

**FACTORS LINKED TO LOW BIRTH WEIGHT AMONG WOMEN WHO
GAVE BIRTH AT CENTRE HOSPITALO-UNIVERSITAIRE DE KAMENGE,
BUJUMBURA PROVINCE, BURUNDI.**

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**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENT FOR THE AWARD OF MASTER OF PUBLIC HEALTH
DEGREE IN EPIDEMIOLOGY AND DISEASE CONTROL OF
MOUNT KENYA UNIVERSITY**

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DECLARATION AND APPROVAL

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Student declaration

I, Egide NIYITERITEKA confirm that this thesis was written by myself and has not been presented for the award of any degree in any University.

Signature: 

Date: 5th, September, 2024

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Approval by Supervisors

We confirm that the work reported in this thesis was carried out by the candidate under our supervision.

Mount Kenya

DEDICATION

I dedicate this thesis to Dear God, Dr. Fader Jason Peter, my Aunt Irambona Revocate, Bigirimana Anatolia and Uncle Terence Nahimana for their unending love.



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First, I give utmost gratitude for the grace to persevere throughout my academic journey.

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ABSTRACT

Low birth weights among women who gave birth continue to be a significant global concern. The factors contributing to low birth weight at Centre Hospitalo-Universitaire de Kamenge in Bujumbura were not perfectly identified, despite the assessment of some common risk factors for adverse pregnancy outcomes in postpartum women and their fetuses. This case-control study took place at the Maternity of the Centre Hospitalo-Universitaire de Kamenge (Hôpital Roi Khaled) in Bujumbura, focusing on the medical records of mothers who had given birth at any age and key informants as gynecologist, clinician and women after delivery before their discharge to interview on health system factors. The study aimed to establish the prevalence and determinants of low birth weight, employing both qualitative and quantitative indicators in the data collection process. We used a systematic sampling technique. The study medical records were randomly chosen, while the Centre Hospitalo-Universitaire de Kamenge in Bujumbura and key informants were purposefully chosen. The study location had a total of 43 cases and 85 controls, and a principal investigator used a data abstraction form to collect the data from medical records. To gather more information, key informant was interviewed using Key Informant Interview Guide. Graphs, logistic regression analysis and cross tabulations were used to illustrate the data, and the odd ratio was used to analyze the relationship between the variables. Thematic analysis was performed on qualitative data. The qualitative data explained, interpreted and supplemented the quantitative data. The findings indicated a statistically significant relationship between LBW and woman's occupation (OR: 0.0481; 95% CI: 0.0047-0.4947), having medical chronic condition such as Diabetes mellitus, Hypertension, HIV/SIDA and cardiac disease (OR: 0.4492; 95% CI: 0.2214-0.9112), exposure to multiple pregnancy, abnormal uterus and oligohydramnios/polyhydramnios (OR: 0.6448; 95% CL: 0.4306-0.9656). The research concludes that the occurrence of LBW among new born babies is influenced by woman's occupation, medical chronic conditions and exposure to multiple pregnancy, abnormal uterus and amniotic liquid such as oligohydramnios and polyhydramnios. The study recommends the General Director of CHUK through MoH to strengthen the efforts towards improving the conditions in workplace, preventive measures against chronic diseases and regularly consult antenatal care for pregnancy monitoring. The research findings are expected to be useful to the nutrition services planners, healthcare professionals, and politic leaders to assist them in creating pertinent policies, briefs, initiatives, and interventions with the goal of reducing the magnitude of occurrence of underweight babies.

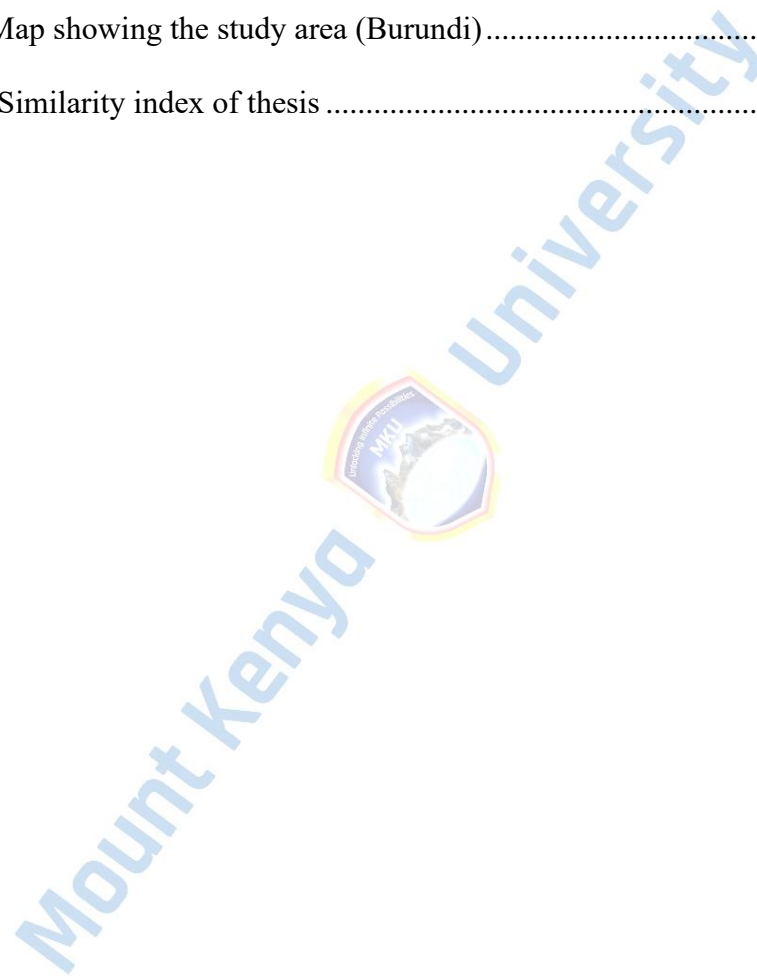
Key words: Low birth weight, CHUK and women after delivery

DECLARATION AND APPROVAL	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
LIST OF TABLES	5
LIST OF FIGURES.....	6
OPERATIONAL DEFINITION OF KEY TERMS	7
LIST OF ABBREVIATIONS AND ACRONYMS.....	9
ABSTRACT	v
CHAPTER ONE.....	11
INTRODUCTION.....	11
1.1 Background to the Study	11
1.2 Problem Statement	12
1.4 Objectives of the Study	14
1.4.1 Broad Objectives	14
1.4.2 Specific Objectives.....	14
1.5 Research Questions	15
1.6 Justification of the Study.....	15
1.7 Scope of the study	16
1.8 Limitations of the Study	16
CHAPTER TWO.....	18
LITERATURE REVIEW	18
2.1 Introduction	18
2.2 Prevalence of Low birth weight	18
2.2.1 Global Perspective.....	18
2.2.2 African Context.	20

2.2.3 Burundian Situation.....	21
2.3 Socio-Demographic Factors linked to LBW.	23
2.4 Gyneco-Obstetric Factors linked to Low Birth Weight.....	27
2.5 Health System Factors.....	36
2.6. Theoretical Framework	44
2.6.1. Health Belief Model (HBM)	44
2.8 Conceptual framework.	46
CHAPTER THREE	48
METHODS AND MATERIALS	48
3.0 Introduction	48
3.1 Study Design	48
3.2 Study Variables.....	48
3.3 Study Area description	48
3.4 Study Population	49
3.4.1 Inclusion Criteria.....	49
3.4.2 Exclusion criteria.....	50
3.5 Sample Size Determination.....	50
3.6 Sampling Techniques	51
3.7 Data Collection Tools.....	51
3.8 The measurement of independent variables	51
3.9 Reliability and Validity.....	52
3.9.1 Validity	52
3.9.2 Reliability	52
3.10 Data Analysis.....	53
3.11 Ethical Issues	53

CHAPTER FOUR	55
RESEARCH FINDINGS AND DISCUSSIONS	55
4.1 Introduction	55
4.2 Hospital prevalence of Low birth weight.....	56
4.3 Socio-demographic factors linked to low birth weight.	56
4.4 Gyneco-obstetric factors linked to low birth weight.....	60
4.5 Health system factors linked to low birth weight.....	62
4.6 Analysis of association between low birth weight and independent variables	64
4.7 Qualitative data analysis and interpretation	69
4.8 The control of the potential confounders	71
4.9 Discussions of findings	72
4.9.1 Socio-demographic factors influencing low birth weight.....	72
4.9.2 Gyneco-obstetric factors influencing low birth weight.....	73
4.9.3 Health system factors	74
CHAPTER FIVE	76
SUMMARY, CONCLUSION AND RECOMMENDATIONS	76
5.1 Introduction	76
5.2 socio-demographic factors	76
5.3 Gyneco-obstetric factors	76
5.4 Health system factors	77
5.5 Conclusions	77
5.6 Recommendations	78
5.6.1 National Government:	78
5.6.2 Community health unit	78
5.6.3 To future researcher:.....	79

REFERENCES	80
Appendix I: Data abstraction form.....	92
Appendix II: Key Informant Interview Guide (Gynecologist).....	96
Appendix III: Ethical clearance Certificate.....	97
Appendix IV: Directorate of postgraduate introduction letter	98
Appendix V: Authorization by King Khaled Hospital	99
Appendix VI: Map showing the study area (Burundi).....	100
Appendix VII: Similarity index of thesis	101



LIST OF TABLES

Table4.3.1 Education Level information.....	56
Table4.3.2 Maternal Occupation information	57
Table4.3.4 Mother’s residence information	58
Table4.3.5 Maternal Chronic medical conditions information	59
Table4.3.6 Marital status information	60
Table 4.4.1 Infectious diseases information	60
Table 4.4.2 other factors information	61
Table 4.5.1 Delays in providing Ambulance information	62
Table 4.5.2 Delays in receiving patients information.....	62
Table 4.5.3 Level of appreciation in terms of staff skills and availability information ..	63
Table4.6.1.1Bivariate analysis between socio- demographic factors and low birth weight	65
Table4.6.1.2 Bivariate analysis between gyneco-obstetric factors and low birth weight	66
Table 4.6.1.3 Bivariate analysis between health facility system factors and low birth weight.....	67

LIST OF FIGURES

Figure 2.1 Conceptual Framework.....	47
Figure 4.1 Results of the Sample	55
Figure 4.2.1 Hospital prevalence of Low birth weight ...	Error! Bookmark not defined.



OPERATIONAL DEFINITION OF KEY TERMS

The key terms used in the research were defined and operationalized as follows:

Cases: a situation requiring investigation or action, in this context of my research, a case is each newborn with underweight (<2500kg)

Centre Hospitalo-Universitaire de Kamenge (CHUK): Is a personalized administration, the University of Burundi's Rector supervises the training in general medicine, general surgery, and gynecology.

Controls: Is a group of individuals, the control group needs to reflect individuals who are vulnerable to becoming a case. Controls ought to be drawn from the identical population as the cases, and their choice should not be influenced by the exposures of interest.

Epi-info: Epi Info is a suite of public domain computer programs for public health professionals developed by the Centers for Disease Control and Prevention (CDC). Epi-Info is used for rapid questionnaire design, data entry and validation, data analysis including mapping and graphing, and creation of reports.

Gyneco-obstetric factors: Care during pre-conception, pregnancy, childbirth, and immediately after delivery is encompassed in obstetric factors. Gynecology encompasses the care of all women's health issues.

Health system: The term healthcare setting represents a broad array of services and places where healthcare occurs, including acute care hospitals, urgent care centers, rehabilitation centers, nursing homes and other long-term care facilities, specialized outpatient services, and outpatient surgery centers. In addition, also how the facility does admit in and out the patients.

Low birth weight (LBW): An infant born weighing 5.5 pounds (2500 grams) or less is referred to as having a low birth weight. This may happen when an infant is born prematurely.

Socio-demographic factors: The characteristics of a population are known as socio-demographics. These characteristics include age, gender, ethnicity, level of education, income, type of client, years of experience, and location.

Unmatched Case control study design: An unmatched case-control study involves comparing two existing groups with different outcomes based on a presumed causal attribute. This type of observational study calculates the sample size needed for a study using specific parameters and the desired confidence level.

LIST OF ABBREVIATIONS AND ACRONYMS

AARR	Average annual reduction rate
ANC	Antenatal Care
APH	Antepartum Haemorrhage
APRHC	African Population and Health Research Centre
BDHS	Burundi Demographic Health Survey
CPRC	Clinic Prince Regent Charles
CWC	Child Welfare Clinic
EmOC	Emergency Obstetric Care
ERC	Ethical Review Committee
FP	Family Planning
IMR	Infant Mortality Rate
IUGR	Intra –Uterine Growth Restriction
KII	Key Informant Interview
LBW	Low birth weight
MKU	Mount Kenya University
MMR	Maternal Mortality Rate
NBW	Normal Birth Weight
NMR	Neonatal mortality Rate
NRHP	National Reproductive Health Policy
PET	Pre-Eclampsia Toxaemia
PIH	Pregnancy Induced Hypertension
PPH	Post-Partum Haemorrhage
PROM	Premature Rupture of Membranes
RGPH	Recensement General de la Population et de l’Habitat

SDG	Sustainable Development Goal
SDGs	Sustainable Development Goals
SIDS	Sudden infant death syndrome
SRH	Sexual Reproductive Health
STIs	Sexual transmitted infections
TFR	Total Fertility Rate
UNAIDS	United Nations Program on HIV and AIDS,
UNFPA	United Nation Population Fund
UNICEF	United Nations Children Education Fund
UTIs	Urinary transmitted infections
WHO	World Health Organization



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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

LBW is a significant global public health issue that has garnered attention from researchers (Fan et al., 2022). Low birth weight below 2500 g is a significant indication of the health of both the mother and the fetus. It can predict mortality, stunting, and long-term developmental and physical health problems, such as chronic conditions like cardiovascular disease that may arise later in life. LBW includes premature infants born before 37 weeks of gestation, as well as infants, whether born prematurely or at term, who have restricted growth and weigh below the 10th centile for their gestational age and sex. A majority of neonatal deaths occur in low-birth-weight newborns, with most being born prematurely and a smaller portion born at term but small for their gestational age. In 2012, the World Health Assembly established global nutrition targets, aiming for a substantial decrease in the prevalence of low birth weight (LBW) by 30% from 2012 to 2025. In 2015, the global prevalence of LBW was estimated to be 14.6%, marking a decrease from 17.5% in 2000. The average annual reduction rate was 1.23%. In 2015, there were around 20.5 million live births with low birth weight, with the majority originating from low- and middle-income countries, particularly southern Asia and sub-Saharan Africa (Blencowe et al., 2019). Sub-Saharan Africa has historically had a relatively high prevalence of LBW. The World Bank estimated in the past that the LBW rate in Sub-Saharan Africa was around 24% of live births. However, this figure can vary significantly between countries within the region (Tessema et al., 2021).

While there has been a slight decrease in LBW from 2000 to 2015, achieving the global nutrition target of 74% AARR between 2012 and 2025, the current progress will need to be more than doubled in order to address the causes of LBW throughout the lifecycle.

Enhanced measurement and program investments will be required to address LBW. (Blencowe et al., 2019). There was a progress made in Burundi regarding the decrease of the issue of LBW among newborns, with 15.1% of infants being affected (Mahmoud, 2021).

1.2 Problem Statement

In 2018, Iyer et al. found that Burundi has some of the most dismal child health outcomes globally. Low birth weight serves as a crucial indicator of an infant's immediate well-being and a determining factor of their future health, as highlighted in Mahumud et al.'s 2017 study. The most recent data from WHO in 2020 revealed that the statistics of LBW among eligible women of childbearing age stood at 6.4% nationwide, with rates of 5.8% and 6.8% in Rumonge and Bururi provinces, respectively. Notably, malnourished women in Burundi were identified as the most significant factor, as highlighted by Odjidja et al. in 2020. Burundi's age-adjusted mortality rate of 9.11 per 100,000 population places the country at 44th in the world (Iyer et al., 2018).

In Kabezi district of Bujumbura Rural Province, research indicated the poor state of infant health in Burundi. The under-five mortality rate was 82 per 1000 live births in 2015, and the mortality rate for low birth weight was 29 per 1000 live births (van den Boogaard et al., 2017). At Centre Hospitalo-Universitaire de Kamenge in Bujumbura (Urban area), The position of this health facility in the country could be strongly related with the highest percentage of 10.5% concerning the burden of low birth weight, which is a major worry (National referral hospital) (Nzokirishaka & Itua, 2018). Burundi's infant mortality rate stands at 36 per 1,000 live births, surpassing the global average of 19. Low birth weight (LBW) affects 15.1% of newborns, contributing significantly to neonatal deaths. In a rural emergency obstetric facility, 24% of newborns had LBW; among those admitted to neonatal care, 85% of deaths were linked to LBW or birth asphyxia. Additionally, acute

respiratory infections caused 10.3 deaths per 1,000 live births. Given CHUK's role as a national referral hospital, investigating LBW-related complications among its maternity patients is urgent to inform targeted interventions and reduce preventable infant deaths (van den Boogaard et al., 2017). My study at CHUK uniquely integrates both quantitative and qualitative methods to identify specific risk factors for low birth weight (LBW), such as maternal occupation, chronic illnesses, and uterine abnormalities. In contrast, previous national research in Burundi primarily relied on secondary data from the Demographic and Health Survey, which limited causal inferences and lacked clinical depth. My research focused on hospital-based approach addresses these gaps, offering actionable insights for targeted interventions at CHUK (van den Boogaard et al., 2017). Currently, the factors linked to low birth weight have not been researched enough, and there is inadequate monitoring and evaluation of the policies aimed at reducing this burden. Many pregnant women in Burundi may not have awareness of the factors that lead to underweight births. Against this backdrop, the research was carried out to address the research and policy gaps by investigating the factors linked to LWB in women who have given birth at Centre Hospitalo-Universitaire de Kamenge in Bujumbura province (Urban area).

1.3 Purpose of Study

In this research, an investigation was conducted at the Maternity of King Khaled Hospital to analyze the primary reasons for low birth weight among women receiving delivery care. Identify necessary changes and implement measures to reduce the risk of women giving birth to underweight babies. The findings of this research are shared with key stakeholders, including community health workers, planners of antenatal and postnatal care, as well as maternity care providers and referral services. With expertise, nutrition services planners, and healthcare professionals, to assist them in creating pertinent

policies, briefs, initiatives, and interventions with the goal of reducing the outcome of postpartum underweight. The study's objective was to make information accessible to the academic community so that it can be used as a future reference and research tool.

1.4 Objectives of the Study

1.4.1 Broad Objectives

The research project aimed to assess the factors linked to underweight babies among women who gave birth at Centre Hospitalo-universitaire de Kamenge, Bujumbura Province, Burundi.

1.4.2 Specific Objectives

The following objectives guided the study:

- i. To determine the hospital prevalence of low birth weight among women who had delivered at Centre Hospitalo-universitaire de Kamenge, Bujumbura province, Burundi.
- ii. To assess the gyneco-obstetric factors linked to low birth weight among women who had delivered at Centre Hospitalo-universitaire de Kamenge, Bujumbura province, Burundi.
- iii. To establish the socio-demographic factors linked to low birth weight among women who had delivered at Centre Hospitalo-universitaire de Kamenge in Bujumbura Province, Burundi.
- iv. To determine the health facility factors linked to low birth weight among women who had delivered at Centre Hospitalo-universitaire de Kamenge in Bujumbura province, Burundi.

