AOR=4.018), 5 fold if the mother had an experience of intimate partner violence(AOR=5.100),2 fold if the mother had less than 2 ANC visits(AOR=2.246) and 5 fold if the mother had a previous low birth weight delivery(AOR=5.721). This is shown in table 9 below.

Table 9: Logistic regression of factors significantly associated with low birth weight

Characteristic	Crude odd ratio (95% C.I)	P-VALUE	Adjusted odd ratio (95%C. I)	P-VALUE
Maternal age	1.034(0.472-2.422)	0.932	0.582(0.206-1.645)	0.308
Marital status	1.427(0.967-2.108)	0.073	4.081(1.383-12.04)	**0.011**
Occupation	0.681(0.500-0.929)	0.012	2.275(0.248-20.85)	0.467
Cigarette smoke exposure	0.866(0.186-4.204)	0.884	1.776(0.649-4.856)	0.263
IPV experience	0.366(0.046-2.888)	0.341	5.100(1.230-21.34)	**0.025**
ANC visits	1.803(0.853-8.513)	0.122	2.246(1.031-4.894)	**0.042**
IPT use	0.886(0.287-2.319)	0.122	4.073(0.781-21.22)	0.095
ITN use	0.837(0.265-2.363)	0.761	3.927(0.664-23.22)	0.131
Previous LBW delivery	11.63(4.606-29.36)	**0.001**	5.721(2.133-15.34)	**0.001**
HIV infection	1.870(0.812-4.505)	0.141	2.417(0.797-7.329)	0.119
UTI in pregnancy	1.505(0.696-3.252)	0.295	1.609(0.657-3.934)	0.298
PV bleeding	2.707(0.955-7.675)	0.061	3.496(0.882-13.85)	0.075
MUAC	0.390(0.088-1.727)	0.215	0.215(0.048-1.309)	0.101
HB level	0.773(0.564-1.639)	0.503	0.419(0.163-1.081)	0.072

CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1: DISCUSSION OF THE RESULTS.

The prevalence of low birth weight in the study population was estimated to be 17.5% (95%C. I:12.8-23.1%). Being unmarried, experience of intimate partner violence, less than 2 antenatal visits and previous history low birth weight increased the risk of low birth weight.

The prevalence obtained in this study is higher than the national prevalence which was estimated to be at 8%. (68) Nyanza region reported a prevalence of 4% according to KDHS 2014. (68) The prevalence exceeds the 15% level that indicates a major public health problem. Globally, the indicator is a good summary measure of a multifaceted public health problem that includes long-term maternal malnutrition, ill health, hard work and poor pregnancy health care.(69)

According to this study, maternal age was not associated with low birth weight. These findings were similar to the findings of a study done by Bayo Louise et al (70) in Uganda Other studies (34) had shown that teenage pregnancy was associated with low birth weight. This was a secondary analysis hence a more likely reason for lack of association.

Lack of formal employment increased the risk of low birth weight although it was not statistically significant. Other studies had similar findings. (23) (71) .This is possibly because unemployed mothers were economically and psychologically dependent on their spouses thus affecting their timely health seeking behavior.

According to this study, there was no association between smoking and low birth weight. The finding of the current study was similar to that of Bayingana et al(29) in Rwanda. This may be largely because cigarette smoking by women is not prevalent in Africa due to cultural influences.

Intimate partner violence experience was significantly associated with low birth weight in this study. The findings were similar with that of Tariku Laelago et al (20) in Ethiopia and Sigalla et al (27) in Tanzania. These findings could be explained by the effect of actual abdominal trauma during pregnancy and the subsequent increased maternal psychological stress. In this study however, it was not clear as to how the IPV affected the birth weight.

Number of antenatal visits was associated with low birth weight ,just like in a study by Kamala et al (72)in Tanzania and Desta et al (73)in Ethiopia. The reason for this could be tha

t a lack of focused ANC visits is associated with inadequate/failure to receive proper nutritional education during pregnancy and failure to obtain vitamin and mineral supplementations, such as folic acid and iron tablets, as well as the identification and management of infections .These findings contradicted the findings by Bayo Louise et al (70) which revealed that number of ANC visits were not associated with low birth weight.

