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Socioeconomic Determinants and Maternal Mortality in Liberia

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Walden University
2024

Abstract

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by

Monee Sherman

MHA, Seton Hall University, 2017

BSHM, Colorado Technical University, 2014

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

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Abstract

High rates of pregnancies and childbirth contribute to a heightened risk of maternal mortality among women between 15 and 49 in Liberia. Most women are uninformed about their maternal risk behaviors, symptom severity, and delayed care-seeking. The mortality rate for women between 25 and 34 during pregnancy and childbirth is unacceptably high. The highest increase in maternal mortality rates is seen among women between 40 and 44 who choose to delay motherhood. In Liberia, the deaths of 4.5 women a day are caused by complications during pregnancy and childbirth. We examined the influence of participant background characteristics, socioeconomic factors, and household demographics on the likelihood of maternal mortality, using the socioecological model to guide the study. We conducted a study using a retrospective case-control design and quantitative techniques to explore the connection between predictor variables and maternal mortality. An analysis was conducted on a sample size of ($N = 8,937$). We employed descriptive statistics to offer a summary and description of population data collected from the 2013 Liberia Demographic and Health Survey (Liberia Demographic and Health Survey [LDHS]). Binomial logistic regression was used to predict the outcome of the dependent variable based on one or more predictor variables. Maternal alcohol consumption ($p = .010$), listening to the radio at least once a week ($p = .017$), unmet needs for limiting births ($p = .048$), no unmet needs ($p = .022$), six or more birth orders ($p = .021$), and rural residence ($p = .052$) significantly predicted maternal mortality. Improving maternal environments and implementing supportive policies would also address maternal health inequality, leading to positive social change.

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Dedication

I dedicate this dissertation to my beloved wife, Belinda Sherman, and daughter, Sherenee Miracle Nana Akua Sherman.

Acknowledgments

I am incredibly grateful to the exceptional individuals who provided guidance and support during my dissertation. I am thankful to God for guiding me through my academic journey. Dr. Patrick A. Tschida, my dissertation chair, deserves my heartfelt thanks for his continuous encouragement, mentorship, and immense expertise that played a crucial role in keeping me focused. Dr. Susan A. Nyanzi, my Co-chair, deserves special acknowledgment for her meticulous feedback and contribution to the content and structure of my dissertation. I want to express my gratitude to Dr. Nancy K. Rea from Walden University for her invaluable expertise and guidance during my dissertation journey.

To my family: I would like to extend my thanks to my exceptional and lovely wife, Belinda Sherman, for her unwavering support, encouragement, and dedication, and for being there for me throughout my academic and dissertation journey. Thank you for bringing our baby, Sherenee Nana Miracle Akua Sherman, into the world when I could not be present. I am thankful for the moral support you have offered. Allow me to take a moment to honor the memory of my late grandmother, Nana Gbadyu. She guided me along the right path, showing me the importance of accountability and the value of helping others. Even though she is gone, her memory continues to exist. I miss you deeply. My emotions today are too profound to put into words. You are the intended recipient of this degree. My dear mother, I cannot find the right words to express my gratitude. I cannot describe how I feel today.

I understand how hard it was for you to afford my school fees. Your efforts and sacrifices do not go unnoticed. You have faith in my ability to make a positive impact on the world. Thank you so much.

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Chapter 1: Introduction to the Study

Introduction

Maternal mortality is defined as "obstetric deaths of women that occur during pregnancy, childbirth, or within 42 days of delivery or the end of a pregnancy" (Demographic and Health Survey [DHS], n.d.). Women in developing countries, sub-Saharan Africa, and some developed countries face disproportionately high maternal mortality rates. The United Nations International Children's Fund (UNICEF) reveals that every eleven minutes, 2.8 million pregnant women and newborns die because of preventable causes and complications during pregnancy and childbirth (2019, September 19). The levels of maternal deaths in sub-Saharan Africa, developing countries, and certain developed nations have no apparent solutions for further reduction. Maternal deaths per 100,000 pregnancies rose from 196,000 in 2017 to 202,000 in 2020. The World Health Organization (WHO) reported that postpartum hemorrhage is the leading cause of maternal deaths worldwide, with 14 million women dying every year (2023, March 7). In sub-Saharan Africa, 85.0% of women's deaths are caused by postpartum hemorrhage (WHO, 2023). West Africa accounts for the most deaths in sub-Saharan Africa, followed by Eastern Africa, Middle Africa, and Southern Africa (see **Figure 1**). In 2020, sub-Saharan Africa had the highest maternal death rate compared to all other regions.

Figure 1

Maternal Deaths in Sub-Saharan Africa by Regions
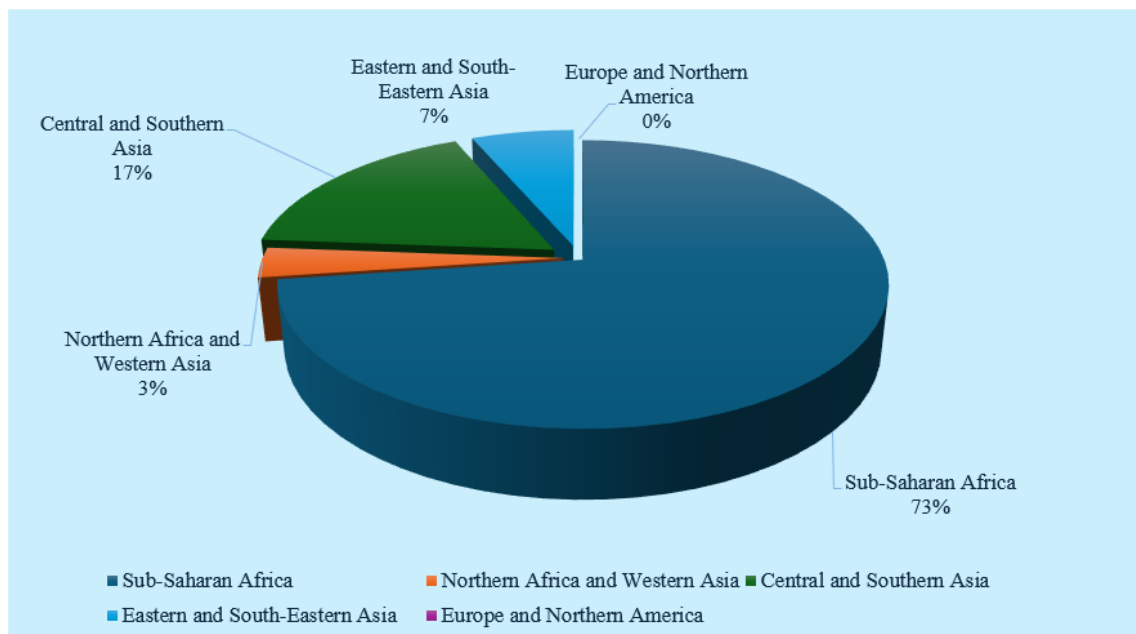
Note. WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division, 2023

Despite the worldwide attention given to maternal mortality as a public health concern, there is a lack of comprehensive understanding of the levels of maternal mortality and morbidity and the factors that contribute to maternal deaths. Sub-Saharan African countries, especially the poorest and least-developed ones, face a significant hurdle in reducing maternal mortality by 70 deaths by 2030, particularly those who fell short of meeting the Millennium Development Goal 5A in 2015. **Figure 2** illustrates the regional maternal mortality trends in 2020, emphasizing the healthcare access disparities and income inequality between high-income and low-income countries.

Figure 2

Regional Maternal Mortality Trends in 2020 by Regions
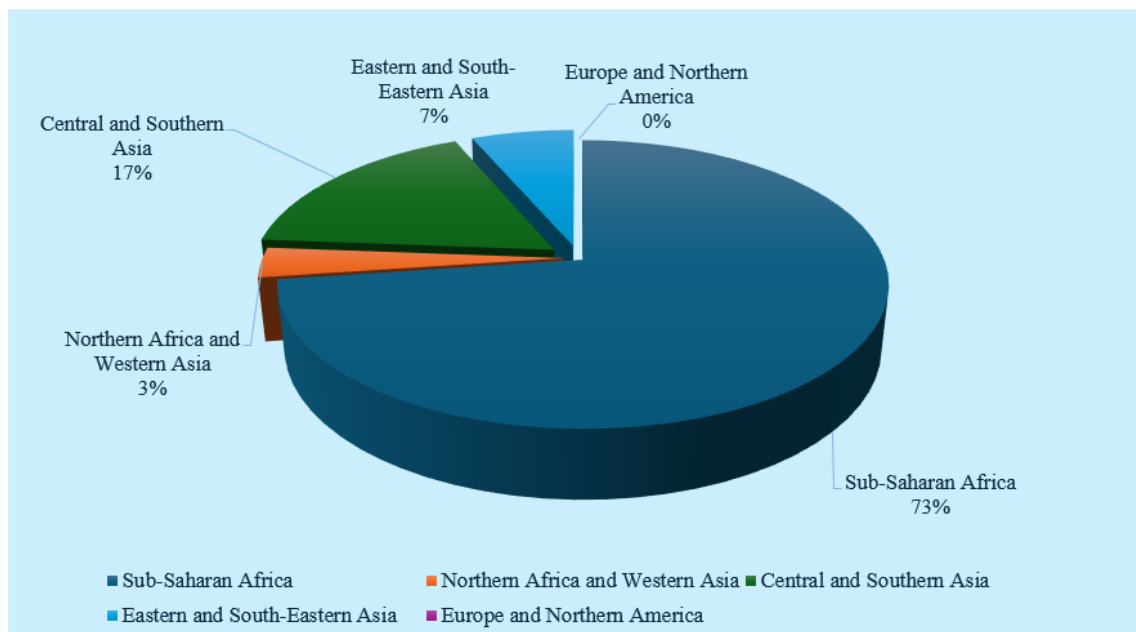
Note. WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division, 2023

A wide gap in healthcare distribution and high fertility rates in high-female countries is linked to high maternal mortality rates. United Nations International Children's Fund (UNICEF) found that women in high-fertility regions are at a greater risk of maternal death compared to women in low-fertility regions (UNICEF, 2023). Women in low socioeconomic settings with high fertility may face challenges in accessing quality care for pregnancy and childbirth, unlike those with high socioeconomic status. Women in countries with high fertility rates, such as Liberia, where the total fertility rate is 4.7, experience elevated maternal mortality rates because of preventable childbirth complications (LDHS, 2014). Limited access to quality maternal care disproportionately affects women in remote areas of Liberia, as well as other sub-Saharan African countries.

Prenatal care, postnatal support, and trained birth attendants are often inaccessible to women in the poorest countries of these regions. The maternal mortality rate in Liberia reached an alarming 1,072 deaths per 100,000 births in 2013. Maternal, neonatal, and under-5 (U5) mortality rates continue to be a concern (as shown in **Figure 3**).

Figure 3

Trends in Mortality Rates in Liberia 2000 - 2020

Trends in Mortality Rates in Liberia

■ 2019-2020   ■ 2006-2013   ■ 2000-2007

Under-5 mortality — 93
Neonatal mortality — 37
Maternal mortality — 742
Under-5 mortality — 94
Neonatal mortality — 26
Maternal mortality — 1072
Under-5 mortality — 110
Neonatal mortality — 32
Maternal mortality — 994
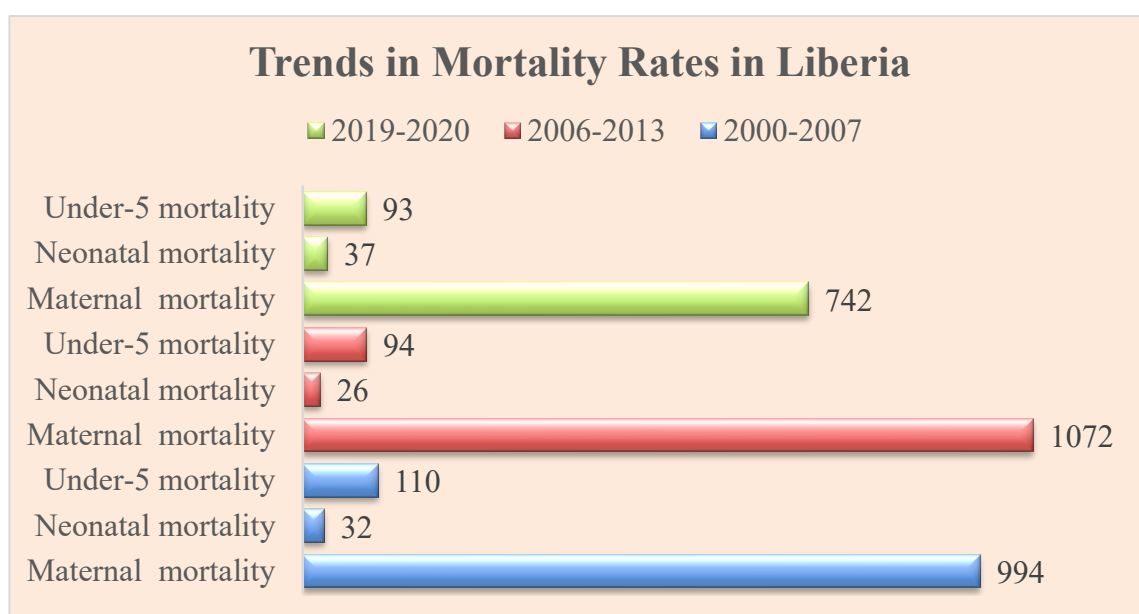
Note. 2014 LDHS and 2021 LDHS.

The high number of pregnancies among young women may contribute to the maternal, neonatal, and U5 mortality rates in Liberia. The rate of women who started having children between 15 and 19 varied from 4% at age 15 to 55% at age 19. Comparatively, women aged 15 have a birth rate of 4 per 1,000 women, whereas women between 45 and 49 have a birth rate of 16 per 1,000 women. The rate of childbirth for women between 20 and 24 was 193 per 1,000 women (LDHS, 2021).

High fertility rates continue to pose a challenge for family planning in Liberia, particularly for women. The percentage of married women with unmet needs for family planning was 33.0%, with 21.0% spacing and 13.0% limiting births. In 2020, only 24.0% of women of reproductive age used contraception. Liberia may not be on track to achieving the Sustainable Development Goal (SDG target 3.1) by 2025, with a maternal mortality target of 415 maternal deaths per 100,000 live births in the poorest countries. Meeting the global goal of reducing maternal mortality to less than 70 per 100,000 live births by 2030 remains difficult. Most countries are failing to meet the target. Based on the current rate, one million lives will be lost. Women in Liberia often face giving birth without support because of an acute shortage of skilled health workers and poor human resource management, leading to increased risks of maternal and neonatal mortality.

Addressing these inequalities in accessing and using quality care services, inequitable health systems, social and physical environments, supportive policies, building communities, and engaging stakeholders across the health system can lead to positive social change in maternal health outcomes. Improving maternal health is crucial for protecting the mother and child during delivery. Chapter 1 includes the introduction to the study, background information, problem statement, purpose, research questions, hypotheses, conceptual framework, nature of the study, definitions of terms, assumptions, scope, limitations, significance, and a summary.

Background

The alarming rates of maternal mortality across the globe, particularly in sub-Saharan Africa and developing countries, led health organizations to organize the Safe Motherhood Conference in Kenya in 1987 (WHO, 2020). The goal was to raise awareness and address the decline in maternal mortality. Maternal mortality rates in sub-Saharan Africa have remained persistently high. Despite remarkable strides in decreasing maternal fatalities from 1990 to 2017, there has been an increase in the number of maternal deaths in 2020 (WHO, United Nations International Children's Fund [UNICEF], United Nations Population Fund [UNFPA], World Bank Group, and United Nations Department of Economic and Social Affairs [UNDESA] or Population Division, 2023). The risk of maternal mortality in sub-Saharan Africa has slightly risen from 1 in 37 in 2015 to 1 in 40 in 2020. The United Nations' (UN) Millennium Development Goal (MDG-5A) saw limited progress in enhancing maternal health outcomes by 2015. Liberia's progress in reducing maternal mortality fell short of the UN's 2015 target.

Despite the substantial growth in nursing and midwifery personnel density per 10,000 population from 3.3 in 2004 to 7.9 in 2022, the lack of accessible basic midwifery or emergency obstetric care contributes to increased maternal and neonatal mortality rates (WHO, 2024). Health worker density per 10,000 people was only 12.8, below the 44.5 recommended by the WHO (WHO, 2022). The absence of referrals to health facilities compels women to give birth in remote communities. Shortages of primary healthcare facilities prevent women and girls with birth and pregnancy complications from receiving life-saving interventions.

At the district, county, and regional levels, there is a dearth of data on maternal and reproductive health. Research on maternal mortality in Liberia is insufficient, particularly regarding participant background characteristics, socioeconomic factors, and household sociodemographic characteristics. The number of home births in Liberia is growing, despite the risks involved. Mothers and newborns face higher risks because of poor hygiene, limited water supply, and contamination in health facilities (Abrampah et al., 2017). Disease surveillance is not effective enough. The lack of essential health information systems and pregnancy monitoring in hotspot communities hinders the identification and monitoring of pregnant and new mothers at risk. Informational systems also need to be coordinated among multidisciplinary medical teams. Liberia urgently needs infrastructure development. Building hospitals and ensuring proper equipment in existing ones is essential. Hospitals can improve maternal care services by increasing performance standards, measuring progress, improving quality, and reporting advancements. In health facilities, emergency supplies and medical equipment are vital to prevent maternal and newborn deaths.

The challenge of accessing quality maternal care services persists for women. Factors at multiple levels, including individual, family, community, and societal factors, can create obstacles in the process of seeking maternal care services, leading to increased maternal mortality. Rural women in Liberia are significantly impacted by maternal mortality. The level of maternal poverty plays a crucial role in determining maternal health outcomes.

Poverty affects 71.8% of women living in rural areas compared to 31.5% of women living in urban areas (United Nations Development Programme [UNDP], 2021). The rural-urban divide in poverty is reflected in a higher maternal mortality rate in rural areas. Studies show that rising poverty levels negatively affect healthcare services, health system use, health disparities, overall health, vulnerable populations, and maternal mortality (Chung et al., 2020; Inglis et al., 2019). Understanding the key factors contributing to maternal mortality in Liberia requires a comprehensive examination of the socioecological model of health. This model includes individual, interpersonal, community, and societal factors.