1.5 Research Questions

The following questions research:

- i. What is the hospital prevalence of low birth weight among women who had delivered at Centre Hospitalo-universitaire de Kamenge, Bujumbura province, Burundi?
- ii. What are the socio-demographic factors linked to low birth weight among women who had delivered at Centre Hospitalo-universitaire de Kamenge in Bujumbura province, Burundi?
- iii. What are the gyneco-obstetric factors linked to low birth weight among women who had delivered at Centre Hospitalo-universitaire de Kamenge in Bujumbura Province, Burundi?
- iv. What are the health system factors linked to low birth weight among women who had delivered at Centre Hospitalo-universitaire de Kamenge in Bujumbura Province, Burundi?

1.6 Justification of the Study

The WHO defines low birth weight as a weight under 2500 grams at birth. Factors such as IGR, prematurity, or a combination of both are often the factors of low birth weight. Many studies have emphasized the impact of maternal variables on the occurrence of underweight infants, including maternal age, parity, socio-economic status, and maternal health conditions such as infections and hypertension. Furthermore, the literature emphasizes the significance of proper antenatal care, nutritional intake, and maternal education in preventing low birth weight, highlighting the need for targeted interventions and educational programs for pregnant women (Hughes, M et al, .2017).

The main objective of the research was to explore the factors of LBW, a serious problem that can result in health issues and mortality among infants. In line with Sustainable Development Goals 3, endeavors have been put forth to identify remedies that can lessen

the negative effects and important knowledge has been acquired to create customized approaches with the goal of decreasing the burden of LBW and enhancing the health effect of both women and infants. Ultimately, this assists policymakers in their planning and decision-making processes. This study enriches existing knowledge by providing context-specific, hospital-based evidence on maternal and obstetric factors associated with low birth weight (LBW) in Burundi, a country with limited primary research on this issue. Unlike national surveys, it identifies clinical risk factors such as maternal illness and inadequate antenatal care at CHUK, supporting targeted health interventions. It fills a critical gap by offering actionable data to policymakers and healthcare providers. (Ndoricimpa, A. et al., 2020)

1.7 Scope of the study

Comprehensive research on LBW among women who gave birth at CHUK Focused on various socio-demographic, gynecological and health facility factors. The factors such as maternal age, parity, hypertension, smoking during pregnancy, education level, family size, antenatal care visits, infectious diseases, marital status, partner employment status, socio-economic position, diseases during pregnancy, delays in receiving and providing ambulance. Understanding and addressing these factors through appropriate healthcare facilities and interventions are crucial in reducing the burden of LBW and improving maternal and neonatal outcomes.

1.8 Limitations of the Study

The Centre Hospitalo Universitaire de Kamenge is public health facility, where the hospital receives plenty of newborns for neonatology services, was the study's main subject. Private institutions and other healthcare facilities were not included in the study. These were a restriction because some women seek delivery care elsewhere. The study

concentrated on medical records of mothers with their infants with normal or low birth weight



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The content of this chapter consists of a literature consultation that includes both theoretical literature and a conceptual framework. In that chapter, you found a comprehensive theoretical review that explored the key concepts and principles that shaped the research study to be discussed. The chapter explored preexisting works and findings by other authors in the empirical review section, followed by a critical analysis of the existing literature that was related to the study. The chapter ended with the identified study gap.

2.2 Prevalence of Low birth weight

2.2.1 Global Perspective

LBW has different immediate and long-term effects on human potential and remains a significant public health issue worldwide. A considerable proportion of neonatal deaths globally are attributed to low-birth-weight babies, with the majority being born prematurely and a notable number being smaller than expected for their gestational age. Underweight babies often have health problems throughout their lives, such as childhood stunted growth, higher rates of morbidity, and long-term physical and developmental difficulties. These difficulties might last until adulthood and perhaps contribute to long-term ailments like heart disease (Blencowe et al., 2019).

The contribution in most countries has not been adequately measured, but the neonatal mortalities for cohort of very underweight children were 442/1000. According to a report, underweight babies experience a significant rate of infant mortality, representing 8.9% to 14.2% of all infant deaths (Were, 2022).

Factors such as smoking, alcohol use, poor diet, and strenuous work during pregnancy contribute to neonatal mortality (Magadi et al., 2024).

A study by Yogev (2020) found that having a child later in life increases the likelihood of negative results for both the mother and the fetus. Hypertensive disorders, including preeclampsia, are significant risk factors affecting numerous women worldwide annually (Parish, 2020). Preeclampsia is the primary contributor to elevated rates of maternal, fetal, and neonatal mortality in the UK according to a study by Maawiya & Obsgyn (2021). In the UK, preeclampsia significantly contributes to increased levels of maternal, fetal, and neonatal mortality (Yogev, 2020).

Furthermore, 12% of newborns are born prematurely on average in emerging nations, compared to 60% of premature deliveries in Africa. Preterm delivery has a direct influence on LBW, which in turn leads to infant mortality: approximately 35% of 3.1 million deaths that registered world widely per annum are caused by preterm delivery (Ajayi et al., 2022). Premature births, which typically result in low-birth-weight babies, are thought to account for 9.6% of all pregnancies, or 12.9 million babies. Of these, 10.9 million preterm births have been reported in the literature; of these, 85% will occur in Africa and Asia, Stacy Becks et al. estimate that 12.9 million births, or 9.6% of all births, are premature (Beck et al., 2020).

Genetic factors, infertility therapies, behavioral variables, and socioeconomic factors are among the reasons of preterm birth, according to research on preterm birth rates throughout the globe (Beck et al., 2020). LBW is a significant factor contributing to poor birth outcomes worldwide, affecting approximately 15.5% of the 20 million births that occur each year (WHO, UNICEF, 2023). It's crucial to understand the potential dangers linked to this condition. Joyce asserts that preterm births, underweight babies, and small babies in size for gestational age are the three main contributors to approximately 60-

90% of infant deaths globally. According to Jebet (2021), birth-related neonatal death is also a significant factor in infant mortality. The WHO reports that there are around 2.6 million stillbirths worldwide annually, resulting in 7178 fatalities per day (WHO, 2022). A significant number of these fatalities take place in sub-Saharan Africa, as indicated by Beck et al. in their 2019 study. According to article that explores risk perceptions and attitudes towards miscarriage and birth deformities in rural western Kenya, the numbers of birth defects (adverse pregnancy outcomes estimate) are significant. Approximately 3 million children across the globe are born with birth defects that have long-lasting effects. Additionally, every year, another 3 million children are born with birth defects, including those who unfortunately do not survive due to insufficient care during childbirth (Kwambai et al., 2023).

2.2.2 African Context.

This study showed that at the end of the follow up 32.46% of LBW neonates died. According to Jebet (2019), in East and West Africa have the highest neonatal mortality rate globally, with 27 deaths per 1000 live births. This region has 43% of all babies' deaths worldwide. Central and southern Asia, on the other hand, have a neonatal mortality rate of 23 deaths per 1000 live births and contribute to 36% of global infant mortality.

According to a study conducted in Tanzania, preeclampsia, postpartum Hemorrhage, anemia and Sepsis are Common causes of low birth weight born fatalities and also Jebet found that endemic diseases like malaria, HIV/AIDS, and tuberculosis, micronutrient deficiencies like Iron and folic acid, malnutrition, childbirth complications, inadequate antenatal and prenatal care, and financial constraints are common causes of low birth weight as one of neonatal cases in which morbidity and mortality can occur (Jebet, 2019).

Preterm birth occurs in about 60% of African women and it is a global issue because it is significantly increasing low birth weight, adverse births outcomes are still common in Sub-Sahara Africa (Wachira, 2020).

According to a Rwandan's study, having an ANC of more than three shown to lower a probability of giving birth to underweight baby or premature baby. According to reports, preterm birth rates are 10 percent in Rwanda and Low birth weight rates are 7 percent and 13 percent in East Africa, respectively (Akintije, 2020).

It has been reported that within the last 12 weeks of pregnancy, 900,000 newborns in Sub-Saharan Africa are stillborn (WHO, 2023). According to a study conducted in Nigeria, teenage pregnancy and low Socioeconomic level have a risk factor for anemia (33%), underweight (18%), preeclampsia (12%), preterm labor (11%), and Stillbirth at 3 % (Maawiya&Obsgyn, 2021).

2.2.3 Burundian Situation.

The weight of a newborn baby is important in determining the health and well-being during infancy and childhood. The issue of LBW continues to persist, with a particularly noticeable impact in countries with lower incomes. Birth weight outcome is impacted by various elements, such as the socio-economic characteristics of mothers, their health behaviors during pregnancy, and their overall maternal and pregnancy health conditions (Hughes et al., 2017).

Nadine Misago has provided evidence that highlights the significant influence of low birth weight (LBW) on neonatal mortality and infant stunting. In addition, it should be noted that low-birth babies may face challenges such as perinatal growth failure, decreased cognitive and neuro-motor functioning, and subpar school performance (Colglazier, 2021). There is a concerning trend where babies with extremely low birth weight are facing significant health issues, which is negatively impacting their overall

well-being. It is crucial to note that babies who are underweight and manage to survive often experience weakened immune systems and a higher susceptibility to diseases. These babies are likely to continue being undernourished, resulting in the weakness of muscle, cognitive capability, and intelligence level that can persist during their lives. Despite ongoing initiatives to enhance the pregnancy management and address the issue of low birth weight (LBW), numerous countries continue to face significant challenges in reducing the prevalence of underweight babies. The WHA resolution in 2012 aimed to achieve 30% of reduction in the statistics of LBW among babies by 2025. The importance of this goal was highlighted by the SDGs planning which targets to address all types of malnutrition, including among pregnant women. The agenda also targets to reduce neonatal deaths until at 12 per 1,000 live births and below 5 deaths at least 25 per 1,000 live births. Despite extensive global efforts, certain countries are still grappling with persistently high rates of LBW, falling short of the expected outcomes. Approximately 21 million underweight babies, accounting around 15% of all live-births globally, with the majority (19 million) coming from Africa and Asia. It is worth noting that Burundi has a relatively high rate of LBW, with approximately 15 to 20% of all live newborns falling into this category. Although Burundi has made progress in reducing its LBW rate from 17.4% in 2000 to 15.1% in 2015, the country still has a higher rate than the global average and is ranked among the highest in LBW rates (Kamble et al., 2021). In order to effectively address low birth weight and meet global targets for maternal and child health, Burundi should prioritize investments in proven interventions that promote healthy pregnancies and support optimal child growth. Extensive evidence has confirmed a clear connection between characteristics of woman, her health during pregnant period, and her behaviors during pregnancy with the outcome of birth weight. The framework developed by WHO to explain causal pathways for an increased risk of underweight includes distal

and proximal causes that may contribute to the birth of small babies. LBW can be influenced by various factors, including maternal characteristics like advanced age, multiple pregnancies, short intervals between births, and socioeconomic status. b) Chronic medical conditions such as high blood pressure and diabetes have been identified as causes that appear in high risk for maternal health conditions. c) Maternal malnutrition is often marked by anemia and significant maternal weight issues (WHO, 2019).

This research targeted to evaluate the frequency and explore factors linked to LBW in Burundi. This study's findings have provided valuable insights for shaping maternal and neonatal policies, with the goal of achieving global and national targets by 2030 (Mahmud, 2017).

2.3 Socio-Demographic Factors linked to LBW.

Research "Socio-demographic factors linked to LBW" carried out by Yadav, DK, Chaudhary, and Shrestha from the Nepal Health Research Council, revealed a strong connection between variables like maternal age, education level, and economic status, and low birth weight (Yadav et al., 2021). Furthermore, it was observed that inadequate nutrition during the study period led to a decrease in the infants' weight (Howe et al., 2021). Upon thorough analysis, it was concluded that there was no significant link between newborn weight and the frequency of prenatal visits to obstetric primary care clinics. Insufficient prenatal care has been found to notably impact birth weight, showing a significant association between inadequate care and weight less than 2500g. Moreover, it has been noted that adolescent mothers are less likely to receive essential prenatal care, which is connected to higher rates of infant mortality (Cummings, 2021). Studies consistently demonstrate a strong connection between education of mothers and LBW. Al-Aziz et al's research illustrated that the low levels of mother's education are predictive of LBW, with disparities in newborn weight increasing over time. Similarly, a study by

Srinath recognized maternal education as a notable risk factor for LBW (Panneerselvam et al., 2019). Al-Aziz et al's research discovered a strong connection between maternal factors like education level, nutritional status, and antenatal care with low birth weight. They found that maternal education up to the primary level posed a significant risk factor (Panneerselvam et al, .2019). Additionally, Boronia et al emphasized the correlation between maternal educational level and preterm birth and suggested that factors like maternal overweight, smoking, and pregnancy complications play a mediating role in this relationship (Boronia et al 2021). Noghani Bhambri and Salari's study demonstrated a causal link between maternal education and infants' health outcomes, illustrating that higher maternal education led to reduced incidences of LBW and preterm birth, possibly due to improved prenatal care and healthier behaviors during pregnancy (Salari et al, .2019). In their systematic literature analysis, Godah et al found a significant protective effect of the education of mother against LBW in low- and middle-income countries. Conversely, Pikhartova and Shelton's study did not establish a connection between mother's education and LBW, underscoring the variation in findings across different research projects and the complexity of factors influencing birth weight disparities (Pikhartova et al., 2022).

The study done by Patel et al. revealed a negative association between occupations in computer/math science and low birth weight (LBW), while food preparation occupations showed a positive association with LBW (Pikhartova et al., 2022). Okui et al. emphasized that manual workers had a notably higher standardized low birth weight ratio compared to other occupations (Kiwanuka et al., 2008). Kumar et al. found that tea garden workers, particularly those involved in activities like plucking tea leaves during pregnancy, show many cases of LBW babies, highlighting an increased risk for low birth weight in this occupational group (Panda et al., 2021). These studies collectively emphasize the impact

of maternal occupation on the risk of delivering low birth weight babies and stress the importance of targeted interventions and prenatal care for at-risk occupational groups (Ghosh et al., 2020). However, research by Yosefinata et al. had not found a strong association between maternal occupation and LBW. Similarly, Kumar et al.'s study on tea garden workers and housewives in India revealed a higher incidence of low birth weight in tea garden workers but did not establish a direct link between maternal occupation and LBW. Moreover, Yosefinata et al. discovered there is not direct association between mother's occupation and LBW in their study, indicating that maternal occupation may not always be a significant factor in determining low birth weight (Yosefinata et al, .2022). Multiple studies from different contexts have shown a strong connection between Mother's age and LBW. Investigations in Riau Province and Yazd, Iran, have indicated that younger mothers, particularly adolescents, have a high probability of LBW babies. Additionally, a meta-analysis including data from various countries has shown that pregnant women under 19 years old have a high risk of delivering underweight babies, even though the association was not statistically significant (Yosefinata et al, .2022). Furthermore, a study in Indonesia utilizing data from the Basic Health Research 2018 has emphasized that both very young and older mothers are at higher risk of having low birth weight children, underlining the significance of educating pregnant women and society to minimize this risk (Ghosh and al, .2020). However, studies by Shah et al. and Santoso et al. did not discover a strong link between mother's age and LBW. Shah et al. conducted research in Karachi and concluded that no connection between mother's age and LBW. Similarly, Santoso et al.'s meta-analysis, which included cohort studies from various countries, found that maternal age below 19 years did not significantly impact the occurrence of underweight babies (Santoso et al, .2020). Birth weight in rural areas shown to be higher than in urban areas, indicating a disparity based on the area of residence.

Likewise, a study in Iran revealed that mothers residing in rural areas shown a high risk of giving birth to underweight babies compared to urban women, along with other adverse results such as preterm birth and the need for neonatal care unit admission. Additionally, research conducted by Purnama and Aulia, Mehrnoush et al., and Bourque et al. all demonstrated association between mother's residence and LBW, with findings indicating that LBW in rural places was higher than in urban places. Analysis by Damayanti et al. supported these results by demonstrating that rural residence increased the risk of newborn death, which can be linked to LBW as a contributing factor. A community-based study in a rural field practice area reported that socio-demographic variables like education, occupation, and socioeconomic class were related to LBW (Damayanti et al., 2022). On other hand, Al Kibria and Nayeem's studies did not discover a notable connection between a mother's rural or urban residency and low birth weight (Kibria et al., 2023). Study done by Nakanishi et al revealed that maternal multi-morbidity, defined as the presence of multiple chronic conditions, was strongly related with LBW (Nakanishi et al., 2024). Similarly, research in Ahvaz emphasized a significant link between various maternal chronic diseases such as cardiac disease, anemia, hypertensive disorders, gestational diabetes, and urinary tract infections with LBW babies. Contrarily, research in Japan indicated that maternal chronic medical conditions were significantly linked to LBW, suggesting a heightened risk of adverse perinatal results with a high number of mothers' chronic diseases. However, Sinclair et al's study explored chronic medical conditions but did not establish a direct association with low birth weight (Sinclair et al, 2019). Correspondingly, a study conducted in Karachi also found no correlation between maternal chronic medical conditions and LBW (Bhurgrri et al, 2021). Multiple studies have had often shown a noteworthy relationship between mother's marital status and low birth weight. Various research from countries such as the United States, Malaysia, Iran,

and Spain has underscored this relationship, suggesting that unmarried women, including single and cohabitating mothers, have higher odds of delivering infants with low birth weight compared to married women (Wells B et al, .2024). Bloch et al.'s study examined the quality of partner relationships among unmarried pregnant women, revealing that relationship quality had a more substantial impact on outcomes than formal marital status. Anderson et al. further validated this concept by unveiling unexpected associations between relationship characteristics and low birth weight (Anderson et al, .2019). On other hand, the study by Gualtieri and colleagues discovered that whether a male partner lived in the household or not did not have a significant effect on low birth weight (Gualtieri et al, .2023).

The implications of this literature review emphasize the importance of prioritizing the development of effective policies, introducing comprehensive gender message in academic institutions, and supporting the villages where teenage mothers live. Taking part in such initiatives can raise awareness about pregnancy prevention among pregnant women and teenagers in the late adolescent age group. It is often observed that teenage mothers are ill-prepared for their circumstances.