Maternal Intermittent prophylaxis against malaria was associated with reduced risk of low birth weight. This is similar to a study by Wigilya et al (74)in Tanzania and Biaou et al(75) in Benin . WHO recommends the use of ≥3 doses of IPTp-SP in areas with moderate to high malaria transmission. The improved infants birth weights in pregnant women using IPTp-SP in areas with a very low prevalence of malaria could be due to the therapeutic effect of SP for both malaria and non-malaria infections. As previously reported, SP has parasitic and bacterial effects which are significant contributing factors for improved infants' birth weights born by mothers who receive IPTp-SP for the prevention of malaria.

Previous low birth weight delivery was significantly associated with low birth weight in this study. These findings were similar to findings in other studies conducted in Ethiopia, Tanzania and Zambia (25) (76) (77).

Maternal HIV status was not associated with low birth weight in the current study. This finding was similar to that or Raquel et al (60) in Mozambique and Coley et al (78) in Tanzania. It however contradicted results of studies in Ethiopia by Daniale et al(58) and in China by Li et al (28)and Peng et al(56). The burden of HIV/AIDS in these studies is comparable to that of the current study. It is possible that with increasing availability and use of antiretroviral drugs for prophylaxis and treatment of HIV in pregnancy, the impact of HIV on pregnancy outcomes may have been reduced.

UTI in pregnancy increased the risks of low birth weight, though not statistically significant in this study. This was similar to the findings of studies in Iran, Papua New Guinea and Taiwan (22) (21) (79).Due to morphological and functional changes that occur in pregnancy, stasis of urine favors UTI. Like other infections, UTI stimulates the production of cytokines which may induce preterm labor through release of prostaglandins.

Antepartum hemorrhage increased the risks of low birth weight delivery according to this study though not statistically significant. This is similar to a study by Shingairai et al(49) in South Africa .This is probably due to the risk the APH poses to the mother and therefore the need for expedite delivery.

Anemia in pregnancy had been associated with low birth weight in some studies(80)(81) but not in others. The current study did not show any association.

Maternal MUAC was not associated with low birth weight. This finding was different from that of Nyamasege et al(82) in Kenya which revealed a significant association between low birth

weight and maternal MUAC <23cm. One possible reason for this difference is that most women in the current study were in a semi-urban setting compared with the informal settlement setting of the other study, with limited access to healthcare and education.

5.2 CONCLUSION

- The prevalence of low birth weight in the three health facilities was 17.5%.
- Maternal sociodemographic and behavioral factors were not associated with low birth weight.
- Hypertension in pregnancy and previous low birth weight delivery were significantly associated with low birth weight.
- After controlling for confounders, marital status, intimate partner violence experience, antenatal care visits and previous low birth weight were significantly associated with low birth weight.

5.3 RECOMMENDATION

- Increasing community awareness on the need and importance of attending antenatal care visits to the recommended at least 8 contacts as well as education against intimate partner violence.
- Increased vigilance among the health care workers to pick out mothers with a previous low birth weight delivery and institute preventive measures.

5.4: LIMITATIONS OF THE STUDY.

- The study was hospital based and therefore results cannot be generalized to the community.

- Only mothers with live neonates were interviewed. This is a source of selection bias. The study did not address factors associated with low birth weight still births.
- Gestational age was not collected and given that LBW is a composite measure of SGA, outcome may not be properly predicted.
- Possibility of misclassification hence missing data on extreme low birth weight infants.