Problem Statement

Despite a slight decline in the maternal death rate in sub-Saharan Africa to 196,000 in 2017, it experienced a notable increase to 206,000 per 100,000 pregnancies in 2020. The estimated lifetime risk of maternal mortality in sub-Saharan Africa was 1 in 37 in 2017 and 1 in 40 in 2020. Women in sub-Saharan Africa face a greater risk of death during pregnancy and childbirth than those in developed nations. The leading causes of maternal death include sepsis, hemorrhage, hypertensive disorders, obstructed labor, and abortion complications. In Liberia, anemia and hemorrhage are significant causes of maternal mortality. Health facilities also account for 74.0% of maternal deaths. One-third of women die within 24 hours after childbirth. 44.0% of women's deaths during delivery and childbirth are attributed to professionals or skilled birth attendants (Karmbor-Ballah et al., 2019).

The maternal mortality ratio in Liberia was 1,072 for every 100,000 pregnancies in 2013. In 2007, the maternal mortality rate in Liberia was 994 deaths per 100,000 pregnancies. Women between 40 and 44 had the highest maternal mortality rate. Women between 25 and 34 experienced notably high maternal mortality rates compared to those between 15 and 19 (LDHS, 2014). High levels of maternal mortality are driven by factors, including high fertility rates, teenage pregnancies, and inadequate access to family planning services.

Most young pregnant women in Liberia frequently delay seeking care and have fewer antenatal care visits, which raises the risk of maternal mortality. Health facilities and skilled birth attendants are seldom used by pregnant women during childbirth. A significant number of pregnant women lack awareness about the significance of antenatal care and skilled attendants during delivery. Medical expenses discourage young pregnant women from seeking healthcare facility deliveries. Lack of respect and inadequate care are common issues faced by young pregnant women in Liberia from health workers. Midwives frequently spoke harshly to younger pregnant women, treating them disrespectfully. During childbirth at health facilities, young pregnant women faced verbal and physical abuse. Negative experiences with midwives led young pregnant women in Liberia to avoid certain health facilities (Karmbor-Ballah et al., 2019). Karmbor-Ballah et al. (2019) found that transportation to health facilities contributed to 12.0% of maternal deaths.

Bobo et al. (2019) found that health workers' failure to provide respect, privacy, and confidentiality to young pregnant women led to increased maternal mortality rates and a reluctance to seek healthcare services during delivery. Stigma and discrimination deter young pregnant women from seeking maternal care services. Hazel et al.(2021) and Kassa et al.(2020) found that pregnant women in sub-Saharan African countries with low socioeconomic backgrounds encounter increased mistreatment, patient neglect, and privacy issues during maternal care services. Maldie et al. (2021) discovered a significant decline in using maternal care services when there is maternal disrespect, discrimination, violation of patient privacy and confidentiality, lack of patient consent, neglect or abandonment, and abuse during labor and childbirth. The researchers emphasized that inequality gaps have a dual impact by limiting access to quality maternal care services for women of lower socioeconomic status and overall access to maternal care services. Nawab et al. (2019) explored how mistreatment and abuse in healthcare facilities affect the use of maternal care services and contribute to maternal death. Adverse treatment from health providers created barriers for pregnant women to access services. Lack of patient care, mistreatment, and abuse resulted in inadequate health services and limited access to family planning (Kassa et al., 2020; Tumlinson et al., 2022).

The WHO (2019, October 9) found that lower-educated younger women face a greater risk of mistreatment during childbirth because of socioeconomic disparities. High fertility rates, limited access to family planning services, and a significantly large number of adolescent pregnancies affect maternal health outcomes.

I examined the 2013 LDHS data to study the factors that impact maternal mortality in Liberian women between 15 and 49, such as participants' background characteristics, socioeconomic factors, and household sociodemographic characteristics.

Purpose of the Study

This quantitative, retrospective case-control study aimed to analyze 2013 LDHS data and identify factors associated with maternal mortality in Liberian women between 15 and 49. It examined participants' background characteristics, socioeconomic factors, and household sociodemographic characteristics. I conducted descriptive statistics and binomial logistic regression to analyze and interpret the findings. Descriptive statistics, such as frequencies and percentages, were used to summarize and explain the population data. The outcome of the dependent variable was predicted using binomial logistic regression, considering one or more predictor variables. The 95% confidence interval (CI) shows the level of precision for the effect. I used the predictor variables to calculate the odds of maternal death and determined statistical significance with a p-value of 0.05%.

Research Question(s) and Hypotheses

RQ1: Is there a statistically significant extent to which participants' background characteristics (maternal alcohol consumption, media exposure, husband/partners' education, family planning, mothers' PNC checkup after delivery, fertility status, place of residence, and wealth quintile) are associated with maternal mortality among women between 15 and 49 in Liberia?

H_o1: There is no statistically significant extent to which participants' background characteristics (maternal alcohol consumption, media exposure, husband/partners' education, family planning, mothers' PNC checkup after delivery, fertility status, place of residence, and wealth quintile) are associated with maternal mortality among women between 15 and 49 in Liberia.

H_a1: There is a statistically significant extent to which participants' background characteristics (maternal alcohol consumption, media exposure, husband/partners' education, family planning, mothers' PNC checkup after delivery, fertility status, place of residence, and wealth quintile) are associated with maternal mortality among women between 15 and 49 in Liberia.

RQ2: Is there a statistically significant extent to which socioeconomic factors such as maternal education, maternal occupation, educational attainment, marital status, and maternal age at birth are associated with maternal mortality among women between 15 and 49 in Liberia?

H_o2: There is no statistically significant extent to which socioeconomic factors such as maternal education, maternal occupation, educational attainment, marital status, and maternal age at birth are associated with maternal mortality among women between 15 and 49 in Liberia.

H_a2: There is a statistically significant extent to which socioeconomic factors such as maternal education, maternal occupation, educational attainment, marital status, and maternal age at birth are associated with maternal mortality among women between 15 and 49 in Liberia.

RQ3: Is there a statistically significant extent to which household sociodemographic characteristics (distance to the nearest health facility, mode of transportation to the nearest health facility, place of delivery, religion, region, and HIV-related breastfeeding, ANC visits, maternal literacy) are associated with maternal mortality among women between 15 and 49 in Liberia?

H_{o3}: There is no statistically significant extent to which household sociodemographic characteristics (distance to the nearest health facility, mode of transportation to the nearest health facility, place of delivery, religion, region, HIV-related breastfeeding, ANC visits, and maternal literacy) are associated with maternal mortality among women between 15 and 49 in Liberia.

H_{a3}: There is a statistically significant extent to which household sociodemographic characteristics (distance to the nearest health facility, mode of transportation to the nearest health facility, place of delivery, religion, region, HIV-related breastfeeding, ANC visits, and maternal literacy) are associated with maternal mortality among women between 15 and 49 in Liberia.

Conceptual Framework for the Study

The socioecological model of health was the guiding framework for the study. Urie Bronfenbrenner, a Russian American psychologist, introduced the socioecological concept in 1977, emphasizing behavioral sciences and public health. Bronfenbrenner investigated different levels of environmental influences that shape individual behavior, including family dynamics, physical surroundings, cultural aspects, economic factors, and politics (Shelton, 2019).

Bronfenbrenner emphasized the importance of considering environmental factors at multiple levels to understand people's situations and health behaviors. The model considers multiple factors that influence health behaviors. Researchers have extensively used the model to study the effects of different factors on behaviors, such as physical activity, cancer prevention, exclusive breastfeeding, and maternal health (Akinyemiju et al., 2022; Kaiser et al., 2019; Abekah-Nkrumah et al., 2020; Shahabuddin et al., 2017; Sun et al., 2023; Timmermans et al., 2020). The model allows me to examine the correlation between social and physical factors and maternal mortality at different levels. I used the model to analyze associations between predictor variables and the dependent variable across various levels of influence, including intrapersonal, interpersonal, community, and societal factors (see **Figure 4**).

Figure 4

Synthesis of the Socioecological Determinants of Maternal Mortality among Liberian Women
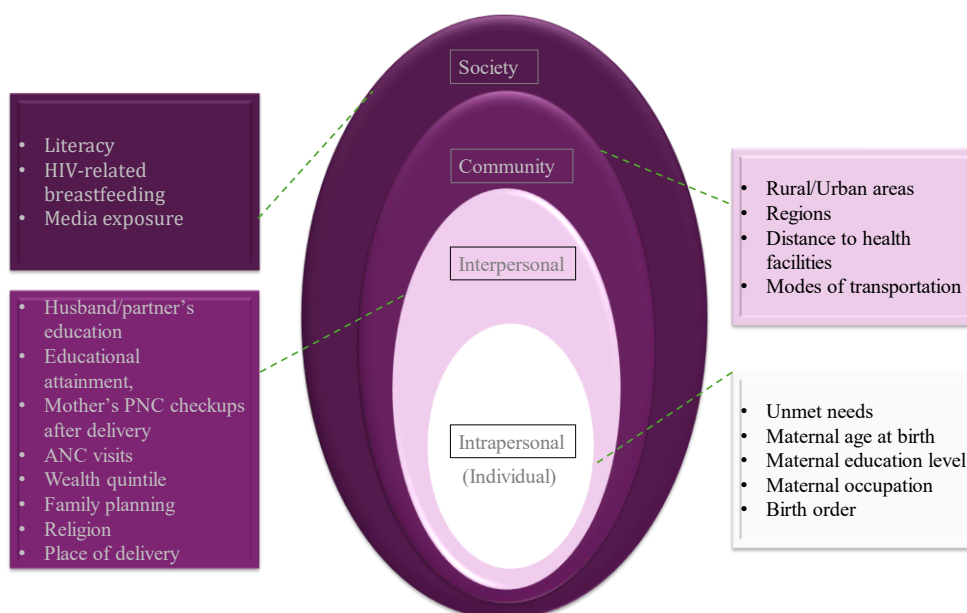
The research focused on understanding the influence of several factors on maternal mortality at the intrapersonal level, including unmet needs, maternal age at birth, marital status, maternal education, maternal occupation, and birth order. At the interpersonal level, factors, including education of husbands or partners, maternal education, PNC checkups after delivery, ANC visits, wealth quintile, family planning, religion, and place of delivery, can affect maternal mortality. Family dynamics, social support, and community have a significant impact on maternal health behaviors, women's health status, living conditions, and family finances. The community-level impact of social connections can be seen in maternal health risk behaviors in neighborhoods and workplaces. At the societal level, factors such as literacy, HIV-related breastfeeding, and media exposure can influence maternal mortality. Examining multiple levels of influence is crucial to understanding the complex causes of maternal mortality.

Nature of the Study

A quantitative, retrospective case-control design was employed in this study. The design of the study permits a detailed analysis of multiple factors that influence maternal mortality. I analyzed the 2013 LDHS data by comparing cases and controls. The design was chosen for its cost-efficiency. Predictor variables included maternal alcohol consumption, media exposure, husband/partners' education, family planning, mothers' PNC checkup after delivery, fertility status, place of residence, and wealth quintile.

Maternal education, maternal occupation, educational attainment, marital status, maternal age at birth, distance to the nearest health facility, mode of transportation, place of delivery, religion, region, HIV-related breastfeeding, ANC visits, and maternal literacy were among the additional variables examined in this study.

Data collection started on March 10 and ended on July 19, 2013. The MEASURE DHS project funded the Ministry of Health and Social Welfare survey with technical support from ICF International and USAID. The data collection process included 16 field teams, a supervisor, an editor, three female interviewers, one male interviewer, and a driver. I conducted descriptive statistics and binomial logistic regression to analyze and interpret the findings. Descriptive statistics, such as frequencies and percentages, were used to summarize and explain the population data. The outcome of the dependent variable was predicted using binomial logistic regression, considering one or more predictor variables. The 95% CI shows the level of precision for the effect. Based on the predictor variables, I calculated the odds of maternal death. I use a *p*-value of 0.05% to determine statistical significance.

Definitions

Antenatal care: Known as prenatal care, it refers to the care provided during pregnancy.

Birth order: Number of birth intervals.

Distance to health facilities: Miles required to reach the closest health facility.

Educational attainment: Households' highest level of schooling.

Excess maternal death: Difference between observed and expected deaths over a specific period (Centers for Disease Control and Prevention [CDC], 2022).

HIV-related breastfeeding: HIV transmitted through breastfeeding.

Households: Number of individuals in a household.

Husbands'/partners' education level: Levels of education categorized as having no formal, primary, secondary, or higher education.

Liberia: Country in West Africa bounded by Guinea to the north, Sierra Leone to the northwest, Cote d'Ivoire to the east, and the Atlantic Ocean to the southwest.

Liberia Demographic and Health Survey: A survey conducted every five years by the Demographic and Health Survey program and implemented by the Liberia Institute of Statistics and Geo-Information Services.

Media Exposure: Radio, newspapers/magazines, and television accessed.

Marital Status: Women's current marital status during the survey.

Maternal age at birth: Mother's age at the time of birth.

Maternal alcohol consumption: Amount of alcohol consumed during pregnancy.

Maternal deaths: Deaths of women while pregnant, during childbirth, within 42 days of delivery, or during pregnancy termination (Demographic and Health Surveys [DHS], n.d.).

Maternal education: Categorized as having no formal, primary, secondary, or higher education.

Maternal literacy: Reading and writing skills of mothers.

Maternal mortality rate: The number of maternal deaths per 1,000 women between 15 and 49.

Maternal mortality ratio: The number of maternal deaths per 100,000 live births.

Maternal pregnancy complications: Complications associated with severe bleeding, infection, and pre-eclampsia.

Maternal occupation: Type of employment.

Mode of transportation: Categorized as private, public, walking, bicycles, wheelbarrows, and other transport methods.

Mother's PNC checkups after delivery: Mothers' checkups within 48 hours.

Neonatal mortality: The probability of dying within the first month of life.

Odds: The chance of a situation happening.

Place of delivery: Health facility delivery for mothers.

Place of residence: Categorized as rural and urban.

Region: Categorized as North Western, South Central, South Eastern A., South Eastern B., and North Central.

Religion: Different religious affiliations.

Under-5 mortality: The probability of dying between birth and the fifth birthday.

Unmet need: Spacing and limiting of births.

Wealth quintile: Living standards of households.

Assumptions

I assume that all pregnant women in Liberia have the right to life and safe motherhood, regardless of their location. The inadequate treatment and mistreatment of women during childbirth elevate the risks involved in pregnancy and delivery. I expected problems with the availability and accessibility of maternal epidemiological evidence-based data in Liberia, from the community to the district level. The exclusion of non-pre-determined households may have omitted valuable insights on the causes of maternal mortality in Liberia. I assumed eligible participants responded honestly and willingly, with a response rate of 98.0%. The participants included women with diverse educational backgrounds.

Scope and Delimitations

I examined associations between predictor variables and the dependent variable using data from the 2013 LDHS. Cases and controls were compared using a retrospective case-control design and quantitative analysis. The analysis included descriptive statistics binomial logistic regression, and women between 15 and 49, regardless of their living situation or mortality in the past seven years. Only pre-selected households were included in the study and women under 15 and over 49 were excluded.

Limitations

There are a few limitations to consider in this study. Concerns arise about potential recall bias because of the survey's design.

The accuracy of reported data on survival status, age of living siblings, age at death, and years since the death of siblings may be compromised because of the absence of death certificates for determining the cause of death.

Significance

I analyzed associations between maternal mortality and various background characteristics of participants (such as alcohol consumption during pregnancy, media exposure, husband/partner's education, family planning, PNC, fertility status, place of residence, and wealth quintile). To assess the effect on maternal mortality, different socioeconomic factors were examined, including maternal education, maternal occupation, maternal education, marital status, and maternal age at childbirth. I also examined household sociodemographic characteristics such as distance to the nearest health facility, modes of transportation to the nearest health facility, place of delivery, religion, region, HIV-related breastfeeding, ANC visits, and maternal literacy to determine their influence on maternal mortality. Understanding factors that influence maternal mortality and how they affect one another is essential to improving maternal health outcomes and reducing maternal mortality among Liberian women between 15 and 49.

The existing research on how demographic and socioeconomic factors related to maternal mortality in Liberian women emphasizes the necessity for more comprehensive studies. I conducted descriptive statistics and binomial logistic regression to analyze and interpret the findings. Descriptive statistics, such as frequencies and percentages, were used to summarize and explain the population data.

The outcome of the dependent variable was predicted using binomial logistic regression, considering one or more predictor variables. The 95% confidence interval (CI) shows the level of precision for the effect. I analyzed the predictor variables and determined the odds of maternal death, considering a p-value of 0.05% as the threshold for statistical significance. The findings will advance academic research by providing relevant data on multiple factors and their effects on maternal mortality.

Summary

Despite accessible preventive models, maternal mortality remains a critical concern worldwide. Pregnancy-related complications continue to cause the deaths of women in Liberia and other sub-Saharan African countries. I examined associations between participants' background characteristics, socioeconomic factors, and household sociodemographic characteristics that likely contribute to maternal mortality in women between 15 and 49 in Liberia. Maternal mortality rates varied by region, requiring further investigation to identify the factors strongly linked to maternal mortality in women between 15 and 49. In 2013, there were 1,072 maternal deaths in Liberia. Despite the alarming rise in maternal mortality, there has been progress in prenatal care coverage and the availability of birth attendants during delivery in the past seven years.

Maternal mortality can be attributed to factors such as high fertility rates, teenage pregnancies, and inadequate access to family planning services. I used the 2013 LDHS data to generate research questions and hypotheses concerning maternal mortality in women between 15 and 49.

The socioecological model of health was used to guide the study. I used the model to investigate complex behaviors and the underlying factors that contribute to maternal mortality in women between 15 and 49.

Cases and controls were compared using a quantitative, retrospective case-control design. The study's design allows for a thorough examination of the factors contributing to maternal mortality. Descriptive statistics and a binomial logistic regression model were used to analyze and interpret the findings. Policymakers can apply the results of the study to create initiatives focused on maternal health promotion, education, and prevention to reduce maternal mortality rates. Chapter 2 includes the introduction, literature search strategy, theoretical foundation, conceptual framework, literature review on key variables, and a summary.

Chapter 2: Literature Review

Introduction

Despite a slight decline in the maternal death rate in sub-Saharan Africa to 196,000 in 2017, it experienced a notable increase to 206,000 per 100,000 pregnancies in 2020. Maternal death is primarily caused by sepsis, hemorrhage, hypertensive disorders, obstructed labor, and abortion complications. In sub-Saharan Africa, women face higher risks during pregnancy and childbirth compared to developed countries. This study aimed to analyze 2013 LDHS data and establish factors associated with maternal mortality in Liberian women between 15 and 49 using a quantitative, retrospective case-control approach.