2.4 Gyneco-Obstetric Factors linked to Low Birth Weight.

Prior medical conditions that affect the fetus' growth may exist in pregnancy. Every woman has to be checked for medical conditions both before and during pregnancy. The term "preconception care" refers to providing biological, behavioral, and social health interventions, as health information and promotion of women who have pregnancy and couples before pregnancy in order to ensure safe conception and pregnancy management (Joyce, 2018). The goal is to increase well-being of the mother and baby by eliminating harmful behaviors, individuals, and environmental factors that could negatively impact their health results. Care before conception encompasses care before the first pregnancy

and between pregnancies (Joyce, 2018). Screening for chronic diseases in women planning to conceive is crucial. Verifying this information is essential as it can lead to pregnancy complications. Testing for illnesses such as syphilis, HIV, rubella, cytomegalovirus (CMV), and hepatitis B and C before getting pregnant is important for understanding one's health status, as these diseases are among the risk factors. Preterm birth, intrauterine fetal death, and cardiac abnormalities are only a few of the effects of rubella infection in early pregnancy (Joyce, 2018). Additionally, it is important to note that hepatitis B and C have the potential transmission from infected mother to her fetus. This can result in liver inflammation and have adverse effects on the fetus, such as low birth weight in newborns. Prior to conception, it is crucial to conduct HIV testing in order to facilitate the implementation of preventive measures aimed at halting the transmission of the virus from mother to child (Joyce, 2018). If a woman tests positive for HIV, antiretroviral therapy is started and she is constantly watched so she can try to get pregnant while her viral load is not high. A woman who has HIV is also informed that with preventative measures in the plan, she can deliver a healthy baby (Joyce, 2018). Given the potential consequences, it is crucial to be aware that cytomegalovirus infection can lead to various health issues such as deafness, blindness, lung, and liver diseases. Furthermore, it is important to note that this infection can be transmitted to the fetus and infant, potentially impacting their development in significant ways. Antibiotics can effectively treat syphilis before planning for pregnancy (Joyce, 2018). Negative outcomes such as miscarriage...etc can arise from syphilis. Screening during the preconception period is crucial to safeguard against the potential harm caused by infectious diseases on pregnancy (Joyce, 2018).

Multiple researches highlighted the link between multiple pregnancies and LBW. Cho and Lee found that a 1 percentage point increase in multiples pregnant led to a 0.495

percentage point increase in LBW rates, with 45.8% of the rise in LBWs attributed to the increase in multiples. Sibilla et al reported that 98% of neonates from multiple gestations had a low birth weight, indicating a high prevalence of LBW in this group (Sibilla et al, .2019). However, while multiple pregnancies are often associated with LBW, researches did not show a significant link between the two factors. For instance, research done in Muhimbili National Hospital did not show a strong correlation between mother's age and LBW, but did note a substantial link between multiple pregnancies and LBW. Additionally, a study on extremely low birth weight newborns in Bulgaria revealed that assisted reproductive technologies (ART) did not influence the outcomes in multiples, indicating that ART did not impact the relationship between multiple pregnancies and LBW in this context (Atanasova et al,.2021).

Studies have consistently shown a strong association between the uterine state and LBW. Research has indicated that a thin endometrium, specifically with a thickness of less than 8 mm, is linked to a higher incidence of LBW. Additionally, women with puerperal infections have a higher prevalence of underweight babies, with LBW being ten times more common among these women compared to healthy puerperal women. Furthermore, LBW has been independently associated with an increased risk of endometriosis, particularly deep infiltrating endometriosis, with patients who had low birth weight having a nearly two-fold higher risk of developing deep infiltrating endometriosis compared to those with normal birth weight (Atanasova et al,.2021). Studies have indicated that there is no meaningful link between the thickness of the endometrium and the birth weight in singleton pregnancies after undergoing frozen-thawed blastocyst transfer. Additionally, research has indicated that low birth weight babies are not necessarily linked to stressed or anxious mothers. Furthermore, a study on postpartum uterine infection found no direct correlation between uterine state and low birth weight,

suggesting that giving birth to a low-birth-weight baby is strongly associated with ensuing puerperal infection rather than the uterus state itself (Asoglu M et al, 2022). Various researches have highlighted the link between infectious diseases and LBW. Research conducted in Indonesia found a significant association between LBW and infections with the incidence of stunting in infants less than two years old. Additionally, a study in Gabon reported a high burden of polyparasitism in mothers who have pregnancy, which was associated with delivering newborns with low birth weight. Furthermore, investigations have shown that being underweight or obese in children increases the risk of various parasitic, viral, and bacterial infections or their severity (Linawati et al, .2022). However, a study focusing on urinary tract infections in late pregnancy did not establish a significant impact on pregnancy outcomes, including premature labor and low birth weight (Asoglu et al, 2022)

The association between fetal position and low birth weight is a topic that has been explored in the context of broader maternal and fetal health factors. While direct studies specifically isolating fetal position as a primary determinant of low birth weight are sparse, several investigations highlight how fetal positioning, in conjunction with other maternal health conditions, can contribute to LBW outcomes (Linawati et al, .2022). Conditions related to maternal health, such as hypertension, anemia, and smoking, have been extensively documented as risk factors for low birth weight. These conditions can also influence fetal positioning (Linawati et al, .2022). A comprehensive review published in Bio Med Central Pregnancy and Childbirth analyzed multiple mother's risk factors linked to LBW. It identified factors like smoking, hypertension, and poor antenatal care as significant contributors to low birth weight. These maternal conditions can lead to suboptimal uterine environments, which may affect fetal positioning, potentially leading to complications like breech presentation or transverse lie (Linawati et al, .2022). Such

abnormal positions can further complicate labor and delivery, often necessitating interventions that might impact fetal growth and birth weight ((Linawati et al, .2022)

The study "Recent trends, risk factors, and disparities in low birth weight in California, 2019," published in *Maternal Health, Neonatology and Perinatology*, provides insights into how fetal position correlates with growth restrictions. Fetal mal positioning is often associated with preterm births and significant gestational age, leading to increased risks of low birth weight. For instance, breech positions, which are more common in preterm births, can complicate delivery and affect fetal growth. The study reported that 100% of preterm significant gestational age infants were low birth weight, emphasizing the strong link between growth restrictions, fetal positioning, and birth weight (Ratnasiri, et al, .2018). Obstetric interventions, often necessitated by abnormal fetal positions, can also influence birth outcomes. A study on the impact of cesarean deliveries, which are frequently performed due to breech or transverse fetal positions, noted a correlation with low birth weight. Cesarean sections, while sometimes necessary for safe delivery, can be associated with preterm deliveries and thus lower birth weights. This highlights a complex interplay where fetal malposition leads to surgical interventions, which in turn are linked to higher incidences of LBW. The biomechanics of the mother's pelvis and its relationship with fetal positioning have also been explored. Research indicates that certain pelvic shapes and dimensions can predispose to abnormal fetal positions like occiput posterior or breech presentations. These mal positions can lead to prolonged labor and increased stress on the fetus, potentially impacting fetal growth and resulting in low birth weight. Studies have shown that fetal positions that deviate from the optimal cephalic position can complicate the delivery process, increasing the likelihood of LBW due to associated stress and intervention requirements (Ratnasiri, et al, .2018). Clinical guidelines often emphasize the importance of monitoring fetal position during prenatal

care to mitigate risks associated with mal positions. Interventions such as external cephalic version (ECV) are recommended for managing breech positions to optimize delivery outcomes. Studies evaluating the effectiveness of external cephalic version have shown that successful repositioning can lead to more favorable birth weights and reduce the necessity for cesarean sections, thereby improving overall neonatal outcomes (Ratnasiri, et al, .2018). In conclusion, while direct evidence linking fetal position exclusively to low birth weight is limited, the interplay between fetal positioning, maternal health conditions, and obstetric interventions forms a complex network influencing birth outcomes. Factors like preterm birth, maternal hypertension, anemia, and smoking contribute to suboptimal fetal positions, which can exacerbate risks for low birth weight. Ensuring effective prenatal care and monitoring the fetal position, along with timely interventions, is essential for reducing risks and promoting healthier birth weights (Ratnasiri, et al, .2018). The traditional belief that the left occipito-anterior position is the best position for the start of labor was questioned by these studies. It was suggested that there may not be a need to encourage this specific position. Although the position of the fetus during labor can impact delivery outcomes, these particular studies did not establish a connection between fetal position and low birth weight. A study by Aishah Ahmad also did not find a significant link between the Left Occipito-Anterior (LOA) fetal position at the onset of labor and birth outcomes (Ratnasiri, et al, .2018). Various studies have pointed out the association between Oligohydramnios and LBW. Mustafa et al's research revealed that pregnant women with Oligohydramnios in the 3rd trimester were linked to LBW. Similarly, Singh et al observed that 46.6% of births from mothers with Oligohydramnios were classified as underweight babies (Ratnasiri, et al, .2018). Furthermore, Das et al. reported a high incidence of underweight babies in pregnancies complicated by Oligohydramnios, emphasizing the impact on perinatal

outcomes. Additionally, Iqbal et al noted that births from mothers with Oligohydramnios had a high strong risk of LBW, further emphasizing the correlation between Oligohydramnios and adverse birth outcomes, particularly underweight. Oligohydramnios, a condition characterized by low amniotic fluid levels, has been closely studied for its impact on perinatal outcomes, particularly low birth weight. Several studies highlight the association between oligohydramnios and LBW. Another strong study conducted in low-middle income countries, including Pakistan, the DRC, Guatemala, and Zambia, did find a strong link between oligohydramnios and LBW. This prospective research analyzed fetal, and mother's outcomes and confirmed that oligohydramnios diagnosed in the third trimester often leads to lower birth weights. Specifically, it showed a high burden of underweight infants among women diagnosed with oligohydramnios compared to those with normal amniotic fluid levels. The average gestational age at diagnosis was around 35.5 weeks, and the study noted significant complications, including increased incidences of cesarean deliveries and fetal malposition (Figueroa et al, .2020). Another retrospective cohort study emphasized the implications of amniotic fluid disorders, including oligohydramnios on weight of newborn. The study found that oligohydramnios is significantly linked to LBW, particularly highlighting that most neonates weighing less than 2.5 kg were diagnosed with oligohydramnios (Ratnasiri, et al, .2018). This study further supports the association by noting that oligohydramnios cases frequently involve shorter gestational periods, which directly impacts fetal growth and birth weight (Figueroa et al., .2020). A critical risk factor for fetal growth restriction, which commonly presents as low birth weight, was identified as oligohydramnios in a thorough review and meta-analysis. The review pooled data from multiple studies and concluded that low amniotic fluid volume is consistently linked with intrauterine growth restriction (Figueroa et al., .2020). On other hand, the study done by Jil Karia and

colleagues, Dr. Fauzia Afridi, and Shashi Gowda have not shown a strong link between Oligohydramnios and LBW (Figuroa et al., .2020). Specifically, Jil Karia's study did not find a meaningful connection between oligohydramnios and the weight of newborns. Shashi Gowda's study also noted that 42.5% of babies born to mothers with oligohydramnios had a birth weight of less than 2.5kgs, suggesting that the presence of oligohydramnios did not consistently result in low birth weight (Afridi et al, .2023). Additionally, a study at Ondokuz Mayıs University in Turkey found no significant association between amniotic fluid disorders and low birth weight. (Bakhsh et al, .2021). Another study, focusing on pregnancies in Saudi Arabia, found that although oligohydramnios cases did include neonates weighing less than 2.5 kg, this was not statistically significant enough to conclude a strong association (KC et al, 2020).

The relationship between oligohydramnios, a condition characterized by low amniotic fluid volume, and low birth weight has been widely debated. While many researches have addressed the association between oligohydramnios and negative perinatal results, such as LBW. While some studies reported a strong connection, others did not show connection. This inconsistency suggests that the link between oligohydramnios and LBW may be more intricate and could be influenced by various factors, including study design, population characteristics, and the criteria used to define oligohydramnios and LBW (Naidoo et al, 2020). A study analyzing data from mothers diagnosed with oligohydramnios compared the outcomes with those of mothers with normal amniotic fluid levels and found no connection between oligohydramnios and LBW. The research emphasized that although oligohydramnios is often associated with various complications, its direct impact on birth weight may not be as significant as previously believed (Naidoo et al, .2020). In a separate study, researchers at a hospital in Saudi Arabia investigated the outcomes of pregnancies complicated by oligohydramnios. The

study included a significant sample size and considered various maternal and neonatal factors. Interestingly, while the study did note instances of low birth weight among neonates diagnosed with oligohydramnios, the overall statistical analysis did not support a significant association between the two. This suggests that other factors may be at play in determining birth weight, and that oligohydramnios alone may not be a reliable predictor of low birth weight in all populations (Bakhsh et al, .2021).

The Studies on polyhydramnios have shown an association with low birth weight. The research conducted by Reddy et al indicated that isolated polyhydramnios was connected to a higher occurrence of underweight babies and premature deliveries. Similarly, Kollmann et al noted that polyhydramnios cases involving small fetuses were linked to low birth weight and should be assessed for abnormalities, particularly when maternal diabetes is present. Furthermore, Wright et al established a correlation between elevated levels of amniotic fluid index (AFI) and an increased likelihood of negative outcomes, such as small-for-gestational-age babies, in cases of severe polyhydramnios (Wright et al, .2021). On other hand, the studies by Sadaf et al. and Khan et al. did not show a relationship between polyhydramnios and low birth weight. In their study, Sadaf and colleagues discovered that no connection existed between idiopathic polyhydramnios and underweight. Meanwhile, Khan and his team reported that there was no strong difference in LBW between pregnancies with polyhydramnios and those without. These conclusions contradict the findings of Reddy and team, whose study suggested that both isolated oligohydramnios and polyhydramnios were linked to high prevalence of underweight babies and preterm deliveries. Additionally, Kyriacou et al. highlighted that the volume of amniotic fluid alone does not necessarily denote abnormality, emphasizing the complexity of the relationship between polyhydramnios and birth weight (Kyriacou et al, .2021).

In conclusion to consult health facilities before and during pregnancy can prevent a woman to deliver a baby with low birth weight.

2.5 Health System Factors.

Research done by Joyce and colleagues, it has been shown that countries experiencing high rates of maternal, perinatal, and neonatal death are facing challenges in their healthcare systems. These challenges are leading to reduced utilization and organization of healthcare services (Joyce, 2018). Lack of professionalism on the part of clinicians may contribute to delays in receiving care. Lack of basic supplies and equipment, a shortage of healthcare workers, and inadequate provider abilities (Joyce, 2018). Negative fetal outcomes, such as low birth weight, mortality, or impairment, are more likely when women do not have access to adequate obstetric care, especially during pregnancy (Joyce, 2018). Insufficient access to qualified obstetric care providers, especially during pregnancy, heightens the chances of negative fetal outcomes, including low birth weight, mortality, or harm (Joyce, 2018). When obstacles like limited staff, expenses, distance, and access to specialized services are removed, women are more inclined to choose the option of seeking healthcare at a facility (Joyce, 2018). By recognizing indicators of potential pregnancy complications and guiding women to appropriate medical resources, we can effectively reduce perinatal, underweight, and neonatal mortality rates (Joyce, 2018).

Delays in providing ambulance services can have significant implications for maternal and natal health outcomes, including low birth weight. Studies have shown that delays in ambulance services can lead to adverse effects on birth weight, with factors such as inadequate prenatal care, complications during pregnancy, and maternal socio-economic status playing a role. Additionally, the quality of attention to women's health during childbirth is crucial, as highlighted in a study evaluating the adequacy and access to health

services for postpartum women, where delays in accessing services were observed, particularly among women from poor areas and those giving birth to low-weight babies (Wright et al, .2021). Several studies explored the link between delays in providing ambulance services and negative pregnancy result, such as LBW. These delays usually occur within the wider context of maternal healthcare and emergency obstetric care, particularly in low- and middle-income countries where healthcare infrastructure may not be as strong. The study demonstrated a strong association between delays in reaching healthcare facilities and LBW. Barriers such as challenging geographical terrain, lack of transportation, and suboptimal distribution of healthcare facilities were identified as critical factors. These obstacles can lead to prolonged travel times for pregnant women experiencing complications, increasing the risk of delivering low birth weight infants due to delayed access to necessary medical interventions (Wright et al.,2021). Another study conducted in Mozambique, published in *Bio Medical Center Pregnancy and Childbirth*, and examined maternal deaths and delays in accessing emergency obstetric care. The study reported that 40.4% of maternal deaths were associated with type II delays (reaching a health facility). The findings underscored that referral complications, often exacerbated by inadequate transport and poorly managed referral systems, played a significant role in these delays. The prevention of timely medical interventions that could mitigate complications during pregnancy and delivery was connected to delays in reaching suitable care facilities, resulting in poor birth outcomes such as low birth weight (Bakhsh et al, .2021). Moreover, a national multi center cross-sectional study highlighted in *Bio Medical Center Pregnancy and Childbirth* examined the correlation between delays in receiving obstetric care (Bakhsh et al, .2021).

Studies have shown that delays in providing ambulance services can have detrimental effects on patient outcomes, including increased mortality rates and risks of re-

attendance. However, there was no significant link found in the research between delays in ambulance services and LBW among infants discharged from neonatal intensive care units. Although medical advancements have enhanced pregnancy outcomes, the absence of a connection between ambulance delays and developmental issues underscores the multifaceted nature of factors impacting the health of infants. Further research may be needed to explore the specific impact of ambulance delays on different health aspects of the population (Pikhartova et al, .2022). While many studies have illustrated a link between delays in ambulance services and negative outcomes for mothers and newborns, while some studies have not found a direct association between these delays and LBW. The American Academy of Pediatrics conducted a comprehensive study on the transportation and safety of premature and low birth weight babies upon hospital discharge. This study considered various factors that can impact neonatal outcomes, including the use of proper car safety seats and observation protocols. However, it did not establish a direct correlation between ambulance service delays and low birth weight. Instead, it underscored the significance of hospital procedures and post-discharge care in determining the health of premature and low birth weight babies (Merritt et al., 2023). A qualitative evaluation carried out in Ethiopia examined the referral systems for premature, weight less than 2500g, and ill newborns. The study, which involved interviews with key informants and group discussions with healthcare providers, facility administrators, and mothers, explored the broader healthcare system and referral processes. While the study acknowledged delays in the referral system and transportation issues, did not find a direct correlation between these delays and low birth weight outcomes. Instead, it pointed to systemic issues such as healthcare facility preparedness, policies, and guidelines affecting neonatal health (Teklu et al, .2020).