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APPENDICES

Appendix 1: STUDY TIMELINES

Development and writing of proposal-June-August 2019

ERC revision and corrections-August- November 2019

Data collection-November 2019 -December 2019

Data analysis-January 2020

Thesis writing and presentation-February 2020

Appendix 2: ELIGIBILITY SCREENING FORM

HEALTH FACILITY OF STUDY: **IN-PATIENT NUMBER:** **STUDY UNIQUE NUMBER:**	
Criteria	**Remark as YES or NO**
Patient delivered within the preceding 24 hours	
Neonate has a birth weight of <2500g	
Given consent	

If YES to all the above, kindly proceed with the study.

Appendix 3a: PARTICIPANT INFORMATION FORM

Study Title

Prevalence and risk factors associated with low birth weight among neonates delivered in Kisumu County: Multicenter cross-sectional study

PART 1: Information

Please read the information in this section or have it read to you carefully before completing the consent form attached. If you have any questions please ask the investigator before signing the consent form.

Introduction

You are requested for participation in this study because low birth weight in a major public health problem in Kenya. Babies born with low weight experience higher rates of illnesses and deaths compared to those born with normal weight. There is need to find out factors associated with this problem in Kisumu so as to implement prevention and treatment measures to reduce the occurrence of the problem.

Freedom of choice

This consent form gives you information about the study, the risks, and benefits in participating in the study. Once you have been explained and understood and agreed to participate in the study, you will be requested to sign or make a mark on the consent form. Before consenting to participate in the study, it is important to understand that your participation is totally voluntary, and that you are free to make inquiries to fully understand the study and you have the freedom to terminate the study at any stage without facing any consequences.

Purpose of the study

The purpose of this study is to determine factors associated with low birth weight among infants born in Kisumu County. Three health facilities are involved, namely Kisumu county Hospital, Ahero County Hospital and Kombewa County Hospital. This will help to make recommendations for action to reduce the occurrence of the problem.

In case of any questions, please contact: Adem Salome Achieng , Cell phone number:0722108497 Email: aachieng39@gmail.com In case you would like to ask someone

other than the researcher, you are encouraged to contact the Chairperson, Kenyatta National Hospital/ University of Nairobi- Ethical Review Committee P.O. box 20723- 00202 Nairobi, Kenya Tel: +254 20 726300-9 or +254 20 726300 Ext 44355 Email: uonknh_erc@uonbi.ac.ke

Expectations during participation

I will ask you simple questions regarding yourself and your family, your current and previous births and pregnancies. I will also take the weight of your baby as well as your height and mid upper-arm circumference if you agree to participate in the study.

Harm and/ or risks and/ or discomforts

We do not anticipate any risks or discomforts to you during the study. We will protect your privacy and confidentiality during the entire study. You will be interviewed privately, and your name will not be recorded anywhere.

Benefits

It will not cost you anything for participating in the study. The results of this study will be useful in implementing community programs to reduce the occurrence of the problem. By participating in this study, you will benefit from free counseling regarding feeding and care of the baby and education to prevent future occurrence and targeted postnatal care.

Privacy of records

All information collected will be kept confidential. You will only be identified by use of a code and personal information from the interview will not be released unless with your written permission. However, absolute confidentiality may not be guaranteed because your records may be reviewed by the Ethics Review Committee at Kenyatta National Hospital.

Appendix 3b: CONSENT DECLARATION FORM

I Miss/Mrs.……do hereby give consent/ assent to Dr.Adem Salome Achieng' to include me in the proposed study entitled 'Prevalence and risk factors associated with low birth weight among neonates delivered in Kisumu County'. I have read the information sheet and understood the purpose of the study and what will be required on my part if I agree to take part in the study. Any questions I have concerning my involvement in the study have been adequately clarified. I understand that I can discontinue from the study at any stage without any consequences. I also understand that I will be interviewed and that the weight of my baby, my height and upper-arm circumference will be measured. I therefore consent voluntarily to participate in the study.

Respondent's signature (left thumb print) ……

Date……

Name of person taking consent……

Signature……...Date……

Appendix 4a: MAELEZO KUHUSU KUSHIRIKI KATIKA UTAFITI

KICHWA CHA UTAFITI

Masuala kuhusu idadi ya Watoto wanaozaliwa katika uzani mdogo na ni nini husabibisha watoto kuzaliwa kwa uzani mdogo katika Kaunti ya Kisumu.