I examined associations between participants' background characteristics, socioeconomic factors, household sociodemographic characteristics, and maternal mortality.

Ariyo et al. (2017) employed multilevel regression and retrospective analysis to explore the influence of social and cultural environments on maternal mortality in Nigeria. The researchers found that region, religion, and women's educational level were independent predictors of maternal mortality. Rural women had higher maternal mortality rates compared to urban women. Boafor et al. (2021) investigated factors affecting maternal mortality at the Korle Bu Teaching Hospital in Accra, Ghana, using logistic regression. The study established a significant correlation between maternal mortality and factors, such as limited education and low antenatal visits among women. Tesfay et al. (2023) investigated the link between maternal deaths and the location of death in Ethiopian women. The demographics of women living in rural areas directly influenced the mortality rate of healthcare facilities. Residence was significantly associated with all places of death. The highest number of maternal deaths occurs in health facilities, with home births and deaths during transport. In health facilities, women between 20 and 29 experienced the highest mortality rates. Maternal deaths showed a significant increase among married Christian women in rural areas lacking education and ANC follow-up. Women with higher education levels had a decreased mortality risk. The study found a strong positive correlation between educational status and deaths occurring at home.

Mweemba et al. (2021) used a mixed-method approach to examine the obstacles to accessing maternal care in low-income African countries. The researchers used a sampling technique with multiple stages in their quantitative analysis.

A pretested structured questionnaire selected a randomized sample of 95 households from two districts. Qualitative data was gathered from women accessing maternal health services through four focus group discussions in each district. The research found a significant association between maternal care services, bicycles, walking, ANC home visits, and the distance to health facilities. Lack of transportation, poor road conditions, and long distances to facilities are significant barriers for women in rural areas to access hospital delivery services, leading to maternal deaths. This chapter includes the study's introduction, literature search strategies, theoretical foundation, conceptual framework, literature review, key variables and concepts, and a summary.

Literature Search Strategy

For the literature review, databases included the Walden University library, ProQuest, PubMed, Medline, SAGE, Google Scholar, Science Direct, United Nations, UNICEF, WHO, UNDP, and World Bank. The search incorporated keywords related to *participant characteristics, risk factors of maternal mortality, household sociodemographic factors of maternal mortality/death, socioeconomic factors of maternal mortality/death, family planning, fertility status, PNC checkups after delivery checkups, ANC visits, HIV-related breastfeeding, and literacy*.

English was the primary language used in my research. Other search terms include developing countries, *Africa, sub-Saharan Africa, Nigeria, Sierra Leone, Ethiopia, Ghana, and Liberia*. I used scholarly and peer-reviewed materials for my study. Google Scholar provided valuable academic knowledge on maternal healthcare barriers and mortality. I included publications from 2017 to 2023.

Theoretical Foundation

This study was guided by the socioecological model of health. In 1977, the model was developed, focusing strongly on behavioral sciences and public health. Bronfenbrenner recognized the interdependence of family dynamics, physical environments, economic circumstances, cultural factors, and political forces. The study analyzed various aspects of models, including individual, social, community, and societal factors that impact health behavior. Both the social and physical environments are vital factors in the model. The model posits behaviors are not solely determined by environmental changes. Changes in the social environment are also required. The model emphasizes the effectiveness of behavior-specific and multilevel interventions in improving health and behavior change. By adopting this model, we can ensure the future prevention of maternal mortality.

Conceptual Framework

I used a four-level model to enhance comprehension of maternal mortality and potential prevention approaches. The model examines how individual, interpersonal, community, and societal factors impact maternal mortality. At an individual level, it encompasses a woman's perception, behavior, and comprehension of the risks and seriousness of maternal complications. Pregnancy complications and mortality risks are elevated for individuals because of inadequate information on maternal diseases and personal health beliefs.

Birth order, maternal age at birth, maternal education, maternal occupation, and family planning needs can affect maternal health behaviors, pregnancy complications, chronic conditions, and maternal mortality at an individual level.

Maternal health behaviors are influenced by the interpersonal level, including education of husbands/partners, educational attainment, PNC checkups after delivery, ANC visits, wealth quintile, family planning, region, and place of delivery. Women's seeking of maternal care is shaped by social support, social ties, family systems, and the family environment. The involvement of husbands or partners influences women's accessing maternal care services. Adult family members, including mothers-in-law, help to influence women's decision-making, access maternal care services, and provide maternal health support.

The community level examines rural/urban areas, regions, distance to health facilities, and modes of transportation that can affect maternal mortality. Strategies to prevent maternal mortality in rural areas may involve improving maternal care services, the built environment, and transportation infrastructure, and addressing underlying factors like poverty and health status. At the societal level, broader social factors are analyzed to understand the increased risks or causes of maternal mortality. Maternal mortality rates can be influenced by factors such as maternal literacy, HIV-related breastfeeding, and media exposure. Maternal health, along with economic and social policies, shapes social inequalities at this level. Prevention strategies at this level include promoting maternal literacy education, safe sex practices, HIV programs, and bilingual media on maternal health education.

Using empirical evidence, the model levels allow for the examination of hypotheses regarding maternal mortality.

Literature Review Related to Key Variables

The literature review aimed to understand how predictor variables relate to maternal mortality. I used the socioecological model of health to analyze factors affecting women during pregnancy and childbirth at individual, interpersonal, community, and societal levels. The purpose of studying multiple factors on maternal mortality in Liberia was to understand their effect on women between 15 and 49. Descriptive statistics allow for the examination of behavior-specific patterns. Inferential statistics allow for the identification of distinct risk factors contributing to maternal mortality and the assessment of their respective strengths.

Maternal Alcohol Consumption and Maternal Mortality

Alcohol consumption during pregnancy has varying effects on women. Alcohol consumption during pregnancy can lead to miscarriage, premature birth, stillbirth, and a range of disabilities known as fetal alcohol spectrum disorders (FASD). Addila et al. (2021) found that consuming more alcohol while pregnant was associated with increased chances of adverse birth outcomes, such as preterm delivery and low birth weight, affecting the mother and fetus. The researchers recommended incorporating alcohol screening into ANC visits for women and offering extensive follow-up and counseling for individuals who drink alcohol. This approach could help reduce harmful birth outcomes for the baby. Oh et al. (2020) investigated the adverse consequences of alcohol consumption on birth complications. The risk of adverse birth outcomes, such as preterm

delivery and sudden infant death syndrome, was greater for those with alcohol use disorders (AUDs). The hazard ratio of adverse birth complications and alcohol dependence-related outcomes was assessed using a multivariate Cox proportional hazards model by researchers. Deliveries and adverse pregnancy outcomes were significantly more likely in the under-20 and over-40 age groups. A significant link existed between AUDs and increased risk of adverse birth outcomes. The researchers advised that healthcare professionals adopt a standard practice of asking pregnant women about their drinking habits, with special attention to those who have a history of alcohol abuse.

Popova et al. (2021) examined the correlation between maternal alcohol consumption and adverse neonatal outcomes and pregnancy complications in British Columbia and Canada. Younger mothers with fewer prenatal visits were more likely to increase alcohol consumption while pregnant. Pregnant women in British Columbia had a higher rate of alcohol consumption compared to Ontario's birth registry. The study revealed that infants exposed to alcohol in utero are susceptible to low birth weight, respiratory distress, and feeding issues.

Exposure to Mass Media and Maternal Mortality

Through education, awareness, and behavior change, mass media plays a crucial role in impacting maternal health before, during, and after pregnancy. Adequate knowledge of maternal healthcare is crucial for decreasing maternal mortality. Women who have access to various forms of media, such as radio, newspapers, magazines, and television, can become more aware of reproductive, maternal, and childcare services, reducing the risk of maternal morbidity and mortality. Fatema and Lariscy (2020) used

logistic regression to analyze associations between mass media exposure and maternal healthcare in Asian women. The researchers examined women in Bangladesh, Nepal, and Pakistan to assess media exposure and the use of maternal healthcare services. The researchers observed that in Bangladesh, Nepal, and Pakistan, women who had greater exposure to mass media were more likely to avail themselves of maternal healthcare services. Antenatal care, skilled birth attendants, and postpartum care were found to be more easily adopted with the help of education and mass media. Urban women with media access had better outcomes for antenatal, birth, and postpartum care compared to rural women.

Aboagye et al. (2022) investigated the influence of mass media exposure on the usage of maternal healthcare services in women from sub-Saharan Africa. Mass media exposure, maternal age, education, marital status, religion, wealth index, and residence were all significantly associated with ANC. Mass media exposure, maternal characteristics, religion, working status, parity, medical help, health insurance, wealth, and residence significantly affected the availability of skilled birth attendants and PNC services. Increased access to media led to higher rates of women choosing skilled birth attendants and PNC services. Women who watched television at least once a week had a higher likelihood of attending ANC, unlike those who did not watch at all. Women who watched TV at least once a week were likelier to use skilled birth attendants than non-readers of newspapers/magazines.

Yaya et al. (2019) conducted a logistic regression analysis to investigate the factors affecting women's use of facility delivery and maternal care services in Liberia.

There was a significant correlation between sufficient ANC visits and listening to the radio less than once or at least once a week. Pregnant women in Liberia who read newspapers/magazines and watched television less than once a week or at least once a week were more likely to have adequate ANC visits. Pregnant women who listened to the radio, read newspapers/magazines, and watched television less than once a week or at least once a week were more likely to use maternal care services. Maternal care services use was more significant in urban areas with high wealth among educated women.

Meh et al. (2019) used logistic regression analysis to examine the factors associated with maternal mortality in both northern and southern Nigeria. A lack of media exposure in the North correlated with a notable rise in maternal mortality rates for women. Limited media access led to a 52.0% higher risk of maternal mortality for women in the South. The North's limited media and education access led to a noticeable surge in maternal mortality rates. The researchers asserted that ensuring access to maternal care services is a vital factor in promoting the health and well-being of both mother and child and in decreasing complications and deaths.

Husband/Partner's Education and Maternal Mortality

The participation of husbands or partners in ANC and PNC visits can positively impact maternal care services. Tunkara-Bah et al. (2021) found that spousal education and participation were vital for increasing the use of maternal care services during pregnancy. A higher level of education in husbands or partners led to a better understanding of obstetric risks and increased preparedness for childbirth.

Sumankuuro et al. (2019) drew attention to the challenges pregnant women encounter in rural Ghana when seeking care for childbirth and obstetric complications. Researchers investigated the correlation between delayed seeking of maternal care services and obstetric complications. The decision-making of spouses plays a role in shaping cultural practices and affecting women's maternal health. The involvement of spouses and families, along with the promotion of women's autonomy, led to a greater use of maternal care services. Jungari and Paswan (2019) examined how husbands' knowledge of pregnancy complications influenced the use of maternal care services. Husbands who knew about pregnancy complications had more prenatal care visits than those who were unaware. Husbands with different levels of education were present when their wives gave birth. Increased knowledge of maternal complications led husbands to be more involved in maternal care.

Dickson et al. (2022) examined the influence of partners' education and the use of skilled ANC care. Women with higher education sought ANC from skilled providers more often than those without formal education. Women whose partners had higher education were more likely to receive an ANC from skilled providers, unlike those with partners who had no formal education. Rahman et al. (2018) investigated the influence of husbands' awareness and involvement on maternal and newborn health in rural Bangladesh. During ANC visits, 47.0% of husbands or partners accompanied their wives. The educational level of husbands or partners significantly impacted ANC visits and health facility delivery.

Unmet Needs and Maternal Mortality

Women opt for health facility delivery because of their unmet needs for family planning and their intention to control the timing and quantity of their children. The factors contributing to unmet requirements are multifaceted. The fear of contraceptive method side effects is prevalent among women who have heard rumors or had personal experiences. Women may be deterred from accepting or supporting family planning because of concerns about their husband's disapproval or retaliation, as well as religious or personal considerations. Women may experience uncertainty about their fertility or have conflicting emotions about starting a family. A proportion of women face challenges in obtaining contraceptives because of limited knowledge and service limitations. Married women in Liberia had an unmet need level of 31.0%, with 22.0% for spacing (delaying) births and 9.0% for limiting births. The percentage of women with unmet birth spacing needs was highest among those between 15-19 (46.4%), followed by women between 20-24 (36.5%) and women between 25-29 (28.0%) in Liberia (LDHS, 2014). Larasanti and Ayuningtyas (2022) conducted a study that investigated the correlation between family planning service use and unmet needs. The researchers used univariate analysis to assess the statistical associations between family planning service factors and unmet needs. Mothers with less than two births experienced a reduced incidence of unmet need for limiting compared to mothers with three or more births. The researchers found a greater need to control and space out births without family planning. Teshale et al. (2022) used multinomial logistic regression to analyze barriers to unmet spacing and limiting needs in sub-Saharan Africa.

The risk of unmet need for limiting was higher among women with primary education than those with higher education. Age, education, media exposure, number of children, and knowledge of contraceptives were factors related to unmet spacing and limiting needs among women. Place of residence, women's illiteracy, and regional differences were identified as contributing factors to unmet spacing and limiting needs. Women with higher education had a lower risk of unmet needs for limiting and spacing than those without formal education. Family planning services in Sub-Saharan Africa remain insufficient.

Mothers' PNC Checkups After Delivery and Maternal Mortality

A woman's well-being is paramount before, during, and after childbirth. PNC provides both treatment for complications, such as STIs and anemia, and prevention of diseases through immunization and micronutrient supplementation.

PNC involves childbirth preparation, readiness for complications, delivery location, and referral for mothers with complications. The highest rate of maternal and infant mortality occurs in the first month after giving birth. The WHO reports that 30% of women and babies across the globe do not have access to sufficient PNC (2022, March 30). In 2020, 2.4 million infants died within their first month, with 75.0% of those deaths occurring in the first week (WHO, 2022). The risk of severe bleeding, maternal morbidity, and death can increase because of delivery complications. Regular PNC checkups at health facilities can prevent adverse maternal mortality and morbidity.

Wudineh et al. (2018) found that marital status, educational level, income, and place of delivery had a significant impact on PNC services. Maternal mortality and morbidity rates were higher among women in Sub-Saharan Africa and northwest Ethiopia. Researchers have established the importance of PNC in reducing morbidity and mortality rates in women and children. Proper postnatal care visits were essential for identifying and treating delivery complications and educating mothers about health and the baby's well-being. Marital status, education level, income, parity, birth outcome, last pregnancy, and place of delivery were all significantly associated with PNC use. Despite the study's findings, PNC has shown no improvement for women in northeast Ethiopia. Tessema et al. (2020) used a multilevel logistic regression model to examine PNC use in sub-Saharan Africa. Researchers found significant associations between factors such as country region, residence, age group, maternal education, maternal occupation, media exposure, ANC visit, place of delivery, accessing health care, and PNC use.

PNC service use among women in central, eastern, and western Africa was notably lower compared to southern Africa. Women with more education were more inclined to use PNC services than those without. Urban women were more likely to receive PNC care compared to rural women. Women between 25 and 49 were more likely to seek PNC than those between 15 and 24. The researchers identified differences in PNC coverage among regions, characterizing it as notably low.

Birth Order and Maternal Mortality

Women who have high fertility rates are at a higher risk of experiencing multiple maternal deaths and increased lifetime mortality compared to women in countries with low fertility rates. Babies born to young or older women, with short birth intervals, or to women with many children face an increased risk of infant and child mortality. Tamirat et al. (2021) investigated the determinants of maternal high-risk fertility behaviors in East African women. Education levels, residence, wealth status, and contraceptive use were all factors that predicted high-risk fertility behaviors. High-risk fertility was associated with increased rates of infant mortality, poor nutrition, and adverse birth outcomes. Education, residence, wealth, and healthcare affected high-risk fertility. Women who did not receive formal education showed higher fertility risk behavior when contrasted with those who had received some schooling. Affluent women were more likely than those of low socioeconomic status to participate in high-risk fertility activities. Better access to quality maternal healthcare and higher levels of women's education can cause a decline in high-risk fertility behaviors.

Howlader et al. (2022) employed descriptive statistics and Pearson's chi-square test to analyze the influences on high-risk fertility behaviors of Bangladeshi women of reproductive age. Researchers observed a connection between partners' higher education levels and husbands' reduced engagement in high-risk fertility behaviors. The fertility risk for women with Caesarean section deliveries was lower compared to those with normal births.

The high-risk fertility behaviors decreased for women between 25 and 34 with secondary education or higher, as well as their partners with higher education levels. Fertility complications are more likely with unplanned pregnancies and no contraception.

Place of Residence and Maternal Mortality

The location where pregnant women live affects their reproductive and maternal health, raising the risk of maternal mortality. Healthcare access, fertility rates, and maternal deaths are more unequal for women in rural areas compared to their urban counterparts. Samuel et al. (2021) used descriptive analysis and Fairlie non-linear decomposition to examine maternal healthcare disparities in rural and urban sub-Saharan Africa. The availability of maternal care differs between rural and urban areas, which is associated with household wealth, media exposure, women's education, and the education of husbands and partners. Maternal healthcare service usage was notably greater in urban areas than in rural areas. Maternal healthcare usage is limited in sub-Saharan Africa's rural areas because of the conditions of healthcare facilities. In rural areas, women choose to give birth at home or alternative centers rather than healthcare institutions. Compared with urban areas, rural areas frequently lack enough health professionals, including doctors, nurses, and midwives. Limited access to quality maternal care and essential medicines persists because of healthcare disparities between rural and urban areas.

Harrington et al. (2023) analyzed the influence of rural and urban disparities on maternal mortality in the United States. Maternal deaths were notably higher in rural areas as opposed to urban areas from 2016 to 2019.

Women living in rural areas were 1.93 times more likely to experience maternal deaths compared to women in urban areas. Rural areas had higher rates of maternal ICU admissions and maternal mortality compared to urban areas. The researchers neglected to analyze the socioeconomic and demographic factors related to maternal mortality in rural areas.

Wealth Quintile and Maternal Mortality

Women's wealth quintile significantly affects the quality of care services provided. Wealth is strongly associated with the type of birth help a skilled birth attendant provides during delivery. Women of higher wealth have better access to maternal and medical care services than those of lower wealth. Sanogo and Yaya (2020) investigated how wealth affects the use of maternal care. Women in the highest wealth quintile had a stronger correlation between maternal care services than those in the lower quintile. Using maternal care services was strongly associated with visits to health facilities for delivery, PNC, and ANC. Wealth quintiles play a role in determining the accessibility of maternal care services and maternal health outcomes. Ekholuenetale et al. (2022) investigated how socioeconomic factors influence the use of antenatal care in Liberia. The study identified wealth and region as factors contributing to the disparities in maternal care services. Women from more affluent households saw a significant rise in ANC visits, medical services, and maternal care usage compared to those from the poorest households. Studies have overlooked the correlation between wealth quintile and maternal mortality.