Significant evidence from studies has indicated a connection between delays in obstetric care and low birth weight among patients. Fu et al's research concluded that low birth weight may be a potential risk factor for negative birth outcomes. Furthermore, Fregni et al's study showed that delays in accessing specialized health services were linked to neonatal near-miss events and neonatal death, underscoring the impact of delayed care on birth outcomes (Fregni et al, .2021). Studying the association between delays in receiving patients and low birth weight involves exploring various factors that could impact both maternal and fetal health outcomes. Several studies have investigated this relationship, highlighting the importance of timely medical intervention and its potential effects on birth weight. Delays in receiving patients refer to the time elapsed between a pregnant woman's arrival at a healthcare facility and the initiation of appropriate medical care. These delays can occur due to various reasons, such as administrative processes, triage procedures, availability of medical staff, or waiting times in overcrowded facilities. A study published in the Journal of Obstetrics and Gynecology examined the effects of delays in receiving pregnant women at hospital triage on birth outcomes (Fregni et al, .2021). The researchers found that prolonged waiting times were associated with an increased risk of low birth weight (LBW) infants. This association was particularly evident in cases where women experienced delays exceeding one hour before receiving initial assessment and medical care (Fregni et al, .2021). Research conducted at several emergency departments in urban hospitals explored the link between delays in receiving pregnant women and low birth weight. The findings indicated that longer waiting times in emergency rooms were correlated with a higher incidence of low birth weight among newborns. Factors contributing to delays included overcrowding, limited resources, and staffing shortages, all of which prolonged the time until pregnant women received necessary medical attention (Fregni et al, .2021). A study focusing on rural healthcare

settings investigated delays in prenatal care and its impact on birth weight outcomes. It revealed that delays in accessing prenatal services due to geographical distances or limited healthcare infrastructure were associated with a higher prevalence of low-birth-weight infants. Women living in remote areas often faced challenges in reaching healthcare facilities promptly, leading to delays in receiving essential prenatal care that could influence birth weight outcomes negatively (Fregni et al, .2021). Timely prenatal care plays a crucial role in monitoring fetal growth and addressing maternal health concerns that could affect birth weight. Delays in initial assessments may result in missed opportunities for early intervention. Prolonged waiting times can contribute to maternal stress, which may impact pregnancy outcomes. Research conducted by Fregni et al in 2021 suggests that chronic stress may have negative effects on the development of the fetus, potentially impacting birth weight. Understanding the impact of delays in receiving patients on birth outcomes involves considering various factors that can influence the results of different studies. Although the link between receiving medical care promptly and better pregnancy results seems obvious, certain research has not been able to definitively prove a connection between delays and low birth weight (Doolittle et al, .2020). A comprehensive systematic literature visit and analysis published in the Journal of Maternal-Fetal & Neonatal Medicine aimed to assess the relationship between delays in receiving pregnant women and LBW. This review included multiple studies from diverse healthcare settings and geographical locations. Surprisingly, the meta-analysis did not find a consistent association between delays in receiving patients and LBW. The researchers noted substantial heterogeneity among the studies, indicating that factors other than delay might have influenced birth weight outcomes in different populations (Doolittle et al, .2020). A study conducted in urban hospitals examined the impact of emergency department (ED) wait times on birth weight outcomes. Contrary to

expectations, the study found that while longer ED wait times were associated with increased maternal stress and dissatisfaction, there was no significant correlation with LBW rates among newborns. The researchers suggested that factors such as socioeconomic status, mother's health conditions, and access to prenatal care might have confounded the relationship between delays in ED care and birth weight. Research conducted at a tertiary care center focused on evaluating delays in admission and its effects on perinatal outcomes. The study controlled for various maternal and fetal risk factors but found no strong association between delays in hospital admission and the incidence of LBW infants. The researchers hypothesized that the high level of medical care available at the center might have mitigated potential adverse effects of delays on birth weight outcomes. Studies that failed to find an association often cited the influence of confounding variables such as mother's age, parity, socioeconomic status, and mother's health conditions. These factors can independently impact birth weight outcomes and may overshadow the effects of delays in receiving medical care (Doolittle et al, .2020). The findings from studies that did not establish a clear association between delays in receiving patients and LBW highlight the complexity of factors influencing birth outcomes. While timely access to medical care remains a critical component of prenatal and perinatal management, these studies suggest that improving birth weight outcomes may require addressing broader healthcare disparities and enhancing overall quality of care rather than focusing solely on reducing delays in patient reception. In conclusion, while delays in receiving patients at healthcare facilities are often assumed to impact birth weight outcomes negatively, several studies have failed to confirm this association. Factors such as study design, patient demographics, healthcare setting, and quality of care provided can significantly influence the results. Ongoing research is needed to delve into

these complexities and create specific interventions aimed at improving the health outcomes of both mothers and fetuses in diverse populations (Doolittle et al, .2020).

Several studies have indicated a strong link between the absence of trained healthcare professionals and a low birth weight. Said and Padrini's research underscores that having trained antenatal care providers and receiving the first antenatal care appointment during the initial trimester can reduce the likelihood of low birth weight. Furthermore, Arsyi et al discovered that inadequate antenatal care services were associated with a higher occurrence of low birth weight. Additionally, Jain emphasizes the significance of the type of healthcare provider in perinatal outcomes, highlighting that the presence of midwives versus obstetricians can affect the risk of low birth weight (Said et al, .2021). The relationship between the availability of trained healthcare providers and low birth weight (LBW) outcomes is a crucial research area in maternal and perinatal health. Many studies have explored how shortages or inadequacies in healthcare staffing can impact prenatal care quality, maternal health, and ultimately, birth weight (Said et al, .2021). A study published in the American Journal of Public Health examined the relationship between nurse staffing levels in maternity units and low birth weight rates. The researchers found that higher nurse-to-patient ratios were associated with improved birth outcomes, including a reduction in low-birth-weight infants. Facilities with adequate nursing staff were better equipped to provide comprehensive prenatal care, monitor maternal health conditions, and intervene promptly in case of complications, thereby potentially reducing the incidence of low birth weight (Lake et al, .2022). Research conducted across multiple healthcare facilities analyzed the impact of physician availability on pregnancy complications and birth outcomes. The research showed that facilities with scant obstetrician or maternal-fetal medicine specialist availability had increased occurrences of preterm births and low birth weight babies. The researchers emphasized the importance

of timely medical interventions and specialized care in managing high-risk pregnancies, which are crucial for preventing adverse birth outcomes like low birth weight. A study focusing on midwifery care availability in underserved rural communities investigated its influence on birth weight outcomes. Communities with access to midwifery-led care reported lower rates of low birth weight compared to those lacking such services. Midwives play a pivotal role in providing personalized prenatal care, education, and support throughout pregnancy, which can contribute to healthier birth weights by addressing maternal health concerns early and promoting healthy lifestyle behaviors (Lake et al, .2022). Adequate staffing levels ensure timely access to prenatal care services, including regular health assessments, screenings, and interventions that can identify and address risk factors for low birth weight. Managing pregnancy complications like gestational diabetes, hypertension, and infections requires skilled healthcare providers. These conditions, if left untreated, can lead to low birth weight. Educating expectant mothers about nutrition, prenatal vitamins, and lifestyle changes that support healthy fetal growth and development is a crucial role of healthcare providers (Lake et al, .2022).

The studies by Kanjanasingh and Said and Padrini did not show a direct association between lack of skilled and sufficient healthcare providers and low birth weight. Kanjanasingh's case-control study determined that the presence of high-quality antenatal care, rather than the frequency of visits, acted as a protective factor against low birth weight, emphasizing the significance of care quality over quantity. Similarly, Said and Padrini's examination of demographic and health surveys concluded that comprehensive antenatal care, which includes skilled attendants and early consultations, proved beneficial in preventing low birth weight in low- and middle-income countries. These studies underscore the significance of healthcare service quality and sufficiency in reducing the risk of low birth weight, rather than exclusively focusing on the availability

of healthcare providers (Said et al, .2021). Research exploring the association between the availability of skilled and sufficient healthcare providers and low birth weight outcomes has yielded varied findings, with some studies failing to establish a significant relationship between these factors.

2.6. Theoretical Framework

2.6.1. Health Belief Model (HBM)

This study utilized the Health Belief Model. The health psychology model that has been widely utilized is the health Belief Model (Rosen stock, 1974). It implies that several socio-demographic factors, gyneco-obstetric factors including health facility factors influence a women's decision to pursue low birth weight prevention. If a pregnant woman is highly motivated to protect herself and her fetus's health, she is more likely to engage in low-birth weight prevention: Our beliefs had a significant impact on the issue of low birth weight through creating awareness of all pregnant women emphasizing on the variables such as maternal occupation, maternal chronic medical conditions, multiple pregnancy, having abnormalities of amniotic liquid(oligohydramnios & polyhydramnios) that had shown a significant association between variables in this present study. It is crucial to recognize the gravity of having an underweight baby and to understand the benefits of preventing low birth weight. Additionally, we must consider the financial implications of extended hospital stays. According to the health belief model, individuals' beliefs about community health issues, perceived benefits of taking action, barriers to taking action, and confidence in their ability to make a difference all play a role in determining whether they engage in activities that promote health. Irwin and Rosen stock, (1974). In the 1950s, the health belief model was developed by a group of social psychologists from the University of Pennsylvania, namely Irwin M., S. Stephen Kegels, and Howard Leventhal. This model is considered one of the original theories in the health

behavior field, dating back to 1950. Public health services and interventions use this model to understand the limitations of low-birth-weight screening programs in pregnant women, as emphasized by Becker et al. (1984). The health belief model has proven to be a valuable tool in predicting various health-related behaviors, such as screening for and diagnosing asymptomatic disorders, as well as promoting public interventions. In recent studies, the model has been utilized to enhance our comprehension of how pregnant women react to the signs and symptoms of low birth weight, follow medical regimens during pregnancy period, engage in lifestyle behaviors for teenagers (such as sexual risk behaviors), and maintain long-term behaviors associated with chronic diseases, in addition to making initial changes in health behaviors. Even in 1988, the model was updated to incorporate the latest findings in psychology regarding self-role efficacies in decision-making and health behavior. Based on the theoretical literature review, the Health Belief Model seems to be the most appropriate for my research. Therefore, I referred to this model extensively throughout my thesis because it is mostly used to change the people's beliefs through communication and achieve to impact positively the communities.

2.7. Gaps in literature review

The reviewed literature on low birth weight (LBW) in Burundi reveals several gaps. Most existing studies rely heavily on secondary data from national demographic surveys, limiting clinical specificity and contextual depth. Few studies focus on hospital-based populations, particularly tertiary referral centers like CHUK, where high-risk pregnancies are concentrated. Additionally, prior research often overlooks critical factors such as delays in care (e.g., ambulance response, patient admission), uterine abnormalities, and availability of skilled healthcare providers; key determinants highlighted in my study. There is also limited integration of both medical and systemic factors, which hinders comprehensive understanding. Moreover, rural-urban disparities and the influence of

infectious diseases on LBW remain underexplored. my work addresses these gaps by combining clinical records and contextual factors in a high-referral setting, offering a more holistic and practical approach to understanding LBW determinants in Burundi.

2.8 Conceptual framework.

The occurrence of low birth weight (LBW) is impacted by a variety of factors such as socio-demographic, gynecologic-obstetric, and health system factors. Characteristics like marital status, partner's employment status, socio-economic status, frequency of ANC visits, number of pregnancies, use of modern Family Planning methods, pregnancy-related illnesses, inadequate prenatal care, pre-delivery weight, height, low socio-economic status, anemia, maternal age, occupation, weight gain during pregnancy, maternal height, maternal weight, placenta previa, eclampsia, preterm labor, severe PET, multiple pregnancies, heart disease, DM, and iron deficiency anemia are recognized as key factors contributing to low birth weight. The multifaceted nature of the issue is underscored by these factors, underscoring the requirement for comprehensive and coordinated interventions to effectively tackle low birth weight among women who delivered at King Khaled Hospital. The relationship between the variables is depicted in the figure below:

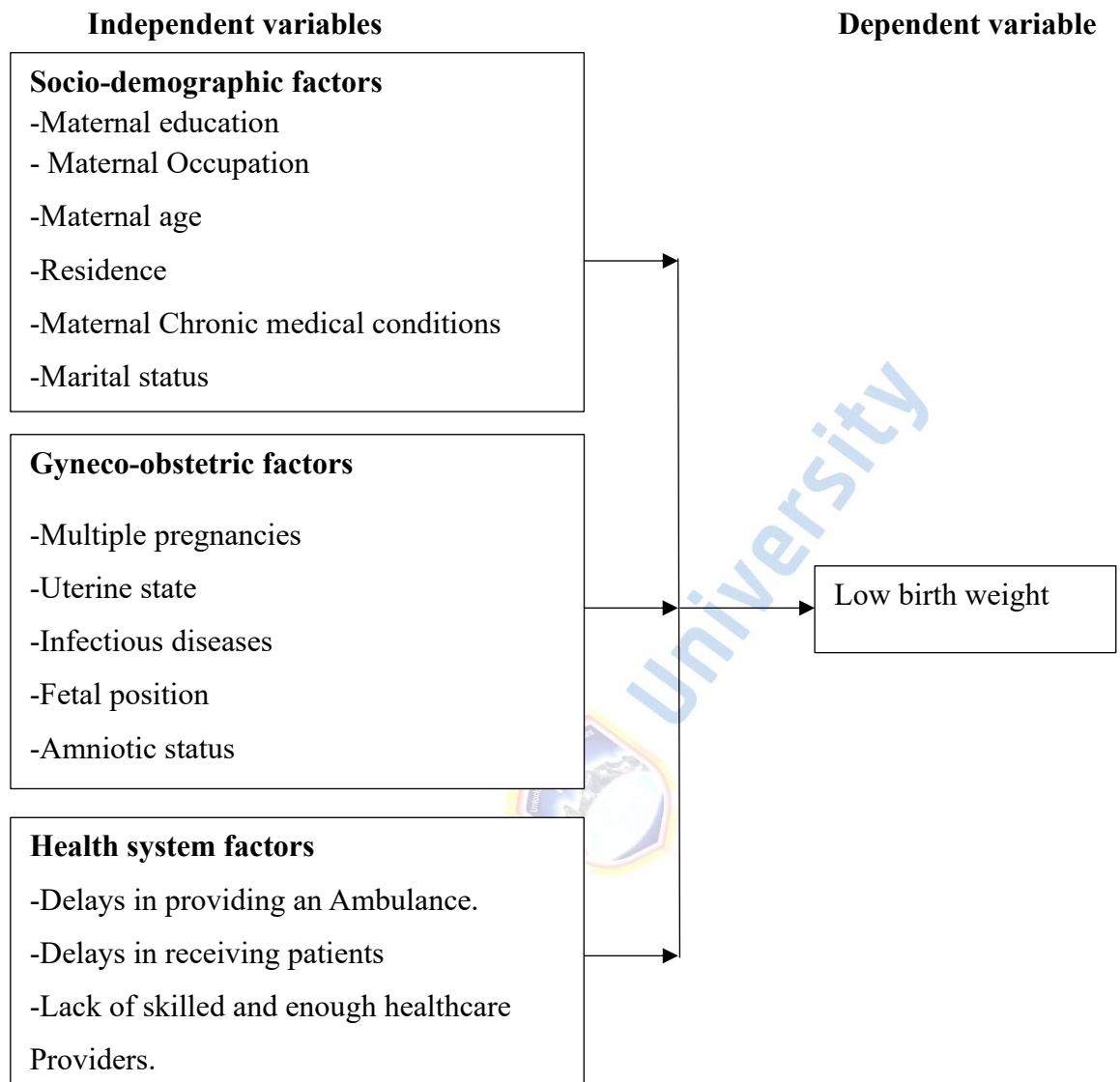


Figure2.1 Conceptual Framework

CHAPTER THREE

METHODS AND MATERIALS

3.0 Introduction

This chapter outlines the methodology and techniques that was employed in the study including the research design study population, sample size, sampling methods, data collection tools, measures of validity and reliability, analysis techniques, data presentation methods and ethical considerations

3.1 Study Design

The research utilized an analytical retrospective study of unmatched case control study design to investigate the various factors that contribute to low birth weight among women who have given birth. These factors include socio-demographic factors, gynecological factors, and health system factors. The effectiveness of the analytical research design lies in its ability to quantify the relationship between independent factors and the dependent factor (low birth weight). The mixed methods of study (quantitative and qualitative) were employed for the purposes of triangulation.

3.2 Study Variables

The dependent variable was the low birth weight which was binary, which was either low or normal birth weight. The independent variables were socio-demographic, health system and gynecological factors. The study considered the influence of independent factors on low birth weight; when independent factors were favorable, low birth weight rates increase whereas when the independent factors were unfavorable, the rate of low birth weight slows down.

3.3 Study Area description

Burundi is a country located between East and Central Africa. There is a total population according to RGP 2018 projections, is estimated at 11,215,578 inhabitants, including 5,500,949 men and 5,714,629 women and the estimated number of households is 2,484,613. This population is distributed in 18 provinces, 119 communes and 2911 hills.

The health system in Burundi is structured in a pyramidal form, with three levels: the central level, the intermediate level, and the peripheral level. The intermediate level consists of 17 provincial health offices. The peripheral level consists of 45 health districts that encompass 43 hospitals and 735 health centers, which are distributed throughout the country's 129 municipalities. A Health District encompasses 2 to 3 municipalities and represents the third administrative level in the health sector, distinct from the territorial administrative level of the municipality. According to the map of Burundi, it shows that the country has a total of 685 functional health centers, with the majority, 63%, being in the public sector. There are a total of 48 hospitals in the country, consisting of 43 district hospitals and 5 national hospitals. These include Hôpital Militaire de Kamenge, Hôpital Cinquantenaire Natwe turashoboye, Hôpital Prince Regent Charles, and Centre Hôpitalo-Universitaire de Kamenge (Rolland EG, .2018).

3.4 Study Population

All women who had given birth at the maternity of Centre Hospitalo-universitaire de Kamenge were included in the target population for this study. The information from the maternity's registers and neonatal case orientation book was collected for the women who delivered between the periods of 2021-2023. Identified total number of 305 (102cases) was compared to the controls of 203. And the Gynecologists working in the study area were also targeted to serve as key informants.

3.4.1 Inclusion Criteria

All registered women after delivery at maternity of Centre Hospitalo-universitaire de Kamenge during my study period were included in the study.

The study included mothers who gave live births weighing less than 2500g and registered in the neonatal book as cases, according to the case definition. In this study, two consecutive controls weighing more than 2500g were included for each case.

3.4.2 Exclusion criteria

All women after delivery transferred to this hospital for medical complications management but who are registered, were excluded.

3.5 Sample Size Determination

Sample size was calculated by using software Epi-Info 7.2 version under Statcalc, choose the unmatched case control. The sample size determination was done taking 90% power ($Z_{\beta} = 0.9$), 95% confidence level ($Z_{\alpha/2} = 2.436$), 5% alpha error (0.05), and 4.6 as anticipated odds ratio, control to case ratio 1:2 ($r = 2$), level of exposure for controls 15.5% and level of exposure for cases 46% (Demelash et al., 2015)

The formula for unmatched case control study design from Epi-Info version 7.2:

$$n_{cases-Fleiss-cc} = \frac{n_{cases-Fleiss}}{4} \left[1 + \sqrt{1 + \frac{2 * (r + 1)}{n_{cases-Fleiss} * r * |p_1 - p_0|}} \right]$$

StatCalc - Sample Size and Power
Unmatched Case-Control Study (Comparison of ILL and NOT ILL)

Two-sided confidence level: 95%
Power: 90%
Ratio of controls to cases: 2
Percent of controls exposed: 15.5%
Odds ratio: 4.64397
Percent of cases with exposure: 46%

	Kelsey	Fleiss	Fleiss w/ CC
Cases	33	34	39
Controls	65	68	77
Total	98	102	116

The sample size was 116 (39 cases and were compared to the 77 controls) in the study

The ideal sample size for this study has consisted of 116 study medical records, with an additional 10% (11.6=12) to account for potential non-response. This resulted in a total sample size of 128 study medical records. After including an additional 10% for cases, the final sample size was 43, while for controls it was 85. The participants for the key

informant interviews were carefully chosen to include a Gynecologist and a Clinician who were actively involved in the reproductive health department.