. SEHEMU YA KWANZA: MAAGIZO

Tafadhali soma habari ifuatayo ama uhakikishe umesomewa kabla ya kutia sahihi kutoa idhini ya kushiriki katika utafiti huu.Ukiwa na maswali yoyote, uliza kwa mtafiti kabla ya kutia sahihi.

Utangulizi

Unaombwa kushiriki katika utafiti huu kwa sababu uzani mdogo kwa watoto wanaozaliwa ni shida inayodhuru afya ya jamii katika nchi ya Kenya. Watoto wanaozaliwa kwa uzani mdogo hukumbwa na maradhi na hata kufa kwa asilimia kubwa kuliko wale wanaozaliwa kwa uzani wa kawaida. Kuna sababu za kutafuta ni kwa nini watoto huzaliwa kwa uzani mdogo katika kaunti ya Kisumu ili kupendekeza suluhu ya kuzuia na tiba ya shida hii katika jamii.

Uhuru wa kushiriki

Fomu hii inakupa habari kuhusu utafiti huu, umuhimu wake na manufaa ya kushiriki. Unapoelewa na kukubali kushiriki, unaombwa kutia sahihi au kuweka alama ya kidole katika sehemu iliyotengwa kwa minajili hiyo. Kabla ya kukubali kushiriki unajulishwa kuwa ni kwa hiari yako na ikiwa kuna masuala ambayo hujaelewa ni vyema kuuliza kabla ya kukubali. Tena uko na uhuru wa kutoshiriki wakati wowote utakaoamua bila ya wewe kuchukuliwa hatua yoyote.

Madhumuni ya utafiti huu.

Madhumuni ya utafiti huu ni kupeleleza ni nini kinachosababisha watoto kuzaliwa kwa uzani mdogo katika Kaunti ya Kisumu. Matokeo ya utafiti huu yatasaidia katika kupendekeza sera za kuzuia shida hii katika jamii. Kwa maswali yoyote uliza:Salome Achieng’ Adem. Nambari ya simu ya rununu: 0722108497 Email;aachieng39@gmail.com .Ukiwa na suala lolote kuhusu utafiti huu na ungependa kumuuliza mtu mwingine ila anayefanya utafiti, unahimizwa kupata ushauri kutoka kwa:

Chairperson, Kenyatta National Hospital/ University of Nairobi- Ethical Review Committee P.O. box 20723- 00202 Nairobi, Kenya Tel: +254 20 726300-9 or +254 20 726300 Ext 44355 Email: uonknh_erc@uonbi.ac.ke

Matarajio

Nitakuuliza maswali rahisi kuhusu familia yako, mimba iliyopo na uzazi uliyopita. Pia nitapima uzani wa mtoto, urefu wako na upana wa mkono wako iwapo utakubali kushiriki kwenye utafiti huu.

Madhara/ hatari ya kushiriki

Hatutarajii madhara au hatari yoyote kwako ukishiriki katika utafiti huu.Unaombwa kushiriki bila wasiwasi wowote kwani mahojiano yatafanyika faraghani na habari utakayoitoa itawekwa pasipo fahamu ya wengine na jina lako halitahifadhiwa.

Manufaa

Hakuna gharama yoyote utakayopitia kwa kushiriki na kushiriki kwako ni kwa hiari yako. Matokeo ya utafiti huu itasaidia kubuni sera na mikakati ya kutatua shida hii katika jamii. Unaposhiriki kwenye utafiti huu, utanufaika kwa mawaidha ya bure kuhusu lishe bora na jinsi ya kutunza mtoto na pia maelezo ya afya baada ya uzazi.