Maternal Education and Maternal Mortality

Mothers' education is a vital factor in promoting maternal health use (Ketema et al., 2020; Mensch et al., 2019; Wang et al., 2021). Barman et al. (2020) found that Indian women with higher education had increased ANC visits and maternal care services. Lack of education increases the risk of maternal morbidity and mortality. Ariyo et al. (2017) investigated how the social and cultural environment affects maternal mortality. Researchers used a multilevel logistic regression model to examine the correlation between social, cultural environment, and maternal mortality. The relationship between a woman's socioeconomic status, social/cultural environment, and factors such as reproductive status, healthcare accessibility, and health behaviors were analyzed using the McCarthy framework in this study. The study found a strong link between women's education and maternal mortality. Meh et al. (2019) examined the factors influencing maternal mortality in northern and southern Nigeria. A correlation was found between education and maternal mortality in Northern Nigeria. Women with limited education, early marriage, and cultural employment barriers were more likely to experience maternal mortality.

Kea et al. (2023) employed logistic regression analysis to explore the variation in maternal mortality in the Sidama region. Mothers lacking formal education faced a greater risk of maternal death than those with formal education. Maternal health service usage and awareness of pregnancy complications and obstetric emergencies were higher among women with higher education.

Wang et al. (2021) investigated the relationship between maternal education, healthcare use, and preventable maternal deaths in the Democratic Republic of the Congo. Wealth and geographic regions were found to be factors that influenced maternal healthcare use. A higher level of education correlated with a greater likelihood of living in urban areas among women. Women with secondary education or higher were more likely to have regular ANC and PNC visits and Cesarean sections. ANC visits were less commonly used by women without education. Skilled attendants at birth and access to prenatal and emergency obstetric care were found to result in higher maternal education levels.

Maternal Occupation and Maternal Mortality

Working women's health can be affected by occupational exposure during pregnancy. Feitosa-Assis and Santana (2020) found evidence of a link between work-related risk factors and maternal mortality, particularly among service and agricultural workers. Domestic workers and service workers had notably higher maternal mortality rates. Women in lower socioeconomic positions are more likely to experience increased maternal mortality risks because of their employment status. Seidu et al. (2022) investigated the relationship between maternal occupations and early antenatal care services in sub-Saharan Africa. ANC service usage was less common among women working in agriculture. Women in managerial roles were more likely to prioritize early ANC visits than those in agriculture. Women of higher socioeconomic status had a greater tendency to seek early ANC. Tessema et al. (2020) and Appiah et al. (2021) also found links between occupation/maternal occupation and the use of postnatal care (PNC) services.

Educational Attainment and Maternal Mortality

Educational attainment is crucial in determining maternal health and overall health status. Paul and Chouhan (2019) examined how sociodemographic factors influence maternal healthcare in India. The study examined how socioeconomic and demographic factors relate to maternal healthcare. Using maternal healthcare services was positively influenced by higher levels of education. Women with higher education were 3.6 times more likely to have an institutional delivery than those without. Higher education gives women better access to healthcare information and a better understanding of maternal risks. Kota et al. (2023) studied the relationship between socioeconomic and cultural factors and maternal healthcare utilization in Togo. Women receiving primary and secondary education had a greater chance of attending appropriate ANC visits than those without formal education. Women who had primary, secondary, and higher education were more likely to give birth in a health facility compared to those who had no formal education. Age, education, religion, and region of residence are among the factors that affect maternal healthcare access in Togo.

Marital Status and Maternal Mortality

Agaba et al. (2022) used binary logistic regression to study the factors influencing health facility childbirth in unmarried and married youth in Uganda. Unmarried adolescent women were more likely to give birth in health facilities compared to their married counterparts. Adolescent women with secondary education were more likely to use healthcare facilities for childbirth compared to married women.

Women between 15 and 24 were more likely to use health facilities during childbirth compared to older women. Married adolescent women in the middle wealth quintile were likelier to give birth in health facilities. Rural unmarried and married adolescent women had lower rates of health facility usage. Zhang et al. (2023) examined the relationship between marital status, educational levels, and neonatal complications and their impact on pregnancy outcomes. Marital status has a strong correlation with pregnancy complications, such as placental inflammation, preterm birth, and stillbirth. Unmarried women had the highest prevalence of sub-chronic hematoma.

Maternal Age at Birth and Maternal Mortality

Women's age plays a crucial in childbirth. The older a woman is when she gives birth, the higher the risk of maternal mortality. MacDorman et al. (2021) investigated the causes of increased maternal mortality risk in women aged 35 and older. Women between 35 and 39 had higher maternal mortality rates than those under 35. Maternal mortality rates were higher in the 45 and 54 age group compared to the 40 and 44 age group. Among women under 35, obstetric hemorrhage was a significant factor in the increased risk of maternal mortality. Women over 35 face a higher risk of maternal mortality, which includes obstetric embolism and eclampsia or preeclampsia. Aoyama et al. (2019) examined how maternal age relates to severe maternal outcomes and mortality in Canada. Maternal mortality rates showed a marked increase among women between 40 and 44, in contrast to those between 20 and 24. An increased risk of maternal mortality was 4.39 times more likely to be experienced by women aged 45 and older. Maternal age continues to affect maternal mortality and morbidity rates.

Distance to the Nearest Health Facility and Maternal Mortality

Banke-Thomas et al. (2022) investigated the impact of pregnant women's travel to hospitals during emergencies on maternal mortality in Lagos, Nigeria. The researchers studied a group of 4,181 pregnant women who had obstetrical emergencies, and 182 (4.4%) of them died. Among the deceased, 60.3% traveled a distance of 10 km or less from their residences, and 61.9% reached the hospital within 30 minutes or fewer. Maternal death was significantly associated with women who traveled 10–15 km. Women who sought medical care at rural hospitals experienced a significant rise in maternal mortality. Escamilla et al. (2017) found that women are increasingly selecting public hospitals instead of nearby health facilities because of the higher standard of services. Women in the richest and poorest quintiles travel long distances for maternal care services and actively seek other health facilities because of the poor conditions. Among women who did not visit the nearest health facility, two-thirds opted for public hospitals. The logistic regression showed that the choice to bypass was independent of the quality of the nearest facility. Public hospitals were preferred for deliveries over private hospitals or high-quality health centers. Cost was a key factor for women choosing public hospitals over smaller private facilities. Treacy et al. (2018) examined the impact of distance, accessibility, and financial factors on childbirth in rural Sierra Leone. The lack of accessible and affordable transportation, along with the distance to the hospital, posed significant challenges for women trying to reach the hospital for delivery. The researchers identified that most women hesitated to travel long distances because of financial limitations when seeking quality maternal healthcare.

Mode of Transportation to the Nearest Health Facility and Maternal Mortality

Access to nearby health facilities for women can be affected by the availability of different transportation methods. Lack of transportation in rural areas creates barriers for mothers seeking quality maternal care, leading to an increased risk of life-threatening incidents during transit to the nearest healthcare facilities. Kisiangani et al. (2020) found that public transportation or walking are the primary transportation options for pregnant women in their third trimesters when going to health facilities. Pregnant women could not use health facility delivery because of the expensive transportation costs. Dahab et al. (2020) underscored the importance of tackling the limited availability of maternal care services in African countries, which plays a significant role in maternal mortality. Lack of transportation poses a significant barrier for women accessing healthcare facilities in rural areas. Inadequate road conditions hinder women from seeking maternal care services. Researchers found that walking was the only mode of transportation to the nearest health facility. Some women chose home delivery over ANC services because of transportation challenges. In Ghana and other sub-Saharan African nations, transportation challenges pose obstacles to healthcare access.

Varela et al. (2019) underscored that limited access to health facilities is a major hurdle for healthcare in middle-income countries. The study found that 1.8% of participants identified walking as the primary means of transportation for their household members to access a primary health facility. Researchers concluded that delays in accessing health facilities were caused by a lack of transportation, financial constraints, and extended travel times among women living in rural Malawi.

Place of Delivery and Maternal Mortality

The accessibility of healthcare services for women, regardless of where they give birth, is critical and can be life-threatening during maternal complications. The proportion of women giving birth in health facilities plays a crucial role in reducing health risks for both the mother and newborn. Health facilities are vital in reducing health risks for both the mother and newborn. Adde et al. (2020) analyzed the factors influencing delivery location in reproductive-age women across sub-Saharan Africa. Urban women were found to have a higher tendency to give birth at a health facility compared to rural women. Deliveries were common among women between 20 and 24 at the health facility. Women who had a higher level of education, wealth, separation, multiple ANC visits, and skilled provider care showed a stronger preference for delivering at a health facility. The likelihood of giving birth in a health facility was higher among women whose partners were educated than those with uneducated partners. Women who did not have to overcome long distances were more easily convinced to deliver at a health facility compared to those who had significant distance challenges. The preference for health facilities among reproductive-age women in sub-Saharan Africa decreased with age.

Doctor et al. (2018) conducted a study on health facility delivery in sub-Saharan Africa, investigating the influence of demographic and socio-economic factors. Women in the highest wealth quintile had a higher rate of health facility births than those in the lowest. Women who had primary education were twice as inclined to give birth in healthcare facilities as those without education.

Health facility births were more common among urban women compared to rural women. Access to healthcare in rural and urban areas positively affects maternal and child health.

Religion and Maternal Mortality

Religious beliefs, as well as traditional and cultural practices, can increase the risk of maternal mortality in women. Yarney (2019) conducted a community-based cross-sectional study to examine how sociodemographic factors affect maternal mortality and decision-making in healthcare. Religious beliefs significantly affected maternal mortality and health decisions. Sociocultural factors, such as pregnancy-related taboos, influenced decisions about maternal health and led to an increase in maternal mortality rates. Muslim women reported higher factors contributing to maternal death compared to Christian women. Ariyo et al. (2017) investigated the impact of sociocultural factors on Nigeria's high maternal mortality rates. Muslim women had a higher rate of maternal deaths compared to Christian women. Pregnancy-related causes resulted in higher mortality rates among Muslim women and women between 20 and 29. Religion played a role in the high maternal mortality rate in Nigeria. Nigerian Muslim women often request their husbands' permission, resulting in adverse maternal outcomes or dangerous delays in ANC visits. Improving access to maternal care services and raising awareness about maternal health is crucial in reducing maternal mortality in the Muslim regions of Nigeria.

Region and Maternal Mortality

Maternal care services and mortality rates differ across countries because of disparities in regional development. Gulumbe et al. (2018) analyzed maternal mortality rates in rural communities in Nigeria. The study showed that maternal mortality rates are highest in the Central, North East, and North-West regions. Maternal mortality is the highest in rural areas of northern Nigeria. Inadequate health systems, facilities, low ANC visits, and maternal care services significantly influenced the risk of women dying from maternal deaths in the region. Maternal mortality rates were elevated because of home births performed by traditional birth attendants, with some deliveries lacking professional health attendants. It is crucial to address the alarming rate of maternal deaths in Kebbi State and the rest of Nigeria. Snyder et al. (2020) examined regional differences in maternal mortality rates in the United States. The study showed regional disparities in maternal mortality, with the South experiencing higher rates and the Northeast having lower rates. The Northeast region has the highest number of health professionals, such as obstetricians and gynecologists, certified nurses, and midwives.

Insufficient numbers of certified nurse-midwives, internal medicine physicians, obstetricians, and gynecologists contributed to the increase in maternal mortality rates in the South.

HIV-Related to Breastfeeding and Maternal Mortality

Maternal mortality rates are rising because of HIV transmission during breastfeeding.

The AIDS epidemic is a significant issue affecting global population health. Factors, including access to care, antiretroviral therapy, knowledge about HIV, stigma, risky behaviors, and STI services, affect HIV care and treatment. Beyene et al. (2018) found several factors associated with the transmission of HIV from mother to child during breastfeeding. Partner involvement, counseling, and delivery method affected HIV transmission through breastfeeding. AIDS plays a significant role in the high rates of childhood illness and death in Ethiopia. Home delivery significantly elevated the chances of children contracting HIV compared to delivery at health institutions. HIV-exposed children who practiced mixed breastfeeding had a much higher risk of HIV infection compared to those who exclusively breastfed or used replacement feeding (Beyene et al., 2018). HIV-positive mothers can minimize HIV transmission risk during breastfeeding with careful monitoring and support. Umeobieri et al. (2018) studied how HIV-positive mothers receiving prevention of mother-to-child transmission care perceive and engage in breastfeeding. Mothers were familiar with HIV transmission during breastfeeding. HIV-positive mothers breastfed despite limited support and health risks. Umar et al. (2022) revealed that children who were exclusively breastfed had double the chance of testing HIV negative, in contrast to those who consumed both breast milk and other foods. The study revealed that exclusive or partial breastfeeding decreased the likelihood of positive PCR tests in children compared to formula feeding. The practice of breastfeeding is prevalent among HIV-positive women in developing countries. Pregnant women, during delivery or through breastfeeding, can transmit the infection.

The decision to breastfeed infants of HIV-positive mothers requires evaluating the risk of HIV transmission versus the heightened risks of death caused by malnutrition, diarrhea, and pneumonia. HIV-infected mothers are advised to undergo lifelong antiretroviral therapy or prophylaxis to minimize the risk of HIV transmission while breastfeeding.

ANC Visits and Maternal Mortality

Early detection, diagnosis, treatment, and prevention of diseases or infections can be achieved through ANC visits. Consistent ANC visits are crucial to save lives. A smooth labor transition, safe birth, and healthy pregnancy are vital for the well-being of both mothers and newborns. Adedokun et al. (2020) examined factors linked to using ANC in women of reproductive age in sub-Saharan Africa. In sub-Saharan Africa, 13.0% of women did not receive ANC, while 35.0% and 53.0% used it correctly. Women between 25 and 34, with at least a secondary education and from affluent households, had the highest ANC use. Women with at least a secondary education had a 34.0% higher chance of using ANC than those without education. Using ANC was strongly correlated with household wealth. Women from more affluent households were likelier to use ANC than those from poorer households. Muchie (2017) conducted a study on how ANC services affect the frequency of antenatal care visits (four or more). Women with higher education were more inclined to complete four or more ANC visits than those without formal education. Women between 20 and 39 had more frequent ANC visits than those between 15 and 19. A correlation was found between women living in rural areas with low socioeconomic status and education and low attendance at four or more ANC visits.

Tessema et al. (2021) used a multilevel multivariable logistic regression model to examine sub-Saharan Africa's recommended antenatal care utilization determinants. The study revealed that women in the wealthiest quintile had a higher rate of ANC visits than those in the poorest quintile. ANC visit rates among women in sub-Saharan Africa remain low. Improving maternal health education is crucial to tackling low ANC utilization among impoverished women in sub-Saharan Africa.

Maternal Literacy and Maternal Mortality

Low maternal literacy is associated with a higher risk of complications during pregnancy and childbirth for women. Maternal literacy, birth preparedness, and complication readiness showed a significant correlation in pregnant women from Ethiopia (Ananche et al., 2020). Women who had higher education were more likely to be well-prepared for childbirth and capable of managing maternal complications, in contrast to women with basic literacy skills. Meldgaard et al. (2022) demonstrated a correlation between inadequate women's health literacy and elevated risks in pregnancy and childbirth. Lack of education poses a threat to women's health as they struggle to comprehend health information. Nawabi et al. (2021) investigated how health literacy in expectant mothers influences the health outcomes of both the mother and baby. Low maternal health literacy was found to be significantly correlated with negative beliefs about medicine, attitudes, knowledge, and lifestyle during pregnancy.

Summary and Conclusions

Maternal mortality poses health challenges for women of childbearing age, impacting their reproductive and maternal well-being. Despite the plethora of scientific research, the rates of maternal mortality have increased. The chapter investigated a range of risk factors and causes of maternal mortality in Liberia, including the participants' background characteristics, socioeconomic factors, and household sociodemographic characteristics. I used the socioecological model of health to examine how various factors contribute to increased maternal mortality risk in women between 15 and 49 in Liberia. The model emphasizes the crucial role of multiple influences on health behaviors, with environmental factors driving outcomes and behaviors being interconnected across these levels. This research synthesized studies related to the key independent and dependent variables. By employing multiple variables in this investigation, it is possible to bridge the gaps in the literature in Liberia, particularly between rural and urban areas, and enhance our understanding of maternal mortality. **Chapter 3** includes the introduction, research design, methodology, data analysis plan, threats to validity, and a summary.

Chapter 3: Research Method

Introduction

This quantitative, retrospective case-control study examined associations between participants' background characteristics, socioeconomic factors, household sociodemographic factors, and maternal mortality. I conducted descriptive statistics and binomial logistic regression to analyze and interpret the findings. Descriptive statistics, such as frequencies and percentages, were used to summarize and explain the population data. The outcome of the dependent variable was predicted using binomial logistic regression, considering one or more predictor variables. Chapter 3 includes the introduction, research design and rationale, methodology, data analysis plan, threats to validity, and a summary.

Research Design and Rationale

The predictor variables included the participants' background characteristics (such as maternal alcohol consumption, media exposure, husband/partners' education, family planning, mothers' PNC checkup after delivery, fertility status, place of residence, and wealth quintile). The socioeconomic factors were maternal education, maternal occupation, educational attainment, marital status, and maternal age at birth. Household sociodemographic characteristics were distance to the nearest health facility, mode of transportation to the nearest health facility, place of delivery, religion, region, HIV-related breastfeeding, ANC visits, and maternal literacy. The dependent variable was maternal mortality.

The study design effectively examined women between 15 and 49 who either died or survived maternal mortality-related risks or causes. I conducted a cost-efficiency analysis using secondary data. Analyzing the 2013 LDHS secondary data allows me to study the relationship between predictor variables and the outcome variable. I aimed to increase my understanding of the factors that contribute to the risks and causes of maternal mortality in Liberia.