3.6 Sampling Techniques

Centre Hospitalo-universitaire de Kamenge was selected purposely since it serves a diverse set of population including low and middle income and it is one of the biggest national level referral Hospital in Burundi. The study medical records in this study were selected through systematic sampling. To identify the sampling interval, the total number of women who had delivered children with low birth weight at maternity of this Hospital, were identified and compared to those with normal birth weight, and then divided by the total sample size ($N_{\text{case}}=102$, $N_{\text{controls}}=203$, $n_{\text{for cases}}=43$, $n_{\text{for controls}}=85$ SI for cases= $102/43=2.4=3$; SI for Controls $203/85=2.4=3$).

All live births delivered in that hospital during the study period were considered, including the children with registered weight. An investigator utilized a data abstraction form to collect information from medical records.

3.7 Data Collection Tools

Section A collected information on the socio-demographic factors, Section B collected information on the gynecological and obstetric factors, and Section C collected information on the health facility system factors related to low birth weight in women who had given birth in hospital. The anthropometric measurements were collected by investigator from medical books.

For the qualitative data both an audio recorder was used to capture audio records for key informant interviews.

3.8 The measurement of independent variables

Maternal education: Categorized as no formal education, primary, secondary, or tertiary.;

Maternal occupation: Classified into employed, self-employed, unemployed, or student;

Maternal age: Grouped into <20, 20–34, and ≥ 35 years; Residence: Recorded as urban or rural; Maternal chronic medical conditions: Included documented history of hypertension, diabetes, or cardiac disease; Marital status: Categorized as single, married/cohabiting, divorced, or widowed; Multiple pregnancies: Confirmed by ultrasound or delivery records; Uterine state: Included abnormalities such as fibroids or scarring, identified via medical history or clinical examination; Infectious diseases: Covered HIV, malaria, and urinary tract infections, confirmed through laboratory results; Fetal position: Determined via clinical and ultrasound examination; Amniotic status: Referred to normal, meconium-stained, or ruptured membranes before labor; Delays in providing an ambulance: Measured by time from request to dispatch (>1 hour = delayed); Delays in receiving patients: Captured waiting time at the facility (>30 minutes = delayed); Lack of skilled/enough healthcare providers: Assessed through staffing records and delivery reports indicating shortages during labor.

3.9 Reliability and Validity

3.9.1 Validity

In order to guarantee that the data collection tools accurately capture the necessary information. The researcher consulted the supervisors who are experienced in designing the data abstraction tool. Investigator requested a gynecologist to review the data collection tools and make sure they gather all the necessary information for this study.

3.9.2 Reliability

Refers to the extent to which a study tool produces a constant result if same study medical records are subjected to the same data abstraction form at different times. Cronbach's Alpha was carried out via Epi-info version 7.2 to calculate the degree on internal consistency of the study variables and obtained a coefficient of 0.71. This was sufficient as it was above 0.70 which is considered as a cutoff point. The test-retest method involved

10 women with new born before discharge at Kamenge Military Hospital on two separate occasions to confirm the stability and reproducibility of data collection tools. A pilot test was conducted with a small representative group to gather feedback on clarity, relevance, and potential biases

3.10 Data Analysis

First, the data was thoroughly examined for any potential gaps or discrepancies. Then input and encoded into Epi-info version 7.2 software. The entered data underwent through cleaning and editing before further analysis. We calculated descriptive analysis measures such as frequency, and percentage for both the cases and controls groups. We cross tabulated the socio-demographic, gyneco-obstetric, and health system factors of the mothers among cases and controls. Further, analysis was conducted using bivariate logistic regression to determine the correlation between various independent variables, such as socio-demographic factors, gyneco-obstetric factors, and health system factors, with the dependent variable of low birth weight. We utilized bivariate analysis and cross-tabulations tests to examine potential associations. The statistical tests were conducted with a two-sided approach, and any significant associations were determined based on a p-value of less than 0.05 and Odds ratio was used for findings interpretation. In relation to qualitative data, we utilized a thematic content analysis approach. We then proceeded with triangulation to ensure accuracy and reliability.

3.11 Ethical Issues

The researcher ensured that all relevant ethical considerations were carefully followed throughout the study. Before commencing data collection, the researcher obtained ethical clearance from the MKU Ethical Review Committee (REF: MKU/ISERC/3774). Additionally, permission to collect data in the study area was received from the general administration office of the Centre Hospitalo-Universitaire de Kamenge

(REF:2024/DGCHUK.2399/11.5). Throughout the research process, the confidentiality of all information obtained from each study medical record was strictly maintained. To ensure participants confidentiality, medical records review was done in a private setting within the hospital. Confidentiality was maintained by encrypting response from medical records and using safety cabinets lock and key to limit accessibility to respondents medical records and documentation. The data recorded electronically via computer have a password known only by the principal researcher to limit access to the study medical records to others.



CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter entails the report of my findings that was conducted at King Khaled Hospital reproductive health unit between the date limit 14th to 28th June 2024. From a sample population of 128 medical records, 126 medical records fulfilled the criteria during data entry in Epi-info and Data abstraction form captured a total of response rate at 98.44% and the 1.56% did not fill the requirement. The information provided in the study by Kimberlin & Winterstein, 2008, was deemed sufficient for offering trustworthy insights into low birth weight. Biemer & Peytchev, (2013) assert that a high response rate strongly supports the argument that obtaining an unbiased estimate is best achieved through a high response. Nonetheless, Fosnacht, Sarraf, Howe, and Peck (2017) contend that even moderately low response rates can still yield dependable institution-level estimates.

The figure below summarizes the result of my study sample.

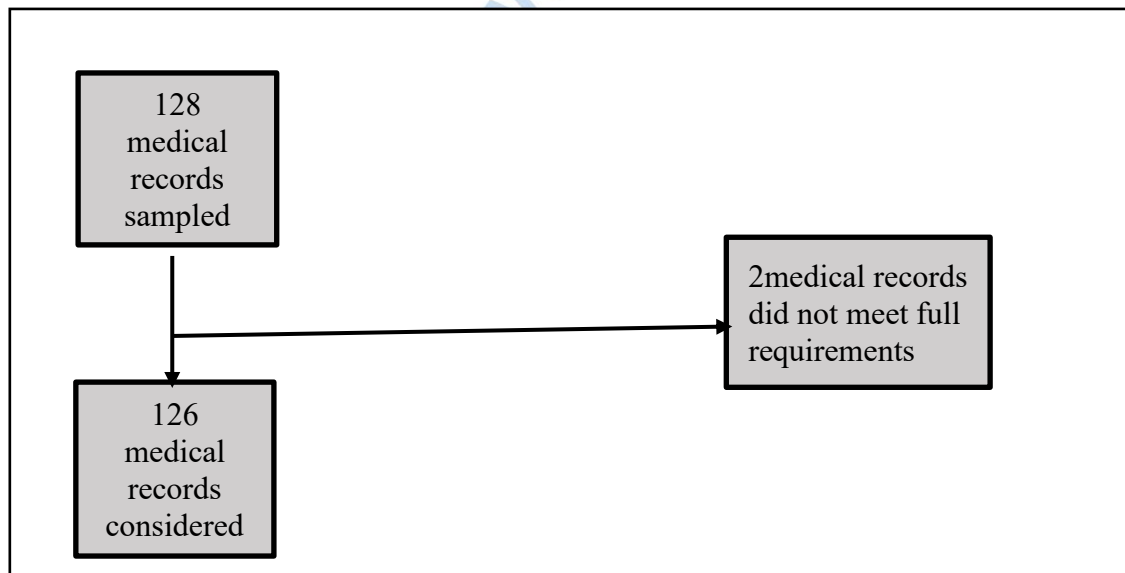


Figure 4.1 Results of the Sample

Source: Primary Data

4.2 Hospital prevalence of Low birth weight

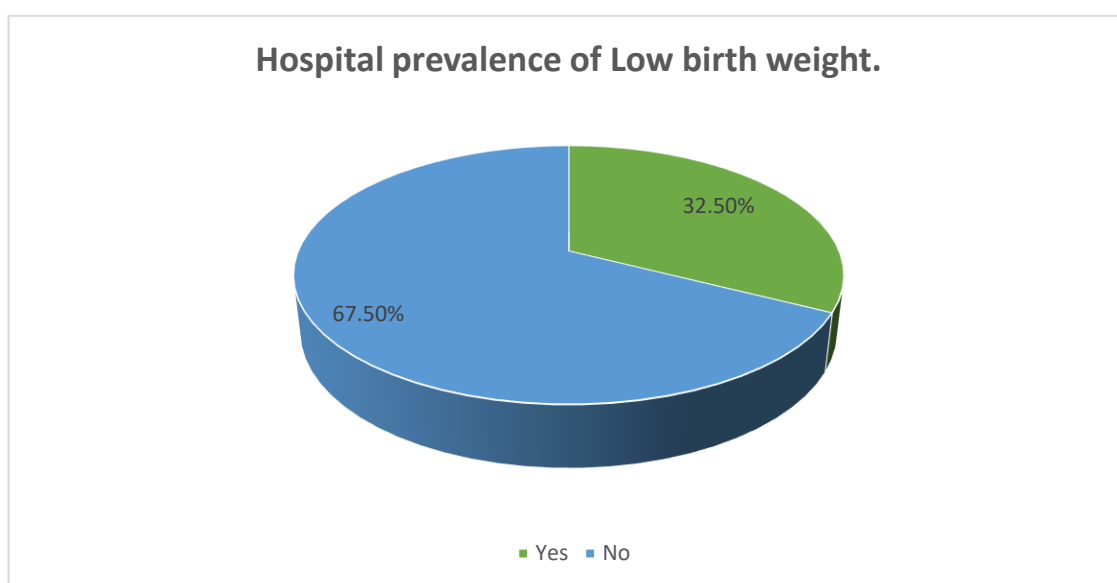


Figure 4.2.1 Hospital prevalence of Low birth weight

Source: Primary Data

The study findings shown a hospital prevalence of low birth weight at 32.50%. This is relatively a high prevalence found at Centre Hospitalo-Universitaire de Kamenge if it is compared to a study done in Tanzania which reported a low-birth-weight prevalence of 18.2% (Dreyfuss et al, .20011) and other study in Garmsar, Iran, reported 4.7% of low-birth-weight prevalence (Safari et al, .2016).

4.3 Socio-demographic factors linked to low birth weight.

Table4.3.1 Education Level information

Education Level	N	%	Low birth weight	
			No	Yes
College/University	14	11. 11%	78. 57% (11)	21. 43 % (3)
None	8	6. 34%	37.50 % (3)	62.50% (5)
Primary	52	41. 27%	61. 54% (32)	38. 46% (20)
Secondary	52	41. 27%	73. 08% (38)	26. 92 % (14)

Source: Primary Data

In matters pertaining education status most women have attained or at least reached the level of secondary/primary education 41.27% and 11.11% in the present findings show that a few number of women had achieved a high education level which is related to a good understanding on pregnancy issues management but unfortunately this number is still low as at the same time a significant number (6.34%) have reported that they haven't achieved the basic level of education as shown in figure 4.3.1 which also explains the higher rate of unemployment for both spouses. According to Luo et al, they mention that education and income levels are important factors to maternal and fetal health outcomes (Luo et al, .2022).

Table4.3.2 Maternal Occupation information

Maternal Occupation	N	%	Low birth weight	
			No	Yes
Salaried job	6	4.76%	50.00%(3)	50.00%(3)
Self-employed	72	57.14%	68.06%(49)	31.94%(23)
Unemployed	48	38.10%	68.75%(33)	31.25%(15)

Source: Primary Data

According to the Table 4.3.2 shows the maternal occupation of most participants were self-employed totaling to 57.14% followed by unemployed totaling 38.10% unfortunately only 4.76% of the participants had salaried job. Most of the women are self-employed means that had not a specific job at 57.14% but there is still a significant number at 38.10% that are not employed. In this particular study we found out that self-employed women reported high rates of low birth weight which does correspond to a study done by Rizvi et al found that pregnant women self-employed have higher risks of low birth weight (Rizvi et al., 2015).

Table4.3.3 Mother's Age information

Mother's age	N	%	Low birth weight	
			No	Yes
18-40	120	95.24%	70.83%(85)	29.17%(35)
41 and Above	2	1.59%	0.00% (0)	100.00%(2)
Under 18	4	3.17%	0.00% (0)	100.00% (4)

Source: Primary Data

According to the Table 4.3.3 shows the mother's Age of most of the participants were aged between 18-40 totaling 95.24% followed by mothers under 18 totaling 3.17%. Most of the women were aged between 18-40. In this particular study we found out that among active women aged between 18-40 reported high rates of low birth weight which does not correspond to a study conducted in Semarang, Indonesia that found no high rates of low birth weight among pregnant women aged between 14-40 years (Haksari et al, .2019)

Table4.3.4 Mother's residence information

Mother's residence	N	%	Low birth weight	
			No	Yes
Rural	19	15.08%	47.37%(9)	52.63%(10)
Urban	107	84.92%	71.03% (76)	28.97% (31)

Source: Primary Data

Table 4.3.4 does indicate that most of the participants reside in urban spaces (84.92%) but then there were still a significant number of them that reside in the rural regions (15.08%). This first of all gives an idea of the socioeconomic factors revolving around the mother and the fetus and other factors that may contribute to pregnancy outcomes. In Ethiopia, a study showed that urban mothers have a lower likelihood of experiencing

negative birth outcomes. The study found no connection between the location of residence and adverse pregnancy results(Muchemi et al., 2015).

Table4.3.5 Maternal Chronic medical conditions information

Maternal Chronic med cond	N	%	Low birth weight	
			No	Yes
Cardiac disease	1	0.79%	0.00%(0)	100.00%(1)
Diabetes mellitus	17	13.5%	5.88%(1)	94.12% (16)
HIV/AIDS	10	7.95%	20.00% (2)	80.00%(8)
Hypertension	42	33.33%	9.52% (4)	90.48% (38)
None	26	20.63%	80.77% (21)	19.23% (5)
Others	0	23.80%	83.33% (25)	16.67%(5)

Source: Primary Data

According to the Table 4.3.5 shows the maternal chronic medical conditions of most of the participants were hypertensive totaling to 33.33% followed by diabetes mellitus totaling 13.5% and HIV/AIDS at 7.95%. Most of the women had hypertension at 33.33%. In this particular study we found out that women with maternal chronic medical conditions reported with high rates of low birth weight among those who had hypertension which does not correspond to a study done by Conway and Amano where they found hypertension had not a higher rates of low birth weight (Conway et al., 2011)

Table4.3.6 Marital status information

Marital status	N	%	Low birth weight	
			No	Yes
Married	113	89.68%	70.80%(80)	29.20%(33)
Separated	2	1.59%	0.00% (0)	100.00% (2)
Single	10	7.94%	50.00% (5)	50.00% (5)
Widowed/Divorced	1	0.79%	0.00% (0)	100.00%(1)

Source: Primary Data

According to the Table 4.3.6 shows the marital status of most of the participants were married totaling to 89.68% followed by single totaling 7.94% unfortunately 1.59% of the participants were separated no information was provided about their spouse. Most of the women are married at 89.68% but there is still a significant number at 7.94% that are not married. In this particular study we found out that married mothers reported with high rates of low birth weight which does correspond to a study done by Yang Shaohua and al found also high rates of low birth weight among married (Yang Shaohua et al., 2015).

4.4 Gyneco-obstetric factors linked to low birth weight.

Table 4.4.1 Infectious diseases information

Infection diseases	N	%	Low birth weight	
			No	Yes
Anemia	8	6.35%	87.50 % (7)	20.00 % (1)
Malaria	27	21.43%	70.37 % (19)	29.63 % (8)
None	50	39.68%	76.92%(39)	23.07%(11)
Sexual transmitted infection	4	3.17%	50.00 % (2)	50.00 % (2)
Urinary tract infection	37	29.36%	62.06 % (28)	37.93 % (9)

Source: Primary Data

The Table 4.4.1 shows the Infectious diseases of most of the participants had urinary tract infection totaling to 29.36% followed by malaria totaling 21.43%. Most of the women had urinary tract infection at 29.36% and malaria prevalence of 21.435. In this particular study we found out that infectious diseases such as urinary tract infection and malaria were reported with high rates of low birth weight which does correspond to a study conducted by Wachira where they found that pregnant woman who had urinary tract infection ,had a higher risks of giving birth to underweight baby (Wachira et al., 2015)

Table 4.4.2 other factors information

Other factors	N	%	Low birth weight	
			No	Yes
Multiple pregnancy	43	34.12%	18.60% (8)	81.40% (35)
Oligohydramnios	35	27.8%	40.00% (14)	60.00% (21)
Polyhydramnios	38	30.20%	31.58% (12)	68.42% (26)
Preeclampsia	3	2.38%	33.33% (1)	66.67% (2)
Unnormal uterus	7	5.5%	42.86% (3)	57.14% (4)

Source: Primary Data

The Table 4.4.2 shows the other factors in which most of the women had multiple pregnancy totaling to 34.12% followed by polyhydramnios totaling 30.20% and oligohydramnios at 27.8 %. In this particular study we found out that pregnant women with other factors such as multiple pregnancy, oligohydramnios, polyhydramniosetc are reported with high rates of low birth weight which does correspond to a study done by Muchemi and Balayla where they found that the above factors mentioned have higher risks on low birth weight (Muchemi et al., 2015).

4.5 Health system factors linked to low birth weight.

Table 4.5.1 Delays in providing Ambulance information

Delays in providing Ambulance	N	%	Low birth weight	
			No	Yes
Yes	72	57.14%	69.44% (50)	30.56% (22)
No	54	42.86%	64.81% (35)	35.19% (19)

Source: Primary Data

According to the Table 4.5.1 shows the delays in providing Ambulance in most of the participants, women received an ambulance assistance services totaling to 57.14% and those did not benefit Ambulance assistance is 42.86%. Most of the women were assisted by Ambulance at 57.14% but there is still a significant number at 42.86% that had not ambulance assistance. This study revealed that women who received assistance from an ambulance had a high incidence of low birth weight. However, there is still a substantial percentage (42.86%) of women who did not receive ambulance assistance, which contrasts with a study conducted by Rizvi. Rizvi's study found that delays in providing ambulance services did not lead to an increased risk of low birth weight(Rizvi et al., 2015)

Table 4.5.2 Delays in receiving patients information

Delays in receiving patients	N	%	Low birth weight	
			No	Yes
1-2 hours	10	8.06%	70.00% (7)	30.00% (3)
Less than 30 min	111	87.90%	68.81% (75)	31.19% (36)
More than two hours	5	4.04%	40.00% (2)	60.00% (3)

Source: Primary Data

According to the Table 4.5.2 shows the delays in receiving patients, most of the women assisted/got health care within 30 minutes totaling to 87.90% but there is still a significant number at 8.06% that had not health care providers' assistance on time. In this particular study we found out that the assisted women within the time less 30 minutes were reported with high rates of low birth weight, which does correspond to a study done by Pikhartova where they found that delays in receiving patients have higher risks of low birth weight (Pikhartova et al., 2022)

Table 4.5.3 Level of appreciation in terms of staff skills and availability information

Staff skills & availability	N	%	Low birth weight	
			No	Yes
Bad	4	3.23%	75.00% (3)	25.00% (1)
Extremely bad	2	1.61%	0.00% (0)	100.00% (2)
Extremely good	101	81.45%	69.31% (70)	30.69% (31)
Fair	1	0.81%	100.00% (1)	0.00% (0)
Good	18	12.90%	62.50% (12)	37.50% (6)

Source: Primary Data

According to the Table 4.5.3 shows the Level of appreciation in terms of staff skills and availability, most of the women extremely appreciated the staff skills and availability totaling to 81.45% but there is still a significant number at 12.90% that had not a very good appreciation according to availability and skills of the staff of king Khaled hospital. In this particular study we found out that the women who extremely appreciated the skills and availability of staff are also reported with high rate of low birth weight which does correspond to a study done by Pikhartova where they found that appreciation in terms of staff skills and availability have not higher risk of LBW (Pikhartova et al., 2022).