Hifadhi ya utafiti

Habari na mahojiano ya utafiti huu itawekwa kwa umakini na siri. Utapewa nambari itakayotumika kwenye utafiti na habari yako ya kibinafsi haitatolewa mtu yeyote bila ya idhini yako. Jina lako halitatajwa kwenye ripoti ya utafiti huu lakini huenda rekodi yako ikatathminiwa na kamati ya kushugulikia maadili ya utafiti ya hospitali kuu ya kitaifa ya Kenyatta.

Appendix 4b: RIDHAA (KUKUBALI KUSHIRIKI)

Arifa ya mhojiwa wa hiari

Mimi Bi…….. natoa ruhusa kwa Dr.Adem Salome Achieng' kunihusisha kwa utafiti, 'Idadi ya watoto wanaozaliwa kwa uzani mdogo n ani nini inayosababisha watoto kuzaliwa kwa uzani mdogo katika kaunti ya Kisumu'. Nimesoma nakala ya habari kuhusu utafiti huu, nimeelewa madhumuni ya utafiti huu na pia yatakayotarajiwa kwangu nikikubali kushiriki. Maswala yote kuhusu kuhusika kwangu kwenye utafiti huu yamejibiwa kikamilifu. Nimeelewa kwamba ninaweza kutoendelea kushiriki bila ya mimi kuchukuliwa hatua yoyote. Naelewa nitahojiwa, na pia uzani wa mtoto wangu utapimwa, pia uzani na urefu wangu na upana wa mkono wangu pia. Nakubali kwa hiari yangu kushiriki kwenye utafiti huu.

Sahihi ya mhojiwa (alama yakidole gumba kushoto) ……

Tarehe ……

Jina la anayepewa ruhusa……..

Sahihi……..Tarehe……

Appendix 5: TAKING MATERNAL MUAC

Adapted from UNICEF 1986

1. Ask the mother to remove any clothing that may cover her left arm. If possible, she should stand erect and sideways to the measurer.
2. Estimate the midpoint of the left upper arm.
3. Straighten the mother's arm and wrap the tape around the arm at the midpoint. Make sure the numbers are right side up. Make sure the tape is flat around the skin.
4. Inspect the tension of the tape on the mother's arm. Make sure the tape has the proper tension and is not too tight or too loose. Repeat any step as necessary.
5. When the tape is in the correct position on the arm with correct tension, read the measurement to the nearest 0.1 cm.
6. Immediately record the measurement.

Appendix 6: TAKING MATERNAL HEIGHT

Adapted from WHO STEPS surveillance.

1. Politely ask the mother to remove their footwear (shoes, slippers, sandals etc.), head gear (hat, cap, hair bows, comb, ribbons, etc.). Do not seek removal of a scarf or veil, the measurement may be taken over light fabric.
2. Ask the mother to stand on the board facing you.
3. .Ask the mother to stand with feet together, heels against the back board, knees straight.
4. Ask the mother to look straight ahead and not look up.
5. Make sure eyes are the same level as the ears.
6. Move the measure arm gently down onto the head of the mother and ask her to breathe in and stand tall.
7. Read the height in centimeters at the exact point.
8. Ask the mother to step away from the measuring board.
9. Record the height measurement in centimeters in the mother's questionnaire.

Appendix 7: BUDGET

ACTIVITY	QUANTITY	UNIT COST	TOTAL COST	JUSTIFICATION
Proposal development	Printing-40 pages Photocopy-80 pages	Printing@10/- a page. photocopy@3/- a page	640/-	Printing and photocopy
Questionnaires	360 pieces	@100	36000/-	Printing and photocopy
Training of research assistants	3 research assistants	@5000/-	15000/-	Stipend
Testing of questionnaires	3 people	@5000/-	15000/-	Stipend
Data collection	3 people	@15000/- a month	135,000/-	Wages
Data analysis	1 statistician		50,000/-	Statistician fees
Printing of analysed data			30000/-	Printing and Photocopy
Miscellaneous			28164	10% of the total
TOTAL			309804	

Appendix 8: EQUIPMENT TO BE USED.

A) ADULT MUAC TAPE.

B) INFANT WEIGHING SCALE.