Methodology

I used nationally representative cross-sectional data from the 2013 Liberia Demographic and Health Survey (LDHS). A questionnaire was designed for women between 15 and 49 to obtain a representative sample of participants. The Liberia Institute of Statistics and Geo-Information Services implemented the 2013 LDHS conducted by the Ministry of Health and Social Welfare (MOHSW). ICF International supported the project funded by USAID, offering technical help. The surveys used a two-stage stratified cluster design. Clusters or Enumeration Areas (EA) were chosen from the 2008 National Population and Housing Census (NPHC) data. The questionnaires followed the MEASURE DHS standard survey questionnaires. 98.0% of eligible women who participated in the interview responded. The data was analyzed using SPSS version 27. The 95% confidence interval (CI) shows the level of precision for the effect. I calculated the odds of maternal death and used a significance level of 0.05% to establish statistical significance.

Population

The study included rural and urban households and national populations across all five regions (North Western, South Central, South Eastern A, South Eastern B, and North Central) of Liberia. Women between 15 and 49 were the primary focus of the survey. Within the 15 counties, 30 sampling strata were equally distributed between rural and urban regions. Every urban and rural cluster had 30 households sampled. The cases were mothers who died during pregnancy or childbirth. Controls were women who were pregnant or had recently given birth. The sample size analyzed was ($N = 8,937$).

Sampling and Sampling Procedures

Cluster sampling was used in the surveys. Half of the 15 counties were designated as rural and the other half as urban, resulting in 30 sampling strata. A household listing operation was conducted in all selected EAs before the main survey. The final household sample was determined by only including the selected segment during the household listing process. In each urban and rural cluster, 30 households were selected in the second selection stage using equal probability systematic sampling. The 2013 LISGIS developed the 2013 sampling frame using the 2008 NPHC data. Nomadic and institutional populations, such as hotels, barracks, and prisons, were not part of the sampling frame. Cohen's d was employed in the study to measure the effect sizes and determine the association level between variables. A confidence level of 95% was used, along with a statistical significance threshold of $p < 0.05$. A power level of .8 or higher will lead to rejecting the null hypotheses in the study.

Procedures for Recruitment, Participation, and Data Collection

The recruitment of LDHS field staff started in October 2012. All counties submitted 3,662 applications. Every application underwent screening within two weeks. The number of shortlisted candidates for aptitude testing was 1,339. Two aptitude tests were given. The event started in November 2013. In January 2013, those who met the criteria took a second aptitude test. In the first test, there were 1,064 candidates, compared to 564 in the second. Among the 128 people invited to the main training, 82 were women, and 46 were men. The field staff underwent a four-week training from February 11th to March 8th, 2013. The MEASURE DHS training followed the protocols, including classroom lectures, role-playing interviews, assessments, and hands-on field experience.

In the fieldwork, 65 women and 31 men were part of the main training group. Sixteen individuals filled the team supervisor and field. Everyone else assumed the position of interviewer. Team supervisors and field editors received extra training on field editing methods, data quality control procedures, and fieldwork coordination. Sixteen field teams collected the data, including a supervisor, a field editor, three female interviewers, one male interviewer, and a driver. A team supervised the field activities, including five senior staff members from the Liberia Institute of Statistics and Geo-information Services and a senior staff member from the National AIDS and STI Control Program. A resident advisor, survey technical specialist, and senior data processing specialist were part of the MEASURE DHS project's fieldwork monitoring team.

The data processing team included 12 data entry clerks, 2 data editors, 1 data entry

supervisor, and two questionnaire administrators.

Instrumentation and Operationalization of Constructs

Two approaches were used to estimate maternal mortality in Liberia: indirect

sisterhood and changed direct estimation methods (LDHS, 2014). I used secondary data

from the 2013 LDHS. **Tables 1-3** display the independent variables used in the study,

including any changes or recoding resulting from the datasets.

Table 1

Participants' Background Characteristics

Variable	Level of Measurement	Values
Maternal Alcohol Consumption	Nominal	0 = no, 1 = yes
Frequency of Listening to the Radio	Nominal	0 = not at all, 1 = less once a week, 2 = at least once a week
Frequency of Reading Newspapers/ Magazines	Nominal	0 = not at all, 1 = less once a week, 2 = at least once a week
Unmet Need	Nominal	0 = not at all, 1 = less once a week, 2 = at least once a week
husbands'/Partners' Education	Nominal	0 = no education, 1 = primary, 2 = secondary, 3 = higher
Mother's PNC Checkups After Delivery	Nominal	0 = no, 1 = yes
Birth Order	Nominal	1 = 0-1, 2 = 2-3, 3 = 4-5, 4 = 6+
Place of Residence	Nominal	0 = urban, 1 = rural
Wealth Quintile	Nominal	1 = poorest, 2 = poorer, 3 = middle, 4 = richer, 5 = richest

Table 2

Socioeconomic Factors

Variable	Level of Measurement	Values
Maternal Education	Nominal	0 = no education, 1 = primary, 2 = secondary and higher
Maternal Occupation	Nominal	0 = not working, 1 = professional, technical, managerial, or clerical/sales, 2 = agriculture-self-employed, 3 = agriculture employee/household and domestic/services/skilled manual/unskilled manual/other
Educational Attainment	Nominal	0 = no education, 1 = incomplete primary, 2 = complete primary, 3 = incomplete secondary, 4 = complete secondary, 5 = higher
Marital Status	Nominal	0 = never in union, 1 = married, 2 = living with partner, 3 = widowed, 4 = divorced, 5 = no longer living together/separated
Maternal Age at Birth	Nominal	1 = 15-19, 2 = 20-24, 3 = 25-29, 4 = 30-34, 5 = 35-39, 6 = 40-44, 7 = 45-49

Table 3

Household Sociodemographic Characteristics

Variable	Level of Measurement	Values
Distance to Nearest Health Facility	Nominal	0 = less than one mile, 1 = 1-3 miles, 2 = 4-5 miles, 3 = don't know
Mode of Transportation to the Nearest Health Facility	Nominal	1 = private transportation, 2 = public, 3 = walking, 4 = bicycle, 5 = wheelbarrow, 6 = other
Place of Delivery	Nominal	0 = at home, 1 = government hospital, 3 = government health facility
Religion	Nominal	1 = Christian, 2 = Muslim, 3 = traditional religion 4= no religion
Region	Nominal	1 = North Western, 2 = South Central, 3 = South Eastern A, 4 = South Eastern B, 5 = North Central
HIV-Related Breastfeeding	Nominal	0 = no, 1 = yes
Antenatal Care (ANC) Visits	Nominal	0 = no antenatal visits, 1 = 1-3 antenatal visits, 2 = 4+ antenatal visits
Maternal Literacy	Nominal	0 = cannot read at all, 1 = able to read only parts of a sentence, 2 = able to read a whole sentence

Data Analysis Plan

For statistical analysis of the data, I used SPSS version 27 (Wagner, 2017). I employed a descriptive statistic to calculate missing value rates for each variable and performed the SPSS Missing Value Analysis procedure to identify missing value patterns. With missing data, I would employ a pair-wise exclusion method. I verify the accuracy of every variable's scores by identifying and correcting errors in the data file during data screening. I eliminated data with higher percentages of missing values during the analysis. Cases without outlier values were the only ones considered by the statistical analysis. The data was manipulated before analyzing the merged data.

Data was collected from a representative sample of women between 15 and 49 across the country using a survey questionnaire. With ICF International's support and USAID's commissioning, the Liberian government conducted population-based surveys. Two-stage clusters with stratification were employed in the survey design.

The selection process began by choosing clusters or enumeration areas (EA) from the latest population census sample frame. These clusters were used for the systematic selection of households. The MEASURE DHS program developed standardized questionnaires for household, men, and women surveys. In-person interviews resulted in a 95.0% response rate for both surveys. To interpret the findings, I used both descriptive and inferential statistics.

Descriptive Statistical Analysis

Descriptive statistics included frequencies or percentages and an overview of data from the entire population. Predictor variables were visually represented using tables and figures (Wagner, 2017).

Inferential Statistics

I conducted a binomial logistic regression analysis to examine associations between categorical independent variables and the dependent variable.

The odds ratio (OR) was employed to assess the associations between the predictor and the outcome variables. The p-value of 0.05 establishes a statistical significance level and a 95% confidence interval. Maternal mortality was recoded as 0 = alive and 1 = dead.

Threats to Validity

Even though this study has methodological strengths, there are still potential validity threats. The self-report data from the 2013 LDHS could be distorted because of recall bias. Researchers' personal bias can be influenced by the social context of an interview. The survival siblings' report frequently lacks accuracy in documenting and representing cases of maternal mortality. Validity threats included both internal and

statistical conclusion validity. The study's internal validity was impacted by selection bias, changes in the measuring instrument, and response measurement frequency. The personal bias of researchers can affect the sample population. Statistical conclusions may be compromised because of low power, violated assumptions, omitted-variable bias, and under-interpretation of findings (Szklo & Nieto, 2019). Accurate statistical conclusions depend on considering the relationships between variables in the analysis.

Ethical Procedures

Ensuring participant rights and data protection were the main ethical priorities of the research. De-identified secondary data from the 2013 LDHS was analyzed in the study. The data excluded participant information, names, addresses, and health data. I ensured ethical considerations were considered when following regulations to protect human subjects. Participants were not requested consent, as no primary data requiring consent was collected. I was granted IRB clearance to adhere to Walden University's ethical standards. I registered as a DHS data user to comply with host-country agreements and access downloadable datasets from the Demographic and Health Survey. Host-country governments have agreed to allow the DHS Program to store data in its repository. Centralizing all datasets in the DHS Program repository makes comparative analysis over time within or across countries possible.

Only research activities approved by host-country governments can access DHS. Only individuals with proper authorization and sincere intentions may access the data. A signed agreement was needed to ensure the dataset's integrity. My research topic on maternal mortality included Walden University in the submission.

My research data is stored on different devices and storage mediums, such as a central server, iPad, laptop, DVDs, CDs, external drive, and a locked cabinet at home. The privacy of participants was safeguarded by using aggregated data. Dissemination of findings will be widespread to stakeholders, including health professionals, policymakers, the Ministry of Health, budget and finance, civil society, the media, and the public.

Summary

In Chapter 3, a retrospective case-control design was used to study the effect of predictor variables on maternal mortality. The design helps identify the major causes of maternal mortality in women between 15 and 49 in Liberia. The purpose of the design was to analyze the factors that might be associated with maternal mortality in this study. A secondary analysis of the 2013 LDHS was conducted. I filtered out cases irrelevant to participants' background characteristics, socioeconomic factors, and household sociodemographic characteristics. Quantitative analyses included descriptive statistics and binomial logistic regression. Statistical significance was established with a *p*-value of 0.05 and a 95% confidence level. The odds ratio approximated the risk of maternal mortality in this retrospective case-control design. Chapter 4 includes the findings for each research question and the correlations between independent and dependent variables.

Chapter 4: Results

Introduction

This quantitative, retrospective case-control study examined associations between participants' background characteristics, socioeconomic factors, household sociodemographic factors, and maternal mortality. This chapter includes the introduction, data collection, results, and a summary.

Data Collection

The Liberia Institute of Statistics and Geo-Information Services collected data from March 10 to July 19, 2013. The Ministry of Health and Social Welfare conducted the survey. ICF International supported the MEASURE DHS project, which received funding from the United States Agency for International Development. Field staff recruitment for the Liberia Demographic and Health Survey began in October 2012. Between February 11 and March 8, 2013, the field training was conducted. MEASURE DHS procedures, tests, and field exercises were incorporated into the training. The fieldwork involved 65 females and 31 males, with 16 supervisors, 16 editors, and the rest as interviewers. I used descriptive statistics to summarize and explain the population's data, encompassing frequencies and percentages. I conducted a binomial logistic regression model and analyzed the odds ratios.

Results

The tables present a descriptive analysis of a representative population, including measurements and frequencies of each variable. **Table 4** and **Figure 5** show maternal mortality frequencies among women between 15 and 49. Among 8,937 sample cases, 239 (81.0%) mothers survived pregnancy-related causes or risks, while 1,698 (19.0%) died from pregnancy and childbirth complications. The 2013 LDHS report revealed 1,072 maternal deaths per 100,000 live births, unlike the study's dataset. Sibling reports were employed as direct estimates of maternal mortality in Liberia, which could have resulted in misclassification, under-reporting, or inaccurate documentation of deaths among women between 15 and 49. The 2013 LDHS report showed a 38.0% rise in maternal deaths, compared to 35.0% in 2007. Evaluating how maternal mortality affects women's health is complicated because of the unavailability of death records at the county, district, and regional scales.

Table 4

Maternal Mortality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Alive	7239	81	81	81
	Dead	1698	19	19	100
	Total	8937	100	100	

Figure 5

Maternal Mortality Rate
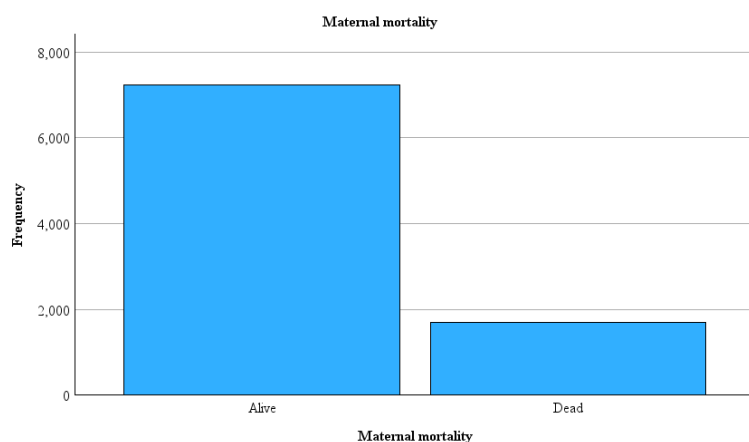
Table 5 and Figure 6 present data on the proportion of women between15-49 who consumed alcohol compared to those who did not. Among pregnant women between 15 and 49, 6,805 (76.1%) consumed alcohol, while 2,131 (23.8%) did not use alcohol. The consumption of alcohol during pregnancy can have serious consequences for both the mother's health and potential mortality.

Table 5

Maternal Alcohol Consumption

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	6805	76.1	76.2	76.2
	Yes	2131	23.8	23.8	100
	Total	8936	100	100	
Missing	System	1	0		
Total		8937	100		

Figure 6

Maternal Alcohol Consumption

Maternal alcohol consumption
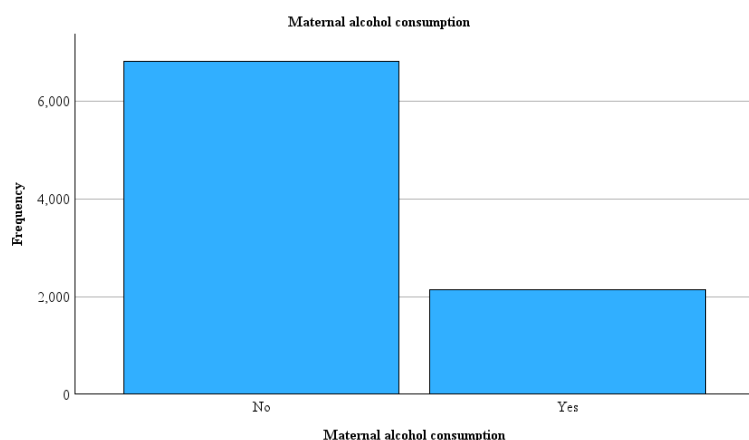
Table 6 and **Figure 7** show that among women between 15 and 49, 2,965 (33.3%) never had radio access, 2,811 (31.5%) listened to the radio less than once a week, and 3,154 (35.3%) listened to the radio at least once a week. Out of the 8,937 cases studied, women who listened to the radio at least once a week had a 35.3% higher chance of being exposed to risk factors associated with maternal death compared to those without radio access.

Table 6

Frequency of Listening to Radio

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	2965	33.2	33.2	33.2
	Less than once a week	2811	31.5	31.5	64.7
	At least once a week	3154	35.3	35.3	100
	Total	8930	99.9	100	
Missing	9	7	0.1		
Total		8937	100		

Figure 7

Frequency of Listening to Radio
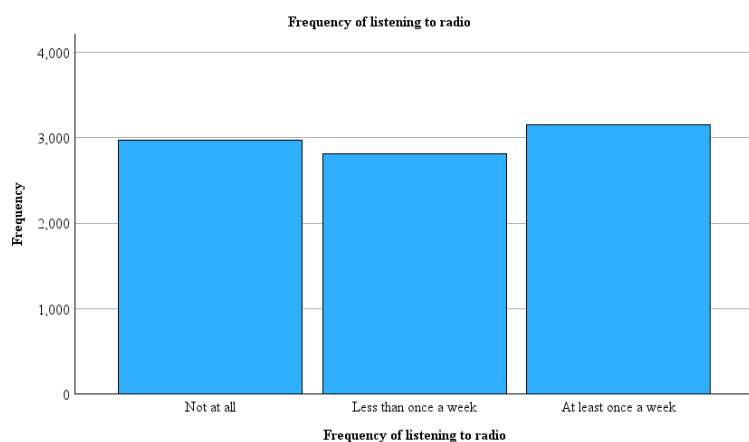
Table 7 and Figure 8 display the percentage of participants exposed to media. Women between 15 and 49 who lacked access to newspapers or magazines were 7,547 (84.4%) compared to 835 (9.3%) of those who read newspapers or magazines less than once a week. Among women between 15 and 49, 526 (5.9%) were exposed to newspapers or magazines at least once a week. Women living in urban are more likely to be exposed to newspapers or magazines compared to those who live in rural areas.