4.6 Analysis of association between low birth weight and independent variables

First, a bivariate logistic regression analysis was carried out to assess the association between low birth weight and socio-demographic, gyneco-obstetric and health facility factors. The bivariate results indicate a significant association between low birth weight and woman's occupation (OR: 0.9163; 95% CI:0.6149-1.3652,P-value:0.02), having medical chronic condition such as Diabetes mellitus, Hypertension, and HIV/SIDA (OR: 0.8755; 95% CI: 0.6885-1.1132,P-value:0.03), exposure to multiple pregnancy, abnormal uterus and oligohydramnios/polyhydramnios (OR: 1.4573; 95% CL:1.1359-1.8696,p-value:0.03) and bivariate analysis did not show any significant relationship between health system factors and LBW. Thereafter, multiple logistic regression analysis was performed to assess the significance of association between the independent variables and the dependent variable when the all-explanatory variables were included in model. The results indicate a significant association between low birth weight and woman's occupation (OR: 0.0481; 95% CI: 0.0047-0.4947, P-value:0.01), having medical chronic condition such as Diabetes mellitus, Hypertension, and HIV/SIDA (OR: 0.4492; 95% CI: 0.2214-0.9112, P-value:0.02), exposure to multiple pregnancy, abnormal uterus and oligohydramnios/polyhydramnios (OR: 0.6448; 95% CL: 0.4306-0.9656, p-value:0.03). On other hand, no significant association was found between low birth weight and maternal age, marital status, education level, residence, Caesarean causes, Ultrasound outcome, Diseases infections, Staff skills& availability, Delays in receiving women, Delays in providing Ambulance. Table 4.4 shows the results of logistic regression analysis.

4.6.1 Bivariate logistic regression analysis between variables

Table 4.6.1.1 Bivariate analysis between socio- demographic factors and low birth weight

Variables	Odds Ratio	95% C.I.	Coefficient	S0.E.	Z-Statistic	P-Value	
Education Level	1.4083	0.8119	2.4426	0.3424	0.281	1.2185	0.223
Marital status	0.3923	0.1282	1.2004	-0.9357	0.5706	-1.6399	0.101
Mother's Age	1.5292	0.2284	10.2391	0.4247	0.9702	0.4378	0.6615
Residence (Yes/No)	0.5509	0.1858	1.634	-0.5961	0.5547	-1.0747	0.2825
Maternal Occupation	0.9163	0.6149	1.3652	-0.0875	0.2035	-0.4299	0.0273
Chronic medical conditions	0.8755	0.6885	1.1132	-0.133	0.1226	-1.0852	0.0378
Constant	*	*	*	0.2094	1.0921	0.1917	0.848

Source: Primary Data

As the table 4.6.1.1 shows that there is association between the independent variables and the dependent variable as many of the pregnancy risks come from the pregnant women who live with maternal chronic medical conditions and those who have unstable job as well as limited finance. With the available data the research presented itself as the highest contributing risk pregnancy came from socio-demographic factors as well as less economic structure and health status. A portion of active pregnant women who were also risked with maternal chronic medical conditions and unstable employment, they faced a

higher risk of giving birth to underweight baby. However, when it comes to looking at the type of health facility available the majority of fetus passed away due to parents' residence, however a study compared the low birth weight between employed and self-employed women showing that low birth weight was lower in employed women (Casas et al, 2015)

Table 4.6.1.2 Bivariate analysis between gyneco-obstetric factors and low birth weight

Variables	Odds Ratio	95% C.I.	Coefficient	S. E	Z-Statistic	P-Value	
Caesarean causes (Preeclampsia, uterine/placenta abnormalities)	0.8076	0.6067 - 1.0749	-0.2137	0.1459	-1.4649	0.1429	
Ultrasound outcomes (Oligi/polyhydramnios & multiple pregnancy...etc)	1.4573	1.1359 - 1.8696	0.3766	0.1271	2.9627	0.033	
Infectious diseases (Malaria, UTI...etc)	0.9758	0.7176 - 1.327	-0.0245	0.1568	-0.1562	0.8759	
Constant	*	*	*	-0.2751	0.8457	-0.3252	0.745

Source: Primary Data

As the table 4.6.1.2 shows that there is association between the independent variables and the dependent variable as many of the pregnancy issues came from the pregnant women who had abnormalities of amniotic liquid (Oligihydramnios /polyhydramnios) including also multiple pregnancy. With the available data the research presented itself as the highest contributing risk pregnancy came from gyneco-obstetric factors as well as genetic

structure. A portion of active pregnant women who were also risked with Oligihydramnios /polyhydramnios and multiple babies, they faced a higher risk of giving birth to underweight baby. Research conducted on oligohydramnios at KIMS Hospital in Bengaluru showed also the high rates of LWB among pregnant women presented Oligihydramnios /polyhydramnios and multiple babies(Tessema et al., 2021).

Table 4.6.1.3 Bivariate analysis between health system factors and low birth weight.

Variables	Odds Ratio	95% C.I.	Coefficient	S.E.	Z-Statistic	P-Value	
skills & availability of staff	0.8372	0.4674	1.4994	-0.1777	0.2973	-0.5978	0.55
Delays in receiving patients	0.7737	0.2888	2.0727	-0.2566	0.5028	-0.5103	0.6098
Delays in providing Ambulance	1.3164	0.6069	2.8553	0.2749	0.395	0.6959	0.4865
CONSTANT	*	*	*	0.7089	0.2995	2.3669	0.0179

Source: Primary Data

As the table 4.6.3 shows that there is no relationship between the independent variables and the dependent variable However, a study conducted in South Africa highlighted the critical impact of delays in receiving patients and providing Ambulance and reported also that health facilities without skilled birth attendants have an influence on low birth weight (Fraser et al.,2020).

Table 5.4 Multiple Logistic regression analysis of association between Low birth weight and independent variables.

Variables	Odds Ratio	95% C.I.	Coefficient	S.E	Z-Statistic	P-Value	
Constant			7.9363	3.0951	2.5641	0.0103	
Social Demographic factors	0.2486	0.1130	0.7029	-1.9177	0.7751	2.7693	0.0186
Gynecologic Obstetric factors	0.4213	0.2102	0.7434	-0.2166	0.1040	-10201	0.0213

Source: primary data

Table 5.4 points out the importance of the independent main driving forces a combination of all the independent and dependent variables. This means that each independent variable is measured on its importance with the rest. This allowed the researcher to determine which independent variable is the most important.

4.7 Qualitative data analysis and interpretation

The thematic analysis related to health system factors was done using NVivo version 14, particularly on delays in providing ambulance assistance, delays in receiving patients, and the availability of skilled and enough healthcare providers, this involved interviews with two gynecologists, two clinicians and some women gave birth at maternity of King Khaled hospital before they are discharged. Interview transcription was made to ensure that the audios with the two gynecologists, two clinicians and some women gave birth at maternity of King Khaled hospital before they are discharged are transcribed into text format. The interview transcripts were imported into NVivo version 14 by selecting files under the Data tab and then importing the transcripts. Organizing the Data was done by Classifying Respondents: Since you had two types of respondents (gynecologists and clinicians), Researcher classified them using Case Classification to distinguish between them. Researcher created attributes like "Role" (gynecologist, some women or clinician), experience, gender, etc., to help categorize responses and allow for later comparisons. Coding Framework was developed, based on the research question, started coding the transcripts on the main themes about delays in Ambulance Services, delays in Receiving Patients and availability of Skilled and enough healthcare providers. For each of these main themes, created nodes (i.e., categories or codes). This is done by highlighting relevant text and assigning it to one of the three nodes or sub-nodes. Thematic Coding was used deductive coding as were specifically looking for themes we pre-identified (such as the three main themes) and inductive coding to capture unexpected insights. Within each node, has been created sub-nodes for more specific factors. For example: For "Delays in Ambulance Services"((Response time, Distance issues, Communication problems)

For "Delays in Receiving Patients": (Time spent in the emergency department, Bed availability, administrative delays)

For "Availability of Skilled Staff" (Staff shortage, Experience level of healthcare providers, Shift allocation)

Analyzing the Data

Researcher used the Text Search Query to find specific phrases related to our themes or the Coding Query to explore how different codes are related across the transcripts. Matrix Coding Query helped to compare responses across our categories (e.g., gynecologists vs. clinicians) to see if they perceive delays or staffing issues differently. Thematic Maps: Used NVivo's visualization features to create thematic maps or word clouds to visually represent how often certain themes (e.g., delays or staffing issues) appear in the interviews.

Reviewing and Refining Themes

As researcher was coding, reviewed the themes to ensure they capture the nuances of the data. Researcher combined, split, or renamed nodes to better reflect the data. Memo Writing: NVivo version 14 allowed to write memos on each node, which helped to record insights or ideas related to specific themes.

Interpreting Results

After coding completion, returned to research questions about delays and staff shortage in the health system. Used the coded data to interpret and discuss: Patterns of delays. Differences between perspectives of gynecologists and clinicians' challenges regarding the availability of skilled and enough healthcare providers and how it affects the system's efficiency.

4.8 The control of the potential confounders

In unmatched case-control study on factors linked to low birth weight (LBW) among women who gave birth at Centre Hospitalo-Universitaire de Kamenge in Burundi, controlling for potential confounders was critical to ensuring valid and reliable results. Based on the study design, investigator likely identified key factors that could confound the relationship between the exposures of interest (e.g., maternal health, socioeconomic factors) and the outcome (low birth weight). Data Collection on Confounders: During the study, ensured I collected a detailed information on potential confounders for both cases (women with LBW babies) and controls (women without LBW babies). This allowed for the confounders to be accounted for during data analysis and I likely used structured questionnaires or interviews to gather consistent information on socio-demographic, health system and gyneco-obstetric factors, ensuring all confounders were measured systematically across both cases and controls.

Controlling Confounders in Analysis

In an unmatched case-control design, multivariable logistic regression is the most commonly used method to control for confounders. Included potential confounders as covariates in the regression model. The dependent variable was the binary outcome (low birth weight: yes/no), and the independent variables included the exposures of interest (e.g., delays in providing ambulance, delays in receiving patients and availability of skilled and enough healthcare providers along with the confounders. A researcher stratified the analysis by key confounders, such as maternal age or parity (e.g., age groups, different levels of prenatal care) and then analyzed the association between exposure and outcome. This method allowed to observe whether the association between exposure and LBW holds across different levels of the confounder, helping to mitigate confounding effects. Sensitivity Analysis used to assess the robustness of findings. This helped to

determine if the results changed significantly with the inclusion or exclusion of specific confounders, which can highlight any variables that may be strong confounders. Interaction Terms, in regression model, included interaction terms between potential confounders and the exposure variables to assess if the relationship between an exposure and LBW changes at different levels of the confounder. Evaluation of Residual Confounding was done even after adjusting for known confounders, some residual confounding might remain due to unmeasured or imperfectly measured variables.

In conclusion by employing multivariable logistic regression, investigator effectively controlled for potential confounders, ensuring that the association between exposures of interest and low birth weight is accurately assessed.

4.9 Discussions of findings

4.9.1 Socio-demographic factors influencing low birth weight.

The study examined socio-demographic factors such as maternal education, maternal Occupation, maternal age, residence, maternal chronic medical conditions and marital status to identify which variables serve as predictors for low birth weight. The study findings revealed that low birth weight occurrence was at 95. 24% among women aged between 18-40 years and is shown that the significant association was between maternal occupation, maternal chronic medical conditions and LBW. The present research is not collaborated by previous literature in which LBW was found among the women aged 40 years (Jahromi and al, 2008). The low birth weight compares well with a study in Singapore which reported that there is an increased risk of LBW in some occupational groups. This study findings have confirmed that although the Burundian government has prioritized the pregnant women's health by implementing some national programs against the malnutrition by planting some vegetables at their homes, the efforts made to decrease level of low birth weight are not enough. The revisiting of women's health policy and

antenatal care services by the government and other stakeholders is crucial for effectively re-aligning the pertinent policies. As the majority of women after delivery were self-employed with economic constraints,

It is necessary to ascertain the tactics for providing sufficient fetal health support. To raise awareness and prevent low birth weight (LBW) in areas with high statistics of low birth weight, it is necessary to incorporate low birth weight messaging into the current health education curriculum. Male partners and employers should be included in the fetus health promotion messages to increase awareness of preterm. These results corroborate a study conducted in the Northeastern region of Kenya, which revealed no correlation between low birth weight and socio-demographic factors (Harada, 2014). It is needed to find out the strategies in order to assist adequately a fetus health. It is important to incorporate information/message about low birth weight into existing health education programs to raise awareness and prevent LBW in areas with high prevalence rates. Messages promoting fetal health should involve male partners and employers to enhance understanding of preterm complications and the negative impact of underweight births. The study of medical records revealed that factors such as education level, mother's age, residence, and marital status were not statically linked to low birth weight. These results align with a study conducted in the North Eastern region of Kenya, which also found no association between socio-demographic factors and low birth weight (Harada, 2014).

4.9.2 Gyneco-obstetric factors influencing low birth weight

The study examined gyneco-obstetric factors such as multiple pregnancies, uterine state, infectious diseases, fetal position, and amniotic status to identify which variables serve as predictors for low birth weight. The study findings revealed that low birth weight occurrence among multiple pregnancies was at 34.12%, urinary tract infections was at 29.36% and Malaria was at 21.43% and is shown that the significant association was

between multiple pregnancies, abnormality of amniotic liquid such as oligohydramnios and polyhydramnios and low birth weight. In comparison of our findings to this study carried out by King Edward Medical University, Laleeta Meena stated that an exposure to oligohydramnios and polyhydramnios during pregnancy can indeed influence low birth weight. Studies have shown that oligohydramnios is related with a higher incidence of LBW babies. Additionally, polyhydramnios has been linked to adverse perinatal outcomes, including low birth weight. Furthermore, infants exposed to oligohydramnios have a higher risk of long-term gastrointestinal morbidity, which can impact their overall health and potentially contribute to lower birth weights. Therefore, abnormal liquor volumes, such as oligohydramnios and polyhydramnios, play a significant role in influencing low birth weight outcomes in newborns (Meena, L and al., 2021). In the research also done by Razia Ashraf concluded the same as our research that an exposure to multiple pregnancies can indeed influence low birth weight. Multiple pregnancies are associated with a higher risk of low birth weight. Abnormalities of amniotic liquid such as oligohydramnios and polyhydramnios can also contribute to low birth weight, as they may impact the development and growth of the fetus. Studies have shown that infants born from multiple pregnancies are at a higher risk of LBW. Therefore, Inadequate antenatal care and poor placental growth are also linked to low birth weight, emphasizing the importance of improving antenatal care programs and monitoring genetic risk factors, it is also crucial to monitor and manage pregnancies with multiple gestations and uterine abnormalities carefully to mitigate the risk of low birth (Moore et al, .2004).

4.9.3 Health system factors

The current research revealed a non-significant relationship between Delays in receiving pregnant women, providing ambulance services, staff skills and availability and low birth weight among pregnant women from a survey done by Gynecologist department manager

played as key informant in my research, compared to a research carried out in Ethiopia by Usman showed a relationship that delays in receiving pregnant women, providing ambulance services, staff skills and staff availability do have an impact on low birth weight(Usman and al., 2019), identified variables they do not directly influence low birth weight. Studies have highlighted that delays in emergency obstetric care are common in resource-constrained settings due to various barriers. Staff skills and availability play a crucial role in providing quality care but are not directly linked to low birth weight (Schuler and al, 2023).



CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this section, the findings and conclusions are outlined, along with recommendations. Additionally, potential areas for future research in the field are also suggested.

5.2 Summary of findings

5.2 socio-demographic factors

The study examined the socio-demographic factors that can influence the occurrence of low birth weight in women who have delivered. Out of the 128 respondents (medical records) who were sampled, 126 medical records considered in the study and medical records consultation rate was obtained at 98.44 percent in the study. In my research at King Khaled Hospital, low birth weight was represented at 32.50%. The majority were aged between 18-40 years with 95.24% while Majority (89.68%) were married and few were widowed and separated. A proportion of 33.33% had chronic medical conditions as hypertension. 41.27% had primary education or secondary education while a few had no education. Majority (84.92%) were living in the urban area and majority (57.14%) were self-employed. A mother's occupation was the key socio-demographic factors to low birth weight among women who have delivered as revealed in the study.

5.3 Gyneco-obstetric factors

The study examined the Gyneco-obstetric factors that can influence the occurrence of low birth weight in women who have delivered. Regarding infectious diseases, the majority (29.36%) had urinary tract infections and malaria at 21.43%. The major gyneco-obstetric factors for low birth weight as identified in this study include maternal chronic medical conditions such as Diabetes mellitus, Hypertension, and having exposure on multiple pregnancy, abnormality of amniotic liquid such as oligohydramnios and polyhydramnios.

5.4 Health system factors

The results showed that the majority (57.14%) of low birth weight occurred among women taken by ambulance with delay. Among health system factors, there is no significant association between days in receiving patients, providing Ambulance and staff skills & availability and low birth weight.

The bivariate and multivariate logistic regression analysis indicated that there was a significant association between low birth weight and woman's occupation, medical chronic conditions and having exposure on multiple pregnancy and abnormality of amniotic liquid (oligohydramnios and polyhydramnios). Marital status, residence, education level, woman's age, infectious diseases, staff skills, staff availability and different delays were not significantly associated with low birth weight.

5.5 Conclusions

In conclusion to my findings, I find important to mention that most cases that arise through pregnancy issues usually came from under mother's occupation, maternal medical chronic conditions and having exposure on multiple pregnancy, abnormality of amniotic liquid and amniotic liquid (oligohydramnios and polyhydramnios). A large portion of the women 95. 24% occurred among active population that aged 18-40 and in this age low birth weight occurred relatively at high level. Seem to face an occupation/job issues such as low income with impact on their nutrition, had medical chronic conditions and have been exposed to multiple pregnancy, abnormality of amniotic liquid (oligohydramnios and polyhydramnios). Therefore, we come to the conclusion that with proper medical consultations/visits offered freely or at a very cheap price, this could lead to a full pregnancy issues management as people become aware and able to combat any problem that may arise.