Table 7

Frequency of Reading Newspapers or Magazines

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	7547	84.4	84.7	84.7
	Less than once a week	835	9.3	9.4	94.1
	At least once a week	526	5.9	5.9	100
	Total	8908	99.7	100	
Missing	9	29	0.3		
Total		8937	100		

Figure 8

Frequency of Reading Newspapers or Magazines

Frequency of reading newspaper or magazine
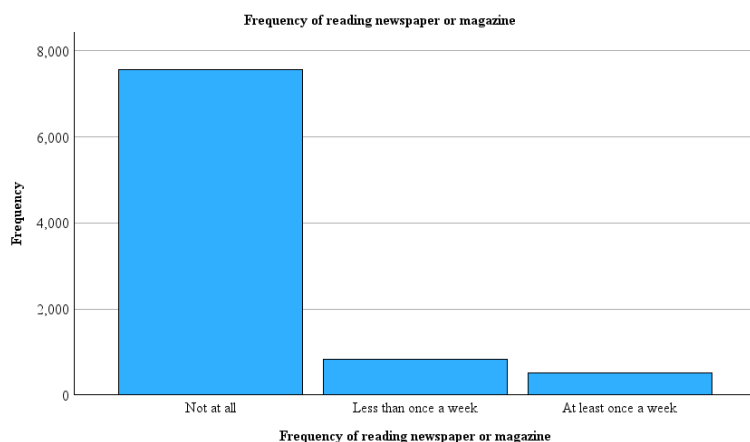
Access to information is crucial for women to comprehend the risks associated with maternal mortality. In Liberia, urban women between 15 and 49 have higher television access to family planning information compared to their rural counterparts. **Table 8** and **Figure 9** show the percentage of women who were exposed to television access. Among 8,908 women, 6,555 (33.3%) had never watched television, 1,349 (15.1%) watched television less than once a week, and 1,025 (11.5%) watched television at least once a week. This information shows how frequently women are exposed to mass media. Awareness of family planning, HIV/AIDS, and other health topics remains critical in reducing mortality. In Liberia, women choose radio as their main source of information, over newspapers, magazines, and television. Women between 15 and 49 with higher education and the highest wealth quintile are more likely exposed to any media.

Table 8

Frequency of Watching Television

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	6553	73.3	73.4	73.4
	Less than once a week	1349	15.1	15.1	88.5
	At least once a week	1025	11.5	11.5	100
	Total	8927	99.9	100	
Missing	9	10	0.1		
Total		8937	100		

Figure 9

Frequency of Watching Television

Frequency of watching television
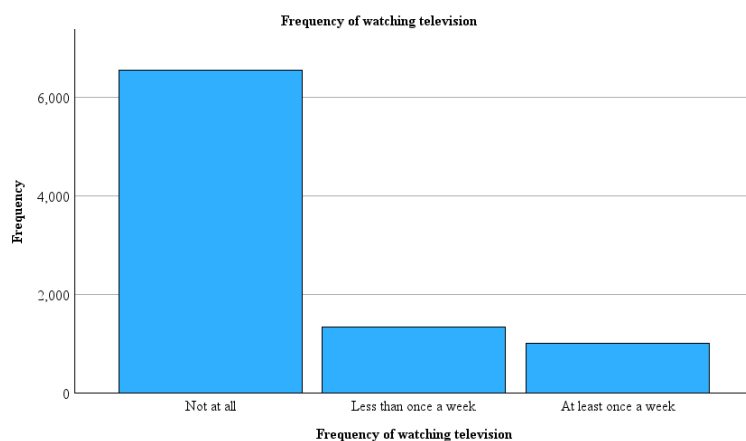
Table 9 and **Figure 10** illustrate the distribution of husbands or partners according to their educational background. Out of 6,452 women, 1,640 (18.4%) had no formal education, 1,269 (14.2%) had primary education, 3,107 (34.8%) had secondary education, and 436 (4.9%) had higher education. Women frequently seek consent from their husbands or partners to access maternal and medical care services.

An increase in maternal care service usage can be attributed to husbands or partners with higher education.

Table 9

Husband/Partner's Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No education	1640	18.4	25.4	25.4
	Primary	1269	14.2	19.7	45.1
	Secondary	3107	34.8	48.2	93.2
	Higher	436	4.9	6.8	100.0
	Total	6452	72.2	100.0	
Missing	System	2485	27.8		
Total		8937	100.0		

Figure 10

Husband/Partner's Education
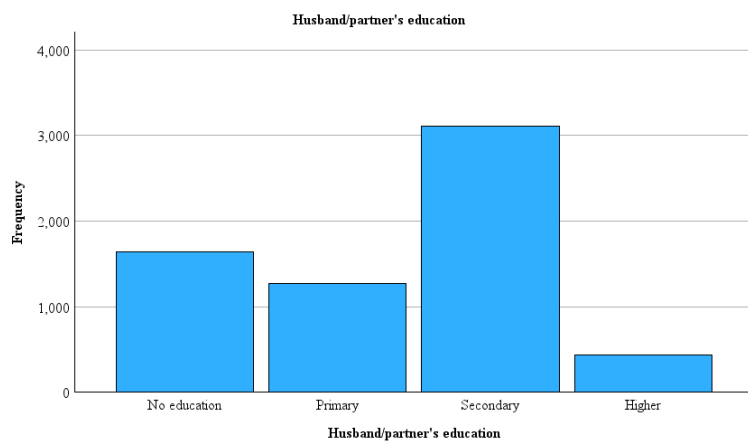
Fertility preferences play a significant role in family planning. A woman's ideal family size and an unmet need for family planning can increase the risk of maternal mortality. The need for contraception, whether for spacing or limiting births, can positively impact health outcomes for both the mother and child. **Table 10** and **Figure 11** include data on the unmet need for family planning. Among 4,419 women, 1,808 (20.1%) of women had an unmet need for spacing, 678 (7.6%) had an unmet need for limiting, and 1,933 (21.6%) had no unmet need for family planning services. Women who refuse all contraceptive methods are most likely to have an unmet need for family planning. The 2013 LDHS report revealed an unmet need for planning of 31.0%. Women living in rural areas are more likely to have an unmet need for limiting childbirth compared to women living in urban areas.

Table 10

Unmet Need

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unmet need for spacing	1808	20.2	40.9	40.9
	Unmet need for limiting	678	7.6	15.3	56.3
	No unmet need	1933	21.6	43.7	100
	Total	4419	49.4	100	
Missing	System	4518	50.6		
Total		8937	100		

Figure 11

Unmet Need
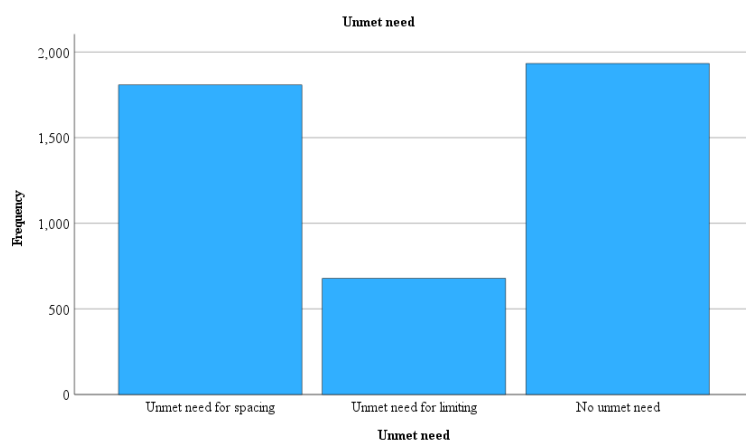
Prioritizing maternal PNC can reduce postpartum hemorrhage and childbirth complications, regardless of the place of birth. Half of all maternal deaths occur within the first 24 hours after delivery. Prenatal care allows for screening, early identification of complications, timely treatment, and disease prevention through immunization and micronutrient supplementation. **Table 11** and **Figure 12** include information on the frequency of PNC check-up usage among mothers between 15 and 49. Among 5,164 women, 1,443 (16.1%) did not have postnatal care checkups, while 3,721 (41.6%) received PNC checkups after delivery.

Table 11

Mother's Postnatal Care Checkup After Delivery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	1443	16.1	27.9	27.9
	Yes	3721	41.6	72.1	100
	Total	5164	57.8	100	
Missing	System	3773	42.2		
Total		8937	100		

Figure 12

Mother's Postnatal Care Checkups After Delivery
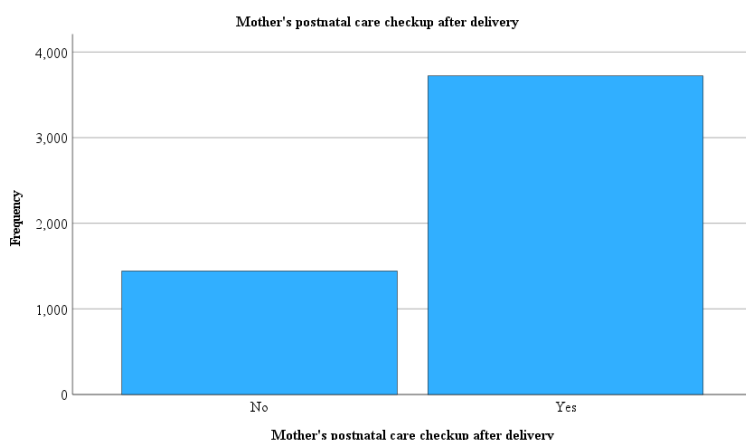
Early childbirth increases the risk of complications during pregnancy, childbirth, and neonatal mortality. **Table 12** and **Figure 13** summarize the birth order distribution among women between 15 and 49. Out of the 7,291 births to women, 1,383 (15.5%) of births to mothers were non-first births, 2,293 (25.7%) were second-third births, and 1,645 (18.4%) were fourth-fifth births. 1,970 (22.0%) of the women had six or more births. Women with six or more children face an avoidable high risk and increased mortality rate during childbirth. Compared to women with fourth-fifth births, those with second-third births faced higher risks during pregnancy and childbirth.

Table 12

Birth Order

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-1	1383	15.5	19.0	19.0
	2-3	2293	25.7	31.4	50.4
	4-5	1645	18.4	22.6	73.0
	6+	1970	22.0	27.0	100.0
	Total	7291	81.6	100.0	
Missing	System	1646	18.4		
Total		8937	100.0		

Figure 13

Birth Order
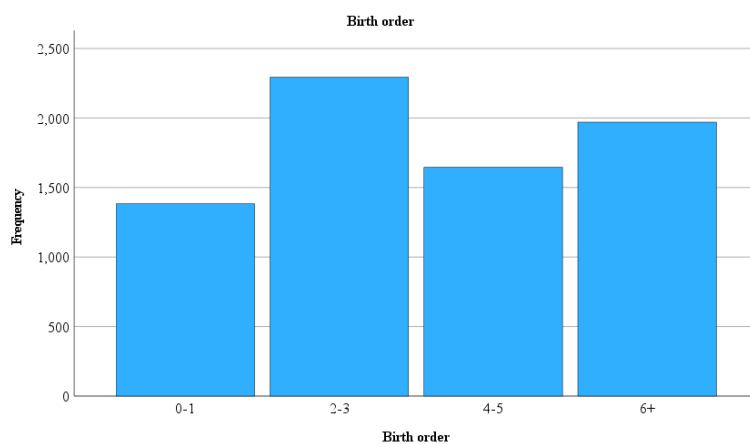
A household's demographic and socioeconomic characteristics are influenced by its place of residence, such as urban or rural areas. **Table 13** and **Figure 14** include information on maternal mortality rates in rural and urban areas. Rural areas have a larger maternal mortality gap compared to urban areas. Rural areas accounted for most maternal deaths, with 5,331 (59.7%), while 3,606 (40.3%) occurred in urban areas.

Accessing healthcare, referral systems, managing environmental conditions, and addressing socioenvironmental issues are more difficult for rural women compared to urban women.

Table 13

Place of Residence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Urban	3606	40.3	40.3	40.3
	Rural	5331	59.7	59.7	100
	Total	8937	100	100	

Figure 14

Place of Residence
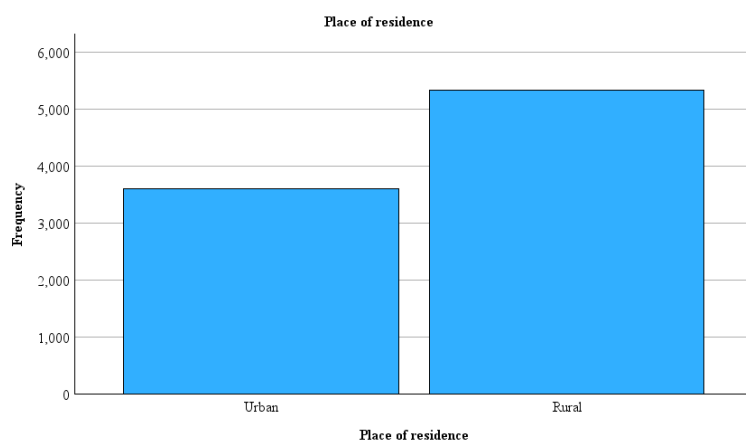
Table 14 and **Figure 15** illustrate the distribution of wealth quintile among women between 15 and 49. Out of the 8,937 cases of maternal death, 2,500 (28.0%) were of women in the poorest quintile, 2,200 (24.6%) in the poorer quintile, and 1,937 (21.7%) in the middle quintile.

Among women in the wealthier and wealthiest quintiles, there were 1,267 (14.2%) and 1,033 (11.6%) maternal deaths, respectively.

Table 14

Wealth Quintile

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Poorest	2500	28	28	28
	Poorer	2200	24.6	24.6	52.6
	Middle	1937	21.7	21.7	74.3
	Richer	1267	14.2	14.2	88.4
	Richest	1033	11.6	11.6	100
	Total	8937	100	100	

Figure 15

Wealth Quintile
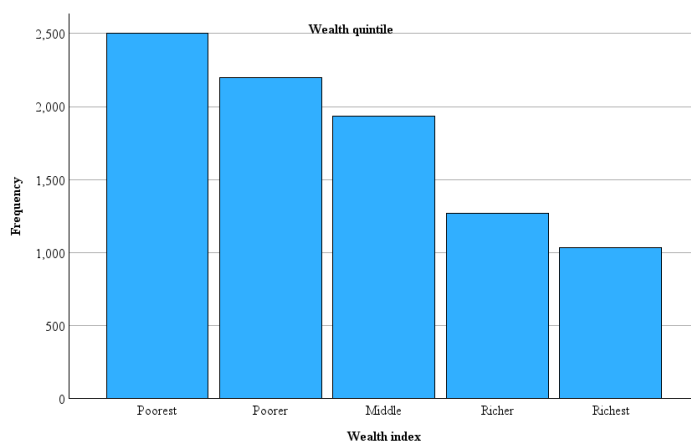
Table 15 and **Figure 16** show the distribution of maternal education for women between 15 and 49. Of the 1,133 women, 165 (1.8%) had no formal education, 393 (4.4%) had primary education, and 575 (6.4%) had secondary and higher education.

Educational disadvantages among women in Liberia can lead to various risks, including missed ANC and PNC visits, delivering babies outside of health facilities, HIV transmission through breastfeeding, and limited knowledge of family planning. Advancing women's education in Liberia can have a positive impact on the health outcomes of mothers, newborns, and children.

Table 15

Maternal Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No education	165	1.8	14.6	14.6
	Primary	393	4.4	34.7	49.2
	Secondary and Higher	575	6.4	50.8	100
	Total	1133	12.7	100	
Missing	System	7804	87.3		
Total		8937	100		

Figure 16

Maternal Education
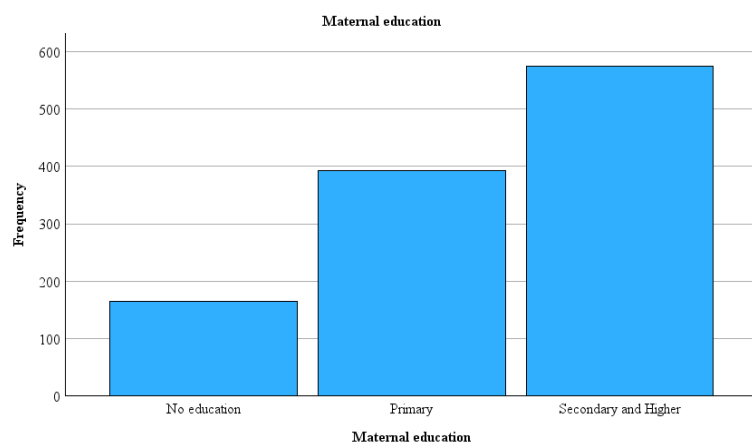
The distribution of women aged 15 to 49 employed in the year preceding the survey, categorized by maternal occupation, is shown in **Table 16** and **Figure 17**. Of the 1,133 women surveyed, 238 (2.7%) were unemployed, and 158 (1.8%) worked in professional/technical/managerial or sales roles. Within the agricultural sector, 372 (4.2%) women were self-employed, and 365 (4.1%) were employed in diverse agricultural, household, domestic, skilled manual, or unskilled roles. Unemployed women were slightly fewer when compared to self-employed women and women in different occupations. The percentage of unemployed women in Liberia is higher than that of those employed in professional, technical, managerial, clerical, or sales positions.

Table 16

Maternal Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not working	238	2.7	21.0	21.0
	Professional/tech nical/managerial/ clerical/sales	158	1.8	13.9	35.0
	Agriculture-self employed	372	4.2	32.8	67.8
	Agriculture - employee/househ old and domestic/services /skilled manual/unskilled manual/other	365	4.1	32.2	100.0
	Total	1133	12.7	100.0	
Missing	System	7804	87.3		
Total		8937	100.0		

Figure 17

Maternal Occupation
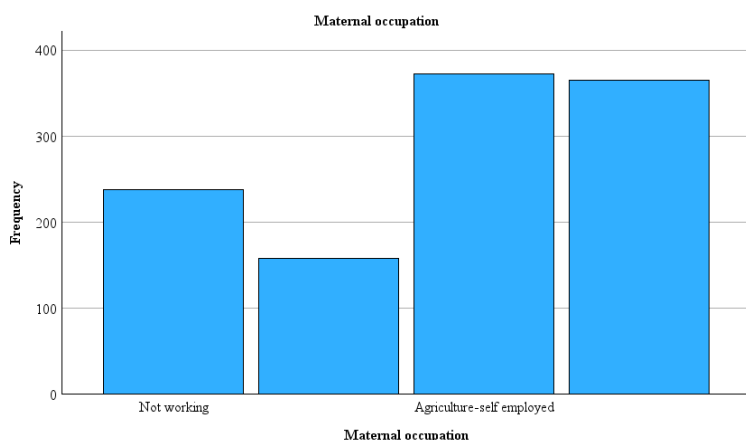
Among women between 15 and 49, **Table 17** and **Figure 18** illustrate the

percentage distribution of educational attainment. Among the 8,937 maternal deaths,

3,528 (39.5%) of women had no formal education, 2,814 (31.5%) had not completed

primary education, and 301 (3.4%) had completed primary education. The statistics show

that 1,779 (19.9%) women did not complete secondary education, 321 (3.6%) completed

secondary education, and 194 (2.2%) had higher education. Low educational

achievement is more prevalent among women in Liberia. Increasing the levels of

educational attainment can increase ANC, PNC, and screening for HIV among pregnant

women.

Table 17

Educational Attainment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No education	3528	39.5	39.5	39.5
	Incomplete primary	2814	31.5	31.5	71
	Complete primary	301	3.4	3.4	74.3
	Incomplete secondary	1779	19.9	19.9	94.2
	Complete secondary	321	3.6	3.6	97.8
	Higher	194	2.2	2.2	100
	Total	8937	100	100	

Figure 18

Educational Attainment
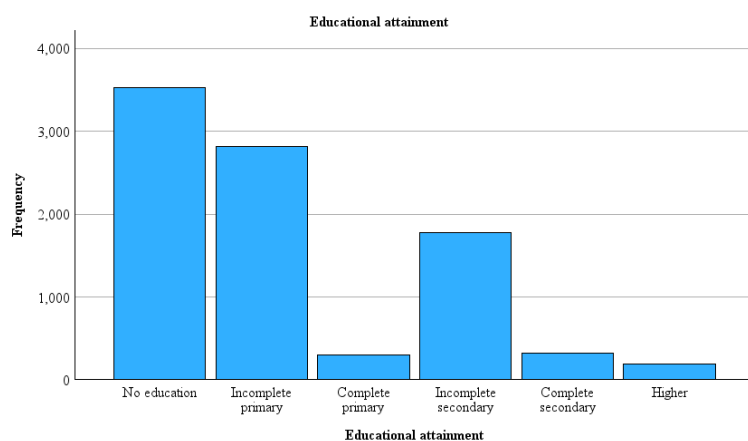
The information from **Table 18** and **Figure 19** shows that out of 8,937 maternal deaths, 2,358 (26.4%) were of women who never married, 2,927 (32.8%) were married, 2,727 (30.5%) were living with their partners, 228 (2.6%) were widowed, 112 (1.3%) were divorced, and 585 (6.5%) were no longer living together or separated.

Table 18

Marital Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never in union	2358	26.4	26.4	26.4
	Married	2927	32.8	32.8	59.1
	Living with partner	2727	30.5	30.5	89.6
	Widowed	228	2.6	2.6	92.2
	Divorced	112	1.3	1.3	93.5
	No longer living together/separated	585	6.5	6.5	100
	Total	8937	100	100	

Figure 19

Marital Status
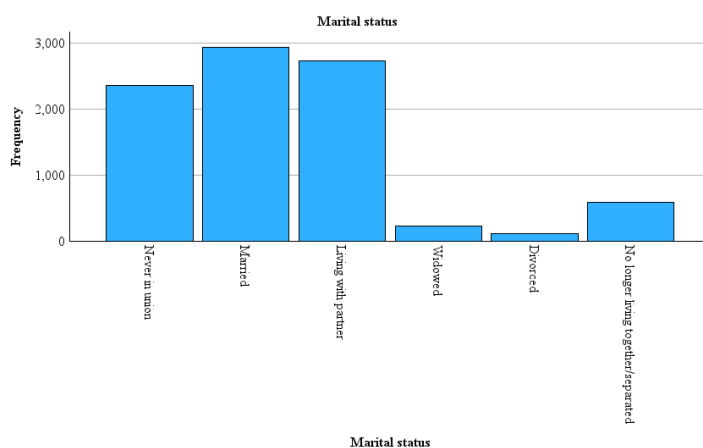
Table 19 and Figure 20 display data on maternal age distribution at birth for ages 15 to 49. In the age groups 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, and 45-49, the percentages of women's age at birth were 1877 (21,0%), 1545 (17.3%), 1538 (17.2%), 1,204 (13.5%), 1,154 (12.9%), 855 (9.6%), and 764 (8.5%), respectively.

Women between 15 and 19 had the highest maternal deaths, followed by age groups 20

and 24 and 25 and 29. Women between 45 and 49 had fewer maternal deaths compared
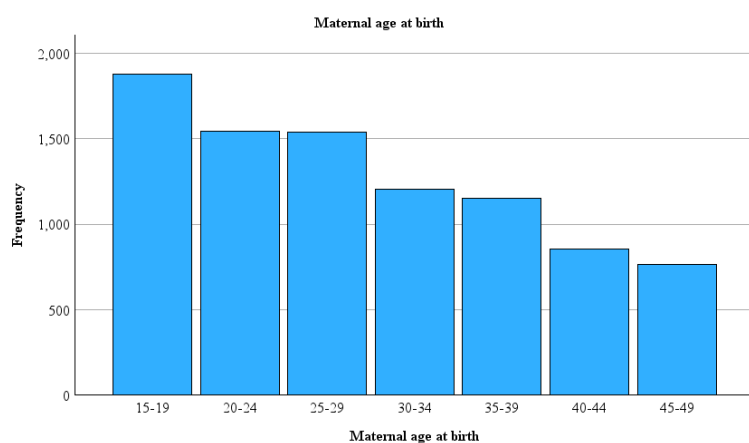
to those between 40 and 44.

Table 19

Maternal Age at Birth

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15-19	1877	21.0	21.0	21.0
	20-24	1545	17.3	17.3	38.3
	25-29	1538	17.2	17.2	55.5
	30-34	1204	13.5	13.5	69.0
	35-39	1154	12.9	12.9	81.9
	40-44	855	9.6	9.6	91.5
	45-49	764	8.5	8.5	100
	Total	8937	100	100	

Figure 20

*Maternal Age at Birth*

Maternal age at birth

Rural women in Liberia continue to face significant difficulties in accessing healthcare facilities compared to urban women. Among 8,598 women between 15 and 49, **Table 20** and **Figure 21** shows that 302 (3.4%) traveled less than one mile to reach the nearest health facilities, 155 (1.7%) traveled a distance of 1-3 miles, and 44 (0.5%) traveled a distance of 4-5 miles. A large percentage of women, 8,097 (96.2%), were unaware of the distance to the nearest health facilities.

Table 20

Distance to Nearest Health Facility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than one mile	302	3.4	3.5	3.5
	1-3 miles	155	1.7	1.8	5.3
	4-5 miles	44	0.5	0.5	5.8
	Don't know	8097	90.6	94.2	100
	Total	8598	96.2	100	
Missing	System	339	3.8		
Total		8937	100		

Figure 21

*Distance to Nearest Health Facility*
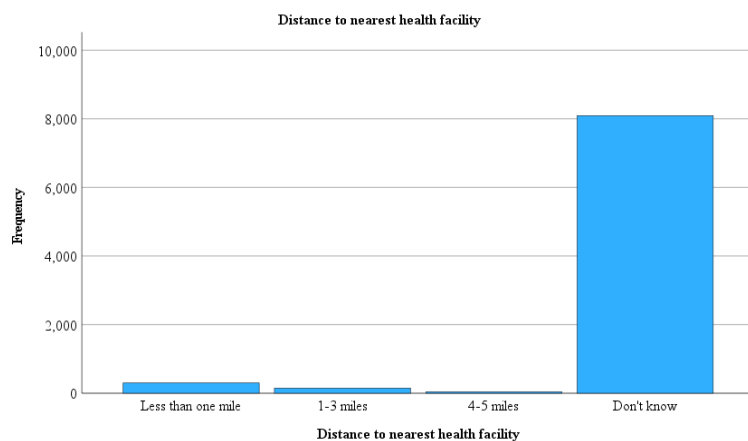
As shown in **Table 21** and **Figure 22**, 256 (2.9%) of women used private transport to the nearest health facilities, 2,023 (22.6%) used public transport, 6, 251 (69.9%) walked, 88 (1.0%) used bicycles, 9 (0.1%) used wheelbarrows, and 53 (0.6%) used other methods of transportation. The risk of adverse pregnancy complications and death is higher for women who walk to health facilities, rather than using public transportation.

Table 21

Mode of Transportation to Nearest Health Facility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Private transportation	256	2.9	2.9	2.9
	Public transportation	2023	22.6	23.3	26.3
	Walking	6251	69.9	72	98.3
	Bicycle	88	.1	.1	99.3
	Wheelbarrow	9	.1	.1	99.4
	Other	53	.6	.6	100
	Total	8680	97.1	100	
Missing	System	257	2.9		
Total		8937	100		

Figure 22

Mode of Transportation to Nearest Health Facility
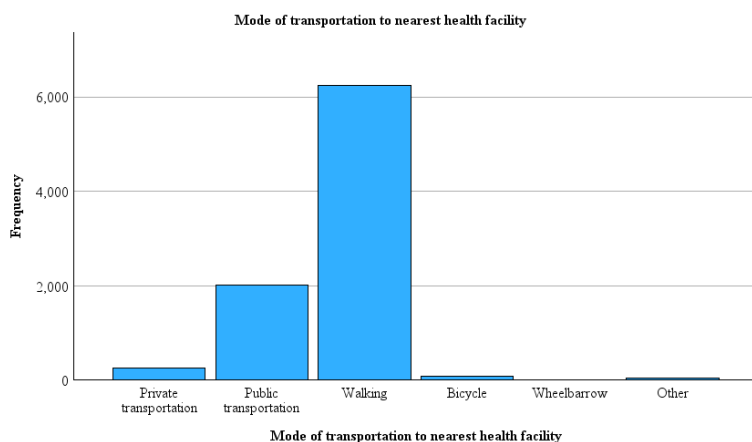
Increasing the number of women delivering babies in healthcare facilities is crucial for reducing health risks to both the mother and newborn. By maintaining healthcare standards and sterile conditions during childbirth, we can safeguard the well-being of both mother and baby, preventing complications and infections. The percent distribution of live births by place of delivery is shown in **Table 22** and **Figure 23** for the past five years. Among 4,493 births, 1,444 (16.2%) occurred at home, 797 (8.9%) occurred elsewhere, 1,167 (13.1%) occurred in government hospitals, and 1085 (12.1%) occurred in government health facilities. Home deliveries have a slightly higher death rate than government hospitals and health facilities. Facility births are far more common in urban than rural areas. The correlation between the place of delivery for women and household wealth and education levels is significant. A mother's place of delivery plays a crucial role in interventions aimed at improving maternal health outcomes and reducing maternal and child mortality.

Table 22

Place of Delivery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	At home	1444	16.2	32.1	32.1
	Other home	797	8.9	17.7	49.9
	Government hospital	1167	13.1	26	75.9
	Government health facility	1085	12.1	24.1	100
	Total	4493	50.3	100	
Missing	System	4444	49.7		
Total		8937	100		

Figure 23

Place of Delivery

The distribution of women between 15 and 49 across different religious backgrounds is shown in **Table 23** and **Figure 24**. Among the 8,918 participants, 7,598 (85.0%) of women identify as Christians, 1,057 (11.8%) as Muslims, 33 (0.4%) practice traditional religion, and 230 (2.6%) have no religion. The risk of maternal mortality in Liberia is higher for Christian women than for Muslim women.

Table 23

Religion

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Christian	7598	85	85.2	85.2
	Muslim	1057	11.8	11.9	97.1
	Traditional religion	33	0.4	0.4	97.4
	No religion	230	2.6	2.6	100
	Total	8918	99.8	100	
Missing	System	19	0.2		
Total		8937	100		

Figure 24

Religion
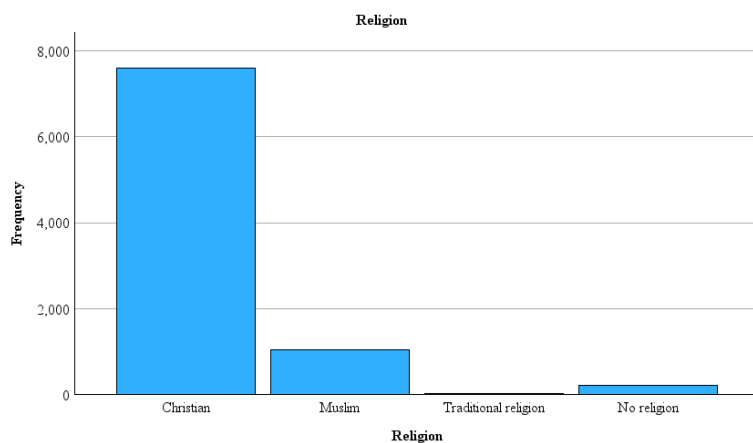
Table 24 and **Figure 25** display the distribution of women by region among women between 15 and 49. Maternal mortality rates show significant variation from one region to another. The North Western, South Central, and South Eastern A. regions reported 1,511 (15.9%), 2,659 (22.9%), and 1,310 (14.7%) maternal deaths, respectively.

In the South Eastern B region, there were 1,378 deaths (15.4%), compared to 2,079 deaths (23.3%) in the North Central region. The counties with the highest maternal deaths were Margibi and Grand Bassa, followed by Bong and Nimba. River Gee and Grand Kru Counties had lower maternal mortality rates compared to Gbarpolu, Grand Cape Mount, and Bomi counties. The maternal mortality rates in River Cess, Sinoe, and Grand Gedeh Counties showed a slight decline.

Table 24

Regions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	North Western	1511	16.9	16.9	16.9
	South Central	2659	29.8	29.8	46.7
	South Eastern A	1310	14.7	14.7	61.3
	South Eastern B	1378	15.4	15.4	76.7
	North Central	2079	23.3	23.3	100
	Total	8937	100	100	

Figure 25

Region
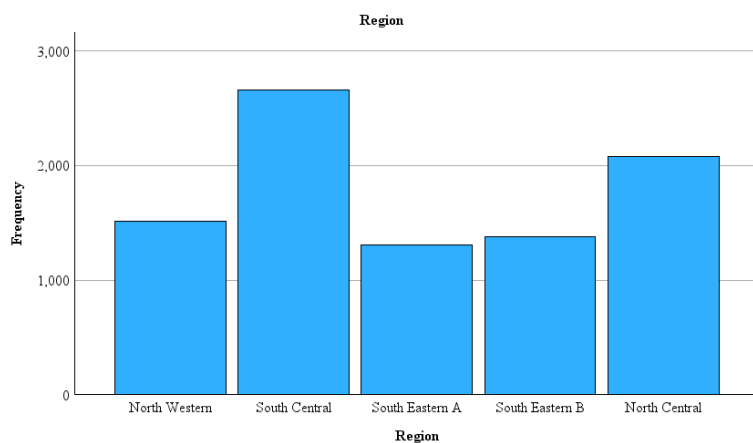
Table 25 and **Figure 26** show the occurrence of HIV-related breastfeeding in women between 15 and 49. Mother-to-child transmission is the primary cause of HIV infection in infants. Transmission of HIV is possible during pregnancy, delivery, or breastfeeding. Among the 7,507 HIV cases, 1,448 (16.2%) of the women decided not to breastfeed their newborns, compared to 6,059 (67.8%) who breastfed.

The risk of breastfeeding by HIV-infected mothers is on the rise in Liberia. Babies breastfed by an HIV-infected mother face a 67.8% risk of contracting the virus.

Table 25

HIV-Related Breastfeeding

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	1448	16.2	19.3	19.3
	Yes	6059	67.8	80.7	100.0
	Total	7507	84.0	100.0	
Missing	System	1430	16.0		
Total		8937	100.0		

Figure 26

HIV-Related Breastfeeding
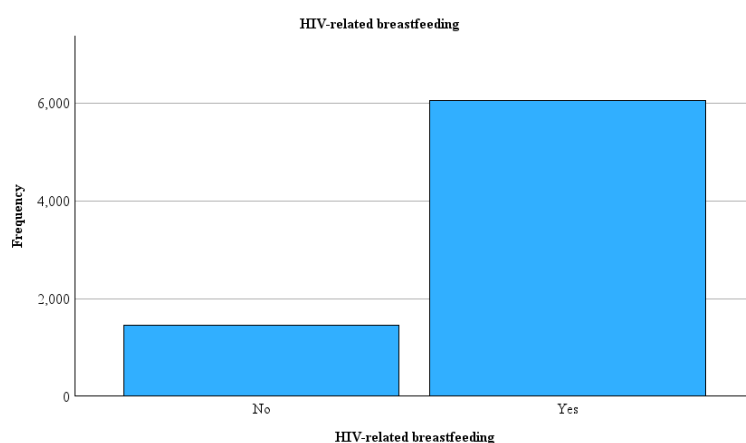
ANC visits play a critical role in the early identification of complications and providing timely treatment during pregnancy. Disease prevention and screening during ANC visits emphasizes immunization and nutritional education. **Table 26** and **Figure 27** illustrate the patterns in ANC visits among women between 15 and 49**.**

Among 4,961 participants,177 (2.0%) of women never attended ANC visits, 1,004 (11.2%) attended one to three visits, and 3,780 (42.3%) attended four or more visits. Expectant mothers are increasingly using ANC services and making it a point to attend at least four or more visits.

Table 26

Antenatal Care Visits

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No antenatal care visits	177	2.0	3.6	3.6
	1-3 Antenatal care visits	1004	11.2	20.2	23.8
	4+ Antenatal care visits	3780	42.3	76.2	100.0
	Total	4961	55.5	100.0	
Missing	System	3976	44.5		
Total		8937	100.0		

Figure 27

Antenatal Care Visits
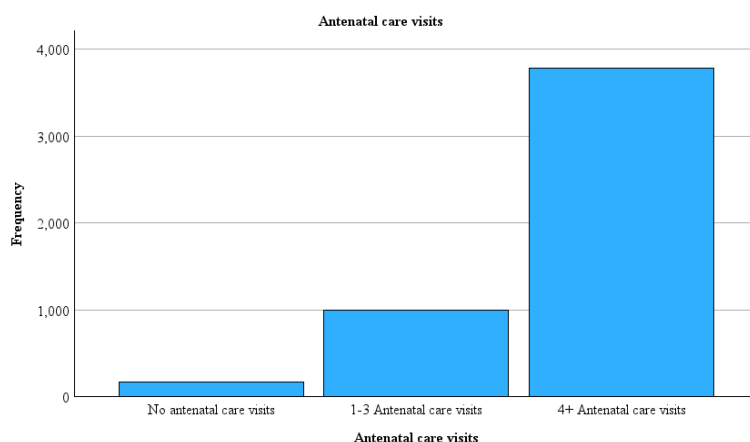
The literacy rate in Liberia remains at a low level. Reading and writing skills are

essential for enhancing personal health literacy. The active use of maternal health

information is imperative, not just its understanding. In Liberia, women's ability to

comprehend and process basic maternal health information is crucial for making

informed decisions. **Table 28** and **Figure 29** show how literacy is distributed among

women between 15 and 49. Among 8,909 women, 5,496 (61.5%) cannot read, 854

(9.6%) can only read parts of a sentence, and 2,559 (28.6%) can read a whole sentence.