5.6 Recommendations

5.6.1 Ministry of health:

1. Social mobilization and community outreach to address issues of reproductive health and those caused by chronic diseases through health education and communicate the negative impact on delays in seeking a health care.
2. Mass sensitization about reproductive health services including family planning, healthy eating during pregnancy, adequate antenatal care for multiple pregnancy, preconception care and safe obstetric care.
3. National Government to increase availability of medicines, health facilities to reduce the distance between people homes and health facilities and make health care affordable
4. Regularly and freely screen the pregnant women to avoid abnormality of amniotic liquid (oligohydramnios/polyhydramnios), chronic medical conditions, well handling multiple pregnancy, and support the jobless/selves-employed pregnant women.

5.6.2 Community health unit

1. Women being transferred to tertiary facilities like hospitals must be well informed of the indications and possible treatments and outcomes /complications that are likely to happen to ensure full compliance of the patients.
2. Community health officers should work together to educate the community about the significance of having a clear referral system in place to ensure timely referrals.
3. Sensitize the women on the importance of antenatal care, family and danger signs of pregnancy.

5.6.3 To future researcher:

1. More research should be conducted to find the causal factors of low birth weight as this study only explored the risk factors.



REFERENCES

- Abu-Saad, K., & Fraser, D (2020). Nigatu, D., Gashaw, K., & Melese, A. (2015). Risk factors for low birth weight in Bale zone hospitals, South-East Ethiopia: A case-control study. *BMC Pregnancy and Childbirth*, 15(1), 264. <https://doi.org/10.1186/s12884-015>
- Ajayi, K. V., Wachira, E., Onyeaka, H. K., Montour, T., Olowolaju, S., & Garney, W. (2022). The use of digital health tools for health promotion among women with and without chronic diseases: insights from the 2017-2020 health information national trends survey. *JMIR mHealth and uHealth*, 10(8), e39520.
- Afridi, F., Afridi, A., Bangash, A. G., Naib, J. M., & Bibi, R. (2023). Personal, professional, and educational challenges faced by the postgraduate residents of Gynecology and Obstetrics in Peshawar during Covid-19 pandemic. *Journal of Medical Sciences*, 31(01).
- Ahmad, A. S., Hassan, M. Y., Abdullah, M. P., Rahman, H. A., Hussin, F., Abdullah, H., & Saidur, R. (2020). A review on applications of ANN and SVM for building electrical energy consumption forecasting. *Renewable and Sustainable Energy Reviews*, 33, 102-109
- Akintije, C. S. (2020). Antenatal care visits and adverse pregnancy outcomes at a hospital in rural western province, Rwanda. *Acta Med. Okayama*, 75(6), 495-503.
- Anderson, D. J., Reeve, J., Gomez, J. E. M., Weathers, W. W., Hutson, S., Cunningham, H. V., & Bird, D. M. (2019). Sexual size dimorphism and food requirements of nestling birds. *Canadian Journal of Zoology*, 71(12), 2541-2545.
- Asoglu, M. R., & Bahceci, M. (2022, July). Endometrial thickness is not associated with birthweight as well as serum levels of pregnancy-associated plasma protein-A: a retrospective analysis of 560 newborns following frozen cycles. In *HUMAN*

REPRODUCTION (Vol. 37, pp. 1549-1549). GREAT CLARENDON ST, OXFORD OX2 6DP, ENGLAND: OXFORD UNIV PRESS.

Atanasova, V., Ivanov, P., Gyokova, E., Georgieva, D., & Veskov, L. (2021). IMPACT OF MULTIPLE BIRTHS ON THE OUT-COME IN EXTREMELY LOW BIRTH WEIGHT NEWBORNS. *Journal of IMAB—Annual Proceeding Scientific Papers*, 27(3), 3985-3991.

Bakhsh, H., Alenizy, H., Alenazi, S., Alnasser, S., Alanazi, N., Alsowinea, M., ... & Alfaifi, B. (2021). Amniotic fluid disorders and the effects on prenatal outcome: a retrospective cohort study. *BMC pregnancy and childbirth*, 21, 1-7.

Beck, S., Wojdyla, D., Say, L., Betran, A. P., Merialdi, M., Requejo, J. H., & Van Look, P. F. (2020). The worldwide incidence of preterm birth: a systematic review of maternal mortality and morbidity. *Bulletin of the world health organization*, 88, 31-38.

Bhurgri, Y., Bhurgri, A., Usman, A., Pervez, S., Kayani, N., Bashir, I. ... & Hasan, S. H. (2021). Epidemiological review of head and neck cancers in Karachi. *Asian Pacific Journal of Cancer Prevention*, 7(2), 195.

Biemer, P., & Peytchev, A. (2020). Using geocoded census data for nonresponse bias correction: An assessment. *Journal of Survey Statistics and Methodology*, 1(1), 24-44

Blencowe, H., Krusevec, J., Onis, M. de, Black, R. E., An, X., Stevens, G. A., Borghi, E., Hayashi, C., Estevez, D., Cegolon, L., Shiekh, S., Hardy, V. P., Lawn, J. E., & Cousens, S. (2019). National, regional, and worldwide estimates of low birthweight in 2015, with trends from 2000: A systematic analysis. *The Lancet Global Health*, 7(7), e849–e860. [https://doi.org/10.1016/S2214-109X\(18\)30565-5](https://doi.org/10.1016/S2214-109X(18)30565-5)

Borobia, A. M., Carcas, A. J., Pérez-Olmeda, M., Castaño, L., Bertran, M. J., García-Pérez, J., ... & Navalpotro, A. B. (2021). Immunogenicity and reactogenicity of BNT162b2

- booster in ChAdOx1-S-primed participants (CombiVacS): a multicentre, open-label, randomised, controlled, phase 2 trial. *The Lancet*, 398(10295), 121-130.
- Capper, T., Gorbacheva, A., Mustafa, M. A., Bahloul, M., Schwidtal, J. M., Chitchyan, R., ... & Kiesling, L. (2022). Peer-to-peer, community self-consumption, and transactive energy: A systematic literature review of local energy market models. *Renewable and Sustainable Energy Reviews*, 162, 112403.
- Colglazier W (2021) Sustainable development agenda: 2030. *Science* 349(6252):1048-1050
- Conway, D. J., Lee, K. S., Divis, P. C., Zakaria, S. K., Matusop, A., Julin, R. A., Conway, D. J., ... & Singh, B. (2011). Plasmodium knowlesi: reservoir hosts and tracking the emergence in humans and macaques. *PLoS pathogens*, 7(4), e1002015.
- Damayanti, D., Saputri, D. R., Marpaung, D. S. S., Yusupandi, F., Sanjaya, A., Simbolon, Y. M. ... & Wu, H. S. (2022). Current prospects for plastic waste treatment. *Polymers*, 14(15), 3133.
- Demelash, H., Motbainor, A., Nigatu, D., Gashaw, K., & Melese, A. (2015). Risk factors for low birth weight in Bale zone hospitals, South-East Ethiopia: A case
- Doolittle, M. M., Cooney, J. J., & Caldwell, D. E. (2020). Lytic infection of Escherichia coli biofilms by bacteriophage T4. *Canadian journal of microbiology*, 41(1), 12-18.
- Dreyfuss, M. L., Msamanga, G. I., Spiegelman, D., Hunter, D. J., Urassa, E. J., Hertzmark, E., & Fawzi, W. W. (2019). Determinants of low birth weight among HIV-infected pregnant women in Tanzania. *The American journal of clinical nutrition*, 74(6), 814-826.
- Figuroa, L., McClure, E. M., Swanson, J., Nathan, R., Garces, A. L., Moore, J. L., ... & Goldenberg, R. L. (2020). Oligohydramnios: a prospective study of fetal, neonatal and maternal outcomes in low-middle income countries. *Reproductive Health*, 17, 1-

- Fosnacht, K., Sarraf, S., Howe, E., & Peck, L. K. (2017). How important are high response rates for college surveys? *The Review of Higher Education*, 40(2), 245-265. control study. *BMC Pregnancy and Childbirth*, 15(1), 264. <https://doi.org/10.1186/s12884-015-0677-y>
- Fraser, A., Le Vay, J. N., Byass, P., Tollman, S., Kahn, K., D'Ambruso, L., & Davies, J. I. (2020). Time-critical conditions: assessment of burden and access to care using verbal autopsy in Agincourt, South Africa. *BMJ global health*, 5(4), e002289.
- Fregni, F., El-Hagrassy, M. M., Pacheco-Barrios, K., Carvalho, S., Leite, J., Simis, M., ... & Brunoni, A. R. (2021). Evidence-based guidelines and secondary meta-analysis for the use of transcranial direct current stimulation in neurological and psychiatric disorders. *International Journal of Neuropsychopharmacology*, 24(4), 256-313.
- Gilboa, S. M., Desrosiers, T. A., Lawson, C., Lupo, P. J., Riehle-Colarusso, T. J., Stewart, P. A. ... & Correa, A. (2021). Association between maternal occupational exposure to organic solvents and congenital heart defects, National Birth Defects Prevention Study, 1997–2002. *Occupational and environmental medicine*, 69(9), 628-635.
- Ghosh, V. E., Moscovitch, M., Colella, B. M., & Gilboa, A. (2020). Schema representation in patients with ventromedial PFC lesions. *Journal of Neuroscience*, 34(36), 12057-12070.
- Graham, N. A., Wilson, S. K., Jennings, S., Polunin, N. V., Robinson, J. A. N., Bijoux, J. P., & Daw, T. M. (2020). Lag effects in the impacts of mass coral bleaching on coral reef fish, fisheries, and ecosystems. *Conservation biology*, 21(5), 1291-1300.
- Gualtieri, A., Rampinini, E., Dello Iacono, A., & Beato, M. (2023). High-speed running and sprinting in professional adult soccer: current thresholds definition, match demands and training strategies. A systematic review. *Frontiers in Sports and Active Living*, 5, 1116293.

- Haksari, E. L. (2019). Historical perspectives: low birthweight and Preterm Infants in Indonesia. *Neoreviews*, 20(10), e548-e560.
- Harada, D., Takigawa, N., & Kiura, K. (2014). The role of STAT3 in non-small cell lung cancer. *Cancers*, 6(2), 708-722.
- He, T., Li, M., Li, W., Meng, P., Xue, X., & Shi, J. (2022). Endometrial thickness is associated with low birthweight in frozen embryo transfer cycles: a retrospective cohort study of 8,235 singleton newborns. *Frontiers in Endocrinology*, 13, 929617.
- Howe, K. L., Achuthan, P., Allen, J., Allen, J., Alvarez-Jarreta, J., Amode, M. R., Armean, I. M., Azov, A. G., Bennett, R., Bhai, J., Billis, K., Boddu, S., Charkhchi, M., Cummins, C., Da Rin Fioretto, L., Davidson, C., Dodiya, K., El Houdaigui, B., Fatima, R., ... Flicek, P. (2021). Ensembl 2021. *Nucleic Acids Research*, 49(D1), D884–D891. <https://doi.org/10.1093/nar/gkaa942>
- Hughes MM, Black RE, Katz J (2017) 2500-g low birth weight cutoff: history and implications for future research and policy. *Maternal and child health journal* 21(2): 283-289.
- Iyer, H. S., Chukwuma, A., Mugunga, J. C., Manzi, A., Ndayizigiye, M., & Anand, S. (2018). A Comparison of Health Achievements in Rwanda and Burundi. *Health and Human Rights*, 20(1), 199–211.
- Jahromi, F., Aroca, R., Porcel, R., & Ruiz-Lozano, J. M. (2021). Influence of salinity on the in vitro development of Glomus intraradices and on the in vivo physiological and molecular responses of mycorrhizal lettuce plants. *Microbial ecology*, 55, 45-53.
- Joyce, S., Shand, F., Tighe, J., Laurent, S. J., Bryant, R. A., & Harvey, S. B. (2018). Road to resilience: a systematic review and meta-analysis of resilience training programmes and interventions. *BMJ open*, 8(6), e017858.

- KC, A., Basel, P. L., & Singh, S. (2020). Low birth weight and its associated risk factors: Health facility-based case-control study. *PloS one*, *15*(6), e0234907.
- Kibria, G. M. A., & Nayeem, J. (2023). Trends and factors associated with mobile phone ownership among women of reproductive age in Bangladesh. *PLOS Global Public Health*, *3*(5), e0001889.
- Kimberlin, C. L., & Winterstein, A. G. (2021). Validity and reliability of measurement instruments used in research. *American journal of health-system pharmacy*, *65*(23), 2276-2284.
- Kiwanuka, S. N., Ekirapa, E. K., Peterson, S., Okui, O., Rahman, M. H., Peters, D., & Pariyo, G. W. (2020). Access to and utilisation of health services for the poor in Uganda: a systematic review of available evidence. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, *102*(11), 1067-1074.
- Kwambai, T. K., Dellicour, S., Desai, M., Ameh, C. A., Person, B., Achieng, F., & Ter Kuile, F. O. (2023). Perspectives of men on antenatal and delivery care service utilisation in rural western Kenya: a qualitative study. *BMC pregnancy and childbirth*, *13*, 1-10.
- Kyriacou, C. (2021). Teacher stress: Directions for future research. *Educational review*, *53*(1), 27-35.
- Lake, E. T., Staiger, D., Horbar, J., Cheung, R., Kenny, M. J., Patrick, T., & Rogowski, J. A. (2022). Association between hospital recognition for nursing excellence and outcomes of very low-birth-weight infants. *Jama*, *307*(16), 1709-1716.
- Linawati, N. (2022). Relationship Between Low Birth Weight And Infectious Diseases With Stunting In Children Aged 4 To 5 Years. *Indonesian Journal Of Multidisciplinary Science*, *1*(9), 1020-1030.
- Lundy, L., & Sainz, G. M. (2018). The role of law and legal knowledge for a transformative human rights education: Addressing violations of children's rights in formal

- education. *Human Rights Education Review*, 1(2), Article 2.
<https://doi.org/10.7577/hrer.2560>
- Luo, J., Hua, W., Zheng, Q., Cai, Q., Zhang, X., & Jiang, L. (2022). Knowledge about neonatal danger signs and associated factors among mothers of children aged 0–12 months in a rural county, Southwest of China: a cross-sectional study. *BMC Pregnancy and Childbirth*, 22(1), 346.
- Maawiya, D. H. A., & Obsgyn, M. (2021.). *Factors Associated With Adverse Pregnancy Outcomes Among Home and Health Facility Deliveries in Lamu County, Kenya: A Comparative Cross Sectional Study*. 76.
- Magadi, M. (2024). Maternal and child health among the urban poor in Nairobi, Kenya.
- Mahmoud, B. (2021). Food Security in Africa. BoD – Books on Demand.
- Mahumud, R. A., Sultana, M., & Sarker, A. R. (2017). Distribution and Determinants of Low Birth Weight in Developing Countries. *Journal of Preventive Medicine and Public Health*, 50(1), 18–28. <https://doi.org/10.3961/jpmp.16.087>
- Manyeh AK, Kukula V, Odonkor G, Ekey RA, Adjei A, et al. (2021) Socioeconomic and demographic determinants of birth weight in southern rural Ghana: evidence from Dodowa Health and Demographic
- Meena, A. L., Karwal, M., Dutta, D., & Mishra, R. P. (2021). Composting: phases and factors responsible for efficient and improved composting. *Agriculture and Food: e-Newsletter*, 1, 85-90.
- Merritt, T. A., Pillers, D., & Prows, S. L. (2023, April). Early NICU discharge of very low birth weight infants: a critical review and analysis. In *Seminars in neonatology* (Vol. 8, No. 2, pp. 95-115). WB Saunders.

- Moore, S. E., Jalil, F., Ashraf, R., Szu, S. C., Prentice, A. M., & Hanson, L. Å. (2024). Birth weight predicts response to vaccination in adults born in an urban slum in Lahore, Pakistan. *The American journal of clinical nutrition*, *80*(2), 453-459.
- Morriss, F. H., Jr, Saha, S., Bell, E. F., Colaizy, T. T., Stoll, B. J., Hintz, S. R., Shankaran, S., Vohr, B. R., Hamrick, S. E. G., Pappas, A., Jones, P. M., Carlo, W. A., Laptook, A. R., Mweu, D. M., Gichunge, C., & Nyamai, J. J. (2019). Socio-Demographic and Cultural Determinants of Family Planning Uptake among Women of Childbearing Age in Turkana Central Sub-County, Kenya.
- Nakanishi, S. (2024). Metabotropic glutamate receptors: synaptic transmission, modulation, and plasticity. *Neuron*, *13*(5), 1031-1037.
- Nzokirishaka, A., & Itua, I. (2018). Determinants of unmet need for family planning among married women of reproductive age in Burundi: A cross-sectional study. *Contraception and Reproductive Medicine*, *3*(1), 11. <https://doi.org/10.1186/s40834-018-0062-0>
- Odjidja, E. N., Hakizimana, S., Gatasi, G., Masabo, J.-B., Irakoze, G., Muzungu, H., Murorunkwere, H., Ngabirano, L. R., Elkasabi, M., & De Courten, B. (2020). Infant and child health status ahead of implementation of an integrated intervention to improve nutrition and survival: A cross-sectional baseline assessment. *BMC Nutrition*, *6*(1), 42. <https://doi.org/10.1186/s40795-020-00372-5>
- Organization WH (2019) UNICEF-WHO low birthweight estimates: levels and trends 2000-2015. World Health Organization.
- Panda, P. K., Gupta, J., Chowdhury, S. R., Kumar, R., Meena, A. K., Madaan, P., ... & Gulati, S. (2021). Psychological and behavioral impact of lockdown and quarantine measures for COVID-19 pandemic on children, adolescents and caregivers: a systematic review and meta-analysis. *Journal of tropical pediatrics*, *67*(1), fmaa122.

- Panneerselvam, C., Murugan, K., Roni, M., Aziz, A. T., Suresh, U., Rajaganesh, R., ... & Benelli, G. (2019). Fern-synthesized nanoparticles in the fight against malaria: LC/MS analysis of *Pteridium aquilinum* leaf extract and biosynthesis of silver nanoparticles with high mosquitocidal and antiplasmodial activity. *Parasitology Research*, *115*, 997-1013.
- Pikhartova, J., & Shelton, N. (2022). Maternal educational inequalities in child's birth weight: ONS Longitudinal Study. *European Journal of Public Health*, *32*(Supplement_3), ckac131-120.
- Raper, M. J. (2019). The Influence of Maternal Aerobic Exercise During Pregnancy on Health Disparities and Birth Outcomes. <https://thescholarship.ecu.edu/handle/10342/8670>
- Ratnasiri, A. W., Parry, S. S., Arief, V. N., DeLacy, I. H., Halliday, L. A., DiLibero, R. J., & Basford, K. E. (2018). Recent trends, risk factors, and disparities in low birth weight in California, 2005–2014: a retrospective study. *Maternal health, neonatology and perinatology*, *4*, 1-13.
- Rizvi, Y, Khan, M. A., & Rizvi, Y. (2020). Effect of salinity, temperature, and growth regulators on the germination and early seedling growth of *Atriplex griffithii* var. *stocksii*. *Canadian Journal of Botany*, *72*(4), 475-479.
- Rolland EG. Analyse sur la situation des enfants dans les centres résidentiels au Burundi.
- Casas, M., Cordier, S., Martínez, D., Barros, H., Bonde, J. P., Burdorf, A., ... & Vrijheid, M. (2018). Maternal occupation during pregnancy, birth weight, and length of gestation: combined analysis of 13 European birth cohorts. *Scandinavian journal of work, environment & health*, 384-396.
- Safari, M., Samiee, A., Salehi, F., Ahmadi, S. N., & Ahmadi, S. S. (2019). The prevalence and related factors of low birth weight. *Epidemiology and Health System Journal*, *3*(3), 214-221.