Table 28

Maternal Literacy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cannot read at all	5496	61.5	61.7	61.7
	Able to read only parts of sentence	854	9.6	9.6	71.3

	Able to read whole sentence	2559	28.6	28.7	100.0
	Total	8909	99.7	100.0	
Missing	System	28	0.3		
Total		8937	100.0		

Figure 29

Maternal Literacy
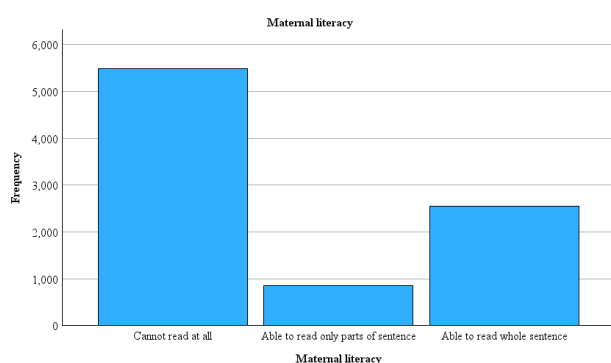
Inferential Statistics

I used binomial logistic regression to investigate associations between participants' background characteristics and maternal mortality. The predictor variables included maternal alcohol consumption, listening to the radio, reading newspapers or magazines, watching television, husband/partner's education, unmet needs, PNC checkups after delivery, birth order, place of residence, and wealth quintile. I coded the dependent variable maternal mortality as 0 = Alive and 1 = Dead. The logistic regression model was statistically significant, $\chi^2(21) = 55.998$, $p < .0001$. The model explained 1.9% (Cox and Snell R square) and 3.1% (Nagelkerke R squared) of the variance in maternal mortality and correctly classified 82.1% of cases.

As shown in **Table 29**, maternal alcohol consumption (B = .288, SE = .113, Wald = 6.552, p = .010; listened to the radio at least once a week (B = .296, SE = .124, Wald = 5.681, p = .017), watched television less than once a week (B = -.358, SE = .178, Wald = 4.058, p = .044); unmet needs for limiting (B = -.291, SE = .147, Wald = 3.919, p = .048); no unmet needs (B = -.339, SE = .109, Wald = 9.667, p = .002); six or more birth orders (B = .399, SE = .173, Wald = 5.339, p = .021); and rural residence (B = .260, SE = .134, Wald = 3.784, p = .052) significantly contributed to maternal mortality. The OR shows that women who drank alcohol had a 1.333 times greater risk of dying from maternal mortality compared to those who did not (OR = 1.334, 95% CI [1.070, 1.664]). Women who listened to the radio at least once a week had a 1.344 times higher risk of maternal mortality (OR = 1.344, 95% CI [1.054, 11.715]) compared to non-listeners. Women who watched TV less than once a week had a 30.1% lower risk of dying from maternal complications compared to those who did not watch TV at all. The risk of maternal mortality was 0.747 lower for women with an unmet need for limiting (OR = 0.747, 95% CI [0.560, 0.997]) compared to those with an unmet need for spacing after adjusting for other variables.

Women without unmet needs had a 0.713 lower risk of maternal mortality compared to those with spacing needs (OR = 0.713, 95% CI [0.576, 0.882]) while controlling for other factors. Compared to women with non-first birth orders, those with six or more children had a 1.5 times higher chance of maternal death during pregnancy and childbirth (OR = 1.490, 95% CI [1.062, 2.090]) after adjusting for other variables.

Rural women had a 1.3 times higher risk of maternal mortality compared to urban women

when controlling for other factors (OR = 1.297, 95% CI [0.998, 1.685]). The variables

with the highest association with maternal mortality in **Table 29** were mothers having six

or more births (OR = 1.490), listening to the radio at least once a week (OR = 1.344),

maternal alcohol consumption during pregnancy (OR = 1.334), and rural areas (OR =

1.297).

Table 29

Binomial Logistic Regression Examined Participants' Background Characteristics

Associated with Maternal Mortality

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Maternal alcohol consumption(1)	0.288	0.113	6.552	1	0.010	1.334	1.070	1.664
Frequency of listening to radio			6.292	2	0.043			
Frequency of listening to radio(1)	0.229	0.123	3.488	1	0.062	1.258	0.989	1.601
Frequency of listening to radio(2)	0.296	0.124	5.681	1	0.017	1.344	1.054	1.715
Frequency of reading newspaper or magazine			0.868	2	0.648			
Frequency of reading newspaper or magazine(1)	-0.003	0.252	0.000	1	0.989	0.997	0.608	1.634
Frequency of reading newspaper or magazine(2)	-0.348	0.376	0.855	1	0.355	0.706	0.338	1.476

	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Frequency of watching television			4.369	2	0.113			
Frequency of watching television(1)	-0.358	0.178	4.058	1	0.044	0.699	0.493	0.990
Frequency of watching television(2)	-0.199	0.222	0.807	1	0.369	0.819	0.530	1.266
Husband/partner's education			3.361	3	0.339			
Husband/partner's education(1)	-0.006	0.136	0.002	1	0.963	0.994	0.761	1.298
Husband/partner's education(2)	-0.084	0.124	0.459	1	0.498	0.919	0.720	1.173
Husband/partner's education(3)	0.393	0.286	1.883	1	0.170	1.481	0.845	2.596
Unmet need			10.404	2	0.006			
Unmet need(1)	-0.291	0.147	3.919	1	0.048	0.747	0.560	0.997
Unmet need(2)	-0.339	0.109	9.667	1	0.002	0.713	0.576	0.882
Mother's postnatal care checkup after delivery(1)	-0.150	0.106	2.009	1	0.156	0.861	0.699	1.059
Birth order			13.024	3	0.005			
Birth order(1)	-0.066	0.165	0.157	1	0.692	0.937	0.677	1.295
Birth order(2)	0.125	0.172	0.527	1	0.468	1.133	0.809	1.586
Birth order(3)	0.399	0.173	5.339	1	0.021	1.490	1.062	2.090
Place of residence(1)	0.260	0.134	3.784	1	0.052	1.297	0.998	1.685
Wealth quintile			1.493	4	0.828			
Wealth quintile(1)	0.059	0.123	0.232	1	0.630	1.061	0.833	1.352
Wealth quintile(2)	0.159	0.147	1.170	1	0.279	1.172	0.879	1.562
Wealth quintile(3)	0.112	0.206	0.294	1	0.588	1.118	0.746	1.675
Wealth quintile(4)	-0.038	0.294	0.017	1	0.896	0.962	0.541	1.713

Constant	-1.757	0.232	57.384	1	0.000	0.173

In the second research, **Table 30** presents the outcomes of a binomial regression analysis that studied associations between socioeconomic factors and maternal mortality. Predictor variables included maternal education, maternal occupation, educational attainment, marital status, and maternal age at birth. Statistical significance was observed for the logistic regression model as $\chi^2(21) = 32.498$, $p = .052$. The model accurately predicted 81% of cases and accounted for 1.9% (Cox and Snell R square) to 4.5% (Nagelkerke R squared) of the variation in maternal mortality. The logistic analysis showed that maternal primary education ($B = -.469$, $SE = .233$, Wald $= 4.055$, $p = .044$), and maternal age at birth between 45 and 49 ($B = -.469$, $SE = .233$, Wald $= 4.055$, $p = .044$) significantly contributed maternal mortality. Women with primary education had a 0.626 lower maternal mortality rate than those with no formal education (OR $= .626$, 95% CI [0.396, 0.988]) after controlling for other factors in the model. The risk of maternal mortality was 2.3 times higher for women between 45 and 49 compared to those between 15 and 19 (OR $= 2.340$, 95% CI [1.087, 5.040]) after adjusting for other variables.

Table 30

Binomial Logistic Regression Examined Socioeconomic Factors Associated with Maternal Mortality

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Maternal education			4.076	2	0.13			
Maternal education(1)	-0.469	0.233	4.055	1	0.044	0.626	0.396	0.988

	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Maternal education(2)	-0.334	0.224	2.211	1	0.137	0.716	0.461	1.112
maternal Occupation			3.412	3	0.332			
maternal Occupation(1)	-0.229	0.295	0.604	1	0.437	0.795	0.446	1.418
maternal Occupation(2)	0.25	0.221	1.274	1	0.259	1.284	0.832	1.981
maternal Occupation(3)	0.086	0.226	0.144	1	0.704	1.09	0.7	1.696
Educational attainment			4.066	5	0.54			
Educational attainment(1)	-0.135	0.204	0.439	1	0.508	0.874	0.586	1.303
Educational attainment(2)	-1.011	0.625	2.619	1	0.106	0.364	0.107	1.238
Educational attainment(3)	0.115	0.221	0.269	1	0.604	1.122	0.727	1.729
Educational attainment(4)	0.105	0.438	0.057	1	0.811	1.111	0.471	2.618
Educational attainment(5)	-0.228	0.661	0.119	1	0.73	0.796	0.218	2.906
Marital status			7.327	5	0.197			
Marital status(1)	-0.021	0.302	0.005	1	0.945	0.98	0.542	1.769
Marital status(2)	0.385	0.264	2.126	1	0.145	1.469	0.876	2.465
Marital status(3)	0.257	0.497	0.268	1	0.604	1.294	0.488	3.426
Marital status(4)	-0.137	0.716	0.036	1	0.849	0.872	0.214	3.55
Marital status(5)	-0.256	0.397	0.417	1	0.519	0.774	0.356	1.684
Maternal age at birth			12.47	6	0.052			
Maternal age at birth(1)	-0.067	0.298	0.05	1	0.823	0.935	0.521	1.679
Maternal age at birth(2)	-0.061	0.325	0.035	1	0.852	0.941	0.497	1.78
Maternal age at birth(3)	-0.13	0.368	0.124	1	0.724	0.878	0.427	1.806
Maternal age at birth(4)	0.319	0.349	0.835	1	0.361	1.376	0.694	2.726

Maternal age at birth(5)	0.431	0.375	1.317	1	0.251	1.538	0.737	3.209
Maternal age at birth(6)	0.85	0.391	4.72	1	0.03	2.34	1.087	5.04
Constant	-1.428	0.363	15.475	1	<.001	0.24		

Table 31 displays the results of my binomial logistic regression, which examines

the relationship between maternal mortality and household sociodemographic

characteristics. The logistic regression model was statistically significant, $\chi^2(23) =$

71.500, $p < .0001$. The model explained the variation in maternal mortality between 2%

(Cox and Snell R square) and 3.2% (Nagelkerke R squared) and correctly classified

81.3% of cases. Public transport ($B = -.714$, $SE = .265$, Wald $= 7.267$, $p = .007$); walking

($B = -.664$, $SE = .254$, Wald $= 6.856$, $p = .009$); government hospitals ($B = -.280$, $SE =$

.122, Wald $= 5.278$, $p = .022$); Muslim ($B = -.745$, $SE = .165$, Wald $= 20.329$, $p <.001$);

South Central ($B = -.591$, $SE = .145$, Wald $= 16.616$, $p <.001$); South Eastern A ($B = -$

.372, $SE = .149$, Wald $= 6.263$, $p =.012$); South Eastern B ($B = -.554$, $SE = .155$, Wald $=$

12.835, $p <.001$); North Central ($B = -.467$, $SE = .136$, Wald $= 11.760$, $p <.001$); HIV-

related breastfeeding ($B = .251$, $SE = .115$, Wald $= 4.750$, $p =.029$); and can only read

parts of a sentence ($B = -.505$, $SE = .180$, Wald $= 7.885$, $p =.005$) significantly

contributed to maternal mortality. The risk of maternal death was reduced by 0.490 times

when comparing public and private transportation after accounting for other factors (OR

$= .490$, 95% CI [.291, .823]). Women who walked to health facilities had a 0.515 lower

risk of maternal death than those who used private transportation (OR $= .515$, 95% CI

[.313, 846]).

The risk of maternal mortality was 0.756% lower for women who accessed government hospitals compared to those who depended on private transportation (OR = .756, 95% CI [.595, .960]) after adjusting for other variables.

Muslim women had a 0.475 times lower risk of maternal death compared to Christian women (OR =.475, 95% CI [.344, .656]), after adjusting for other variables. The OR of maternal death was 0.554 times lower for women in the South Central region than for those in the North Western region (OR=.554, 95% CI [.417,.736]) after adjusting for other variables. Women living in the South Eastern A region are 0.690 times (OR=.690, 95% CI [.515, .923]) less likely to die from causes of maternal death compared to women in the North Western region, after adjusting for other variables. Compared to the North Western region, South Eastern B had a lower risk of maternal mortality after adjusting for other variables (OR=.574, 95% CI [.424, .778]). The North Central region's maternal mortality rate was 0.627 times lower because of underlying causes than those in North Western after adjusting for other variables (OR=.627, 95% CI [.480, .778]). The risk of transmitting HIV was 1.285 times higher for HIV-positive mothers who were breastfeeding than for HIV mothers who did not breastfeed after adjusting for other variables (OR=1.285, 95% CI [1.026, 1.610]). The risk of maternal mortality decreased by 0.603 times for women who could only read part of a sentence compared to those who could not read at all after adjusting for other variables (OR= 0.603, 95% CI [.424,.859]).

Table 31

Binomial Logistic Regression Examined Socioeconomic Factors Associated with

Maternal Mortality

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Distance to nearest health facility			3.490	3	0.322			
Distance to nearest health facility(1)	-0.497	0.422	1.382	1	0.240	0.609	0.266	1.393
Distance to nearest health facility(2)	-1.499	1.056	2.015	1	0.156	0.223	0.028	1.769
Distance to nearest health facility(3)	-0.312	0.230	1.846	1	0.174	0.732	0.467	1.148
Mode of transportation to nearest health facility			9.933	5	0.077			
Mode of transportation to nearest health facility(1)	-0.714	0.265	7.267	1	0.007	0.490	0.291	0.823
Mode of transportation to nearest health facility(2)	-0.664	0.254	6.856	1	0.009	0.515	0.313	0.846
Mode of transportation to nearest health facility(3)	-0.539	0.496	1.180	1	0.277	0.583	0.220	1.543
Mode of transportation to nearest health facility(4)	0.884	1.040	0.723	1	0.395	2.421	0.315	18.594
Mode of transportation to nearest health facility(5)	-0.839	0.611	1.884	1	0.170	0.432	0.130	1.432

Place of delivery			5.588	3	0.133			
Place of delivery(1)	-0.177	0.129	1.872	1	0.171	0.838	0.651	1.079
Place of delivery(2)	-0.280	0.122	5.278	1	0.022	0.756	0.595	0.960
Place of delivery(3)	-0.123	0.118	1.096	1	0.295	0.884	0.702	1.113
Religion			23.929	3	0.000			
Religion(1)	-0.745	0.165	20.329	1	0.000	0.475	0.344	0.656
Religion(2)	0.000	0.647	0.000	1	1.000	1.000	0.281	3.555
Religion(3)	0.402	0.231	3.017	1	0.082	1.494	0.950	2.350
Region			21.020	4	0.000			
Region(1)	-0.591	0.145	16.616	1	0.000	0.554	0.417	0.736
Region(2)	-0.372	0.149	6.263	1	0.012	0.690	0.515	0.923
Region(3)	-0.554	0.155	12.835	1	0.000	0.574	0.424	0.778
Region(4)	-0.467	0.136	11.760	1	0.001	0.627	0.480	0.819
HIV-related breastfeeding(1)	0.251	0.115	4.750	1	0.029	1.285	1.026	1.610
Antenatal care visits			1.853	2	0.396			
Antenatal care visits(1)	0.250	0.269	0.866	1	0.352	1.285	0.758	2.176
Antenatal care visits(2)	0.121	0.262	0.214	1	0.643	1.129	0.676	1.887
Maternal literacy			9.078	2	0.011			
Maternal literacy(1)	-0.505	0.180	7.885	1	0.005	0.603	0.424	0.859
Maternal literacy(2)	-0.168	0.110	2.322	1	0.128	0.846	0.682	1.049
Constant	-0.188	0.445	0.178	1	0.673	0.829		

Maternal mortality was impacted by several factors, including participant background characteristics, socioeconomic factors, and household sociodemographic characteristics.

Maternal mortality was significantly influenced by participants' background characteristics, including listening to the radio at least once a week, watching television less than once a week, an unmet need for limiting, no unmet needs, six or more birth orders, and rural residence. Listening to the radio less than once a week, reading newspapers or magazines, watching television at least once a week, husbands' or partners' education, and PNC checkups after delivery were not significantly associated with maternal mortality. Maternal mortality did not show a significant association with second-third birth orders, fourth-fifth birth orders, or wealth quintile.

Summary

Descriptive analysis and binomial logistic regression were employed in this chapter to analyze maternal mortality. The chapter extensively examined and interpreted predictive factors associated with participants' background characteristics, socioeconomic factors, and household sociodemographic characteristics. The data used in this study was collected by the Liberia Institute of Statistics and Geo-Information Services and conducted by the Ministry of Health and Social Welfare. Some predictors did not impact maternal mortality, but they could still be worth exploring. Chapter 5 includes interpreting the findings, study limitations, research recommendations, and positive social change implications.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

This quantitative, retrospective case-control study examined associations between participants' background characteristics, socioeconomic factors, household sociodemographic characteristics, and maternal mortality in women between 15 and 49. The study's design enables a detailed analysis of factors contributing to maternal mortality in Liberia, using data from the 2013 LDHS. I examined associations between participants' background characteristics and maternal mortality among women between 15 and 49 in Liberia.

Interpretation of the Findings

Logistic regression analysis revealed significant associations between maternal mortality and factors such as maternal alcohol consumption, listening to the radio at least once a week, watching television less than once a week, unmet needs for limiting, no unmet needs, six or more birth orders, and rural areas. I rejected the null hypothesis that there was a significant difference between the predictor variables and maternal mortality. Maternal mortality is positively influenced by alcohol consumption during pregnancy, listening to the radio weekly, and having six or more children. There was no significant association between predictor variables (such as listening to the radio less than once a week, reading newspapers/magazines, watching television at least once a week, husbands' or partners; education, mother's PNC checkup after delivery, two-third birth orders, fourth-fifth birth orders, and wealth quintile) and maternal mortality.

I failed to reject the null hypothesis that there were no significant differences between the predictor variables and maternal mortality.

The second research question investigated associations between socioeconomic factors and maternal mortality in Liberian women between 15 and 49. Maternal mortality showed a significant association with factors such as maternal primary education and maternal age at birth between 45 and 49, as shown by logistic regression analysis. I rejected the null hypothesis that there was a significant difference between the predictor variables and maternal mortality. The study found no significant association between maternal