- Said, D. S., Lopes, G., Loretto, L., Farina, G., Napodano, C. M. P., Amadori, A., ... & Alzoubi, Y. (2021). Mental health and COVID-19 pandemics: the worrisome humanitarian perspective from the Middle East. *Journal of Global Health, 11*.
- Salari, M., Javid, R. J., & Noghanibehambari, H. (2021). The nexus between CO2 emissions, energy consumption, and economic growth in the US. *Economic Analysis and Policy, 69*, 182-194.
- Santoso, E., Ediati, R., Kusumawati, Y., Bahruji, H., Sulistiono, D. O., & Prasetyoko, D. (2020). Review on recent advances of carbon based adsorbent for methylene blue removal from waste water. *Materials Today Chemistry, 16*, 100233.
- Schuler, A. L., Tik, M., Vasileiadi, M., Woletz, M., Linhardt, D., Williams, N., & Windischberger, C. (2023). Concurrent TMS/fMRI reveals individual DLPFC dose-response pattern. *NeuroImage, 282*, 120394.
- Shahzad, R., Waqas, M., Khan, A. L., Asaf, S., Khan, M. A., Kang, S. M., ... & Lee, I. J. (2019). Seed-borne endophytic *Bacillus amyloliquefaciens* RWL-1 produces gibberellins and regulates endogenous phytohormones of *Oryza sativa*. *Plant Physiology and Biochemistry, 106*, 236-243.
- Sibilla, S., Godfrey, M., Brewer, S., Budh-Raja, A., & Genovese, L. (2019). An overview of the beneficial effects of hydrolysed collagen as a nutraceutical on skin properties: Scientific background and clinical studies. *The Open Nutraceuticals Journal, 8*(1).
- Sinclair, A., Morley, J., & Barnett, A. (2021). Rahman Shah. *Diabetes Metab, 37*, S27-38.
- Singh, T., Bedi, P., Bumrah, K., Singh, J., Rai, M., & Seelam, S. (2019). Updates in treatment of recurrent *Clostridium difficile* infection. *Journal of clinical medicine research, 11*(7), 465.
- Smith, S. M., Fulton, D. C., Chia, T., Thorneycroft, D., Chapple, A., Dunstan, H. ... & Smith, A. M. (2024). Diurnal changes in the transcriptome encoding enzymes of starch

metabolism provide evidence for both transcriptional and posttranscriptional regulation of starch metabolism in Arabidopsis leaves. *Plant physiology*, *136*(1), 2687-2699.

Teklu, A. M., Litch, J. A., Tesfahun, A., Wolka, E., Tuamay, B. D., Gidey, H., ... & Every Premie-SCALE Ethiopia Implementation Research Collaboration Group Tedros Hailu Solomie Jebessa Amaha Kahsay Kemal A. Kuti Gillian Levine Judith Robb-McCord Yared Tadesse Abraham Tariku Abubeker Kedir Usman Abate Yeshidinber Weldetsadik. (2020). Referral systems for preterm, low birth weight, and sick newborns in Ethiopia: a qualitative assessment. *BMC pediatrics*, *20*, 1-12.

Tessema, Z. T., Tamirat, K. S., Teshale, A. B., & Tesema, G. A. (2021). Prevalence of low birth weight and its associated factor at birth in Sub-Saharan Africa: A generalized linear mixed model. *PLOS ONE*, *16*(3), e0248417. <https://doi.org/10.1371/journal.pone.0248417>

Usman, K., Al-Ghouthi, M. A., & Abu-Dieyeh, M. H. (2019). The assessment of cadmium, chromium, copper, and nickel tolerance and bioaccumulation by shrub plant *Tetraena qataranse*. *Scientific reports*, *9*(1), 5658.

Van den Boogaard, W., Zuniga, I., Manzi, M., Van den Bergh, R., Lefevre, A., Nanan-N'zeth, K., Duchenne, B., Etienne, W., Juma, N., Ndelema, B., Zachariah, R., & Reid, A. (2017). How do low-birthweight neonates fare 2 years after discharge from a low-technology neonatal care unit in a rural district hospital in Burundi? *Tropical Medicine & International Health*, *22*(4), 423–430. <https://doi.org/10.1111/tmi.12845>

Van Meurs, K. P., Sánchez, P. J., Hale, E. C., Newman, N. S., Das, A., Higgins, R. D., & for the Eunice Kennedy Shriver National Institute of Child Health and Human Development Neonatal Research Network. (2024). Surgery and Neurodevelopmental

- Outcome of Very Low-Birth-Weight Infants. *JAMA Pediatrics*, 168(8), 746–754.
<https://doi.org/10.1001/jamapediatrics.2014.307>
- Wachira, B. M. (2020.). FACTORS ASSOCIATED WITH ADVERSE BIRTH OUTCOMES AMONG NEONATES IN KAJIADO COUNTY REFERRAL HOSPITAL, KENYA. 105.
- Were, F. N., & Bwibo, N. O. (2022). The contribution of very low birth weight death to infant mortality. *East African Medical Journal*, 86(8).
- World Health Organization. (2022). Trend in maternal mortality: 1990 to 2010: WHO, UNICEF, UNFPA and The World Bank estimates.
- WHO, UNICEF. (2020). *The Africa Malaria Report on Malaria during pregnancy*.
<http://http://www.rbm.who.int/amd2003/amr2003/ch4.htm/pdf>
- Wright, J. D., Pri-Paz, S., Herzog, T. J., Shah, M., Bonanno, C., Lewin, S. N., ... & Devine, P. (2021). Predictors of massive blood loss in women with placenta accreta. *American journal of obstetrics and gynecology*, 205(1), 38-e1.
- Yadav, D. K., Chaudhary, U., & Shrestha, N. (2021). Risk Factors Associated with Low Birth Weight. <http://elibrary.nhrc.gov.np:8080/handle/20.500.14356/1984>
- Yang Shaohua, .Han, S., Yang, S., Cai, Z., Pan, D., Li, Z., Huang, Z., ... & Wang, W. (2025). Anti-Warburg effect of rosmarinic acid via miR-155 in gastric cancer cells. *Drug Design, Development and Therapy*, 2695-2703.
- Yogov, Y., Melamed, N., Bardin, R., Tenenbaum-Gavish.K, Ben-Shitrit, G., & Ben-Haroush, A. (2020). Pregnancy outcome at extremely advanced maternal age. *American journal of obstetrics and gynecology*, 203(6), 558-e1.
- Yosefinata, K., Zuhairini, Y., & Luftimas, D. E. (2022). Association Between Maternal Mid-Upper Arm Circumference and Baby's Birth Weight. *Majalah Kedokteran Bandung*, 54(3), 172-176.

APPENDICES

Appendix I: Data abstraction form

Code _____ No. _____

Facility _____

Code for cases (A1, 2, 3.... etc.) and for controls (B1, 2, 3 ...etc.)

Respondent Code/Case: A.....

Respondent Code/Control: B.....

Socio - demographic data

1. Age

a) Under 18 b) 18-40 c) 41 and above

2. Marital status

a) Married b) single c) separated d) widowed
e) Others (specify)

3. Residence

a) Urban b) rural c) others (specify).....

4. Education level

a) None b) Primary c) Secondary d) College/University

5. Occupation

a) Unemployed b) casual job c) self- employed
d) Salaried job

6. Husband/Partner's occupation

a) Unemployed b) self- employed c) casual job d) salaried job

7. What chronic medical conditions before pregnancy did you have?

a) None b) Diabetes mellitus c) Hypertension d) Cardiac disease
e) HIV/AIDS f) others (specify)

Gyneco-obstetric factors:

8. What was the weight of the baby at birth?

- a) Below 2500g b) 2500g and above

9. What was the mode of recent delivery?

- a) Normal vaginal delivery b) caesarean section

10. If any other factor, what was that?

- a) Preeclampsia b) multiple babies c) uterine/placenta abnormalities
d) Polyhydramnios e) Oligohydramnios f) others

(specify).....

11. If normal delivery and birth of underweight baby, what was the cause?

12. Had a woman used to deliver before a child with a low weight (under 2500g)?

- a. Yes b. No

13. Where did a woman deliver her baby?

- a) Hospital b) Health center c) Home d) others (specify)

14. Who assisted a woman during delivery?

- a) Nurse/midwife b) Doctor c) Alone e) others (specify)

15. If complications, what was the nature?

- a) Maternal under nutrition b) preterm birth
c) Feto-placental incompatibility d) others (specify).....

16. What is the disease, a woman had during her pregnant period?

- a) Malaria b) urinary tract infection c) gestational diabetes
d) Anemia d) Sexual transmitted infection e) others (specify).....

17. If ultrasound done, what was the result?

- a) Normal b) Polyhydramnios c) Oligohydramnios

- d) Unmoral weight e) Multiple pregnanc f) Unnormal uter

Antenatal care (additional information for health education)

18. Did a woman attend ANC during your recent or current delivery?

- a) Yes b)

19. If yes, which ones were done? (Check in the history of pregnancy)

- a) Hemoglobin level b) blood group c) VDRL
d) Serology e) urinalysis f) none

20. What other parameters were observed during your ANC visits?

- a) Blood pressure b) weight c) fetal vitality
d) Others (specify)

21. What was given as prophylaxis treatment during ANC?

- a) Vitamins (acid folic, iron, calcium b) some antibiotid c) others
(specify).....

22. Did a woman receive tetanus toxoid injection during pregnancy?

- a) Yes b) no

23. If no, why?

- a) Not available b) allergic c) others (specify)
.....

Health facility System factors

24. What type of health facility did a woman attend?

- a) public hospital b) private hospital c) health centers
d) Others (specify).....

25. What is the distance from her home to the heath facility?

- a) Less than 1km b) 1 – 5km c) more than 5km

26. Does the health facility provide ambulance assistance if needed?

a) Yes b) no

27. If no, why?

28. Does a woman easily get a health specialist if needed?


a) Yes b) no



Appendix II: Key Informant Interview Guide (Gynecologist)

1. How is the staffing in your department?
2. How many clients do you monthly receive with low birth weight?
3. Are the clients with low birth weight referred early enough to neonatology service before developing complications?
4. Does the facility organize the opportunity for health education on lifestyle during pregnancy period in the communities?
5. What is the characteristic of the clients probably with underweight baby when they arrive in your facility?
6. What is the criteria of the referring underweight baby to neonatology department?
7. What proportion of women who experience this health problem are received in your facility?
8. How equipped are you to handle obstetric emergencies as they arise?
9. In your own opinion what can be done to help pregnant women to minimize low birth weight outcomes at:
 - a. National level
 - b. Province level
 - c. District Level
 - d. Facility level
 - e. Community level

Appendix III: Ethical clearance Certificate


Mount Kenya University

REF: MKU/ISERC/3774
TO: EGIDE NIYITERITEKA

Date: 12 June 2024

REG: MPH/2023/45962

Dear Sir/Madam,

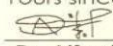
RE: FACTORS LINKED TO LOW BIRTH WEIGHT IN WOMEN WHO HAVE GIVEN BIRTH AT CENTRE HOSPITALO-UNIVERSITAIRE DE KAMENGE, BUJUMBURA PROVINCE, BURUNDI.

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **2818**. The approval period is **12/06/2024 - 11/06/2025**.

This approval is subject to compliance with the following requirements:

- i. Only approved documents including informed consents, study instruments, MTA will be used
- ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
- iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
- v. Clearance for export of biological specimens must be obtained from relevant institutions
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
- vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Yours sincerely,



Dr. Alfred Owino, PhD
Chairman, Mount Kenya University ISERC

The Chairman
Mount Kenya University
Ethics Review Committee
P.O. Box 342-01000 Thika

Main Campus, General Kago Road, P.O. Box 342-01000 Thika.
Cell: +254 709 153 000 | +254 709 153 200
Email: info@mku.ac.ke, Web: www.mku.ac.ke
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Unlocking Infinite Possibilities

Appendix IV: Directorate of postgraduate introduction letter

Mount Kenya University



DIRECTORATE OF GRADUATE STUDIES

MPH/2023/45962

13th June, 2024

TO WHOM IT MAY CONCERN

Dear Sir/Madam,


RE: EGIDE NIYITERITEKA- REGISTRATION NO. MPH/2023/45962

The purpose of this letter is to introduce the above named student who is pursuing **Master of Public Health** in the department of **Community Health, Epidemiology and Biostatistics** in the school of **Public Health**.

The title of the research is **"Factors Linked to Low Birth Weight in Women Who Have Given Birth at Centre Hospital- Universitaire De Kamenge, Bujumbura Province Burundi."** It has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data between **June, 2024 and August, 2024**.

Any assistance accorded to the student will be highly appreciated.

Thank you.


Dr. Samuel M. Karonga, Ph.D
Director, Graduate Studies
Enc.

Mount Kenya University
P.O. Box 342-01000, THIKA
Office of the Director,
Graduate Studies

Appendix V: Authorization by King Khaled Hospital



CENTRE HOSPITALO-UNIVERSITAIRE DE KAMENGE

V/Réf.:

Bujumbura, le 14/06/2024

N/Réf.: 2024/AGCTUK.2399/M.5

A Monsieur NIYITERITEKA Egide
Quartier KANYOSHA
Tél. : 257 68 001 802

A BUJUMBURA

Objet : Accès aux données

Monsieur,

J'accuse réception de votre correspondance du 06/12/2023 et vous informe que je marque mon accord à votre demande d'accès aux données dans le cadre d'approfondir votre sujet : « FACTEURS ASSOCIES AUX FAIBLE POIDS A LA NAISSANCE PARMIS LES MERES QUI ONT ACCOUCHE A LA MATERNITE DE L'HOPITAL ROI KHALED »

Je tiens à vous informer également que les usagers des archives de l'hôpital doivent tenir compte de la confidentialité des dossiers médicaux.

Veuillez agréer, Monsieur, l'assurance de ma considération distinguée.

LE DIRECTEUR GENERAL,

Pr. HARAKANDI Stanislas

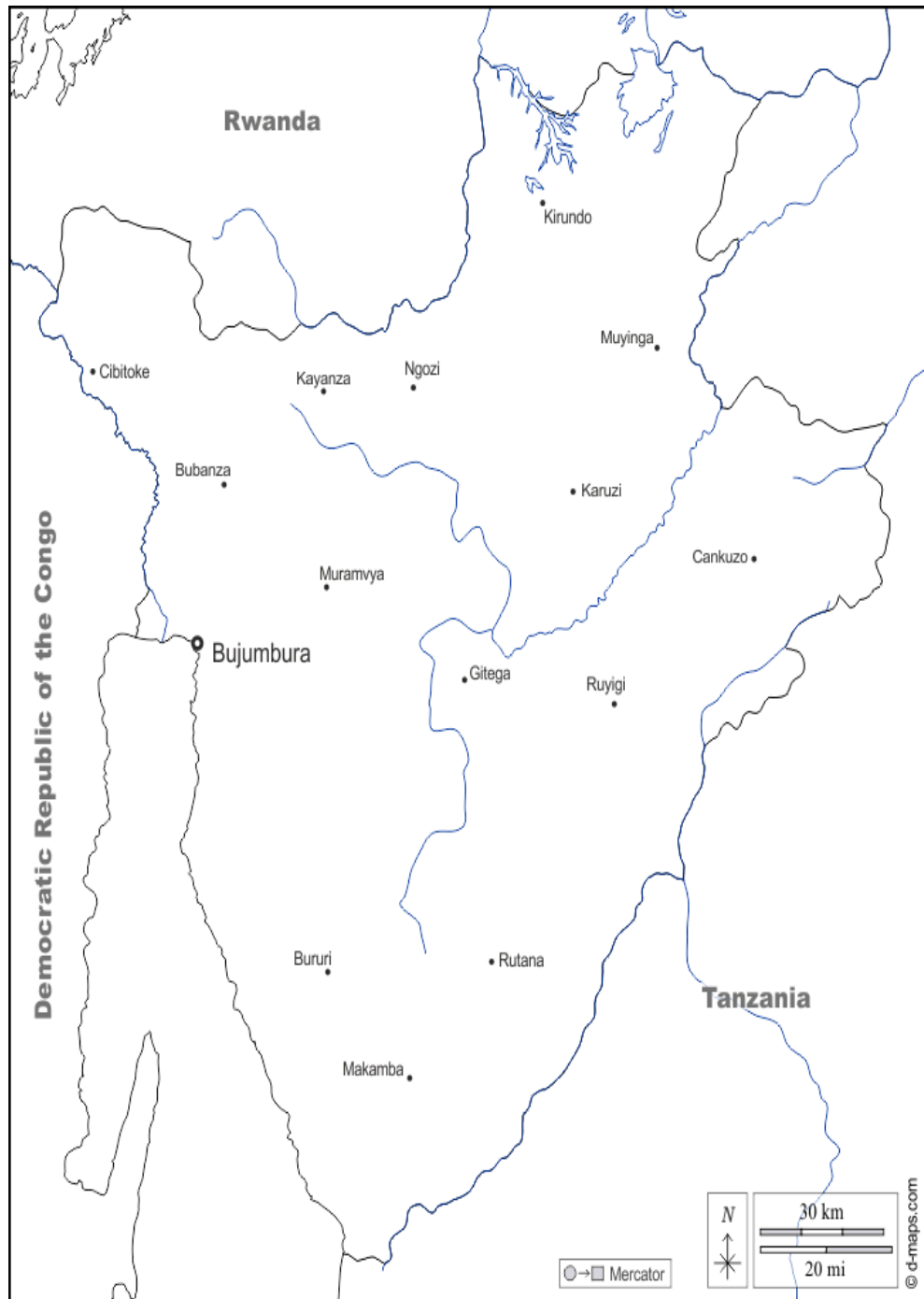
COPIE POUR INFORMATION A :

- Monsieur le Directeur-Adjoint Chargé des Soins
- Madame le Directeur-Adjoint Chargé des Finances
- Monsieur le Chef de Département Gynécologie Obstétricale
- Madame le Chef de Département Pédiatrie




B.P.2210 Bujumbura, Tél: (257)22236062; (257) 22232267; Mail:chukamenge@yahoo.fr

Appendix VI: Map showing the study area (Burundi)






Appendix VII: Similarity index of thesis

 Page 1 of 93 - Cover Page Submission ID trn:oid::1:3009906449


Egide Niyiteriteka

FACTORS LINKED TO LOW BIRTH WEIGHT AMONG WOMEN WHO GAVE BIRTH AT CENTRE HOSPITALO-UNIVERSITAIRE ...

 Quick Submit
 Quick Submit
 Mount Kenya University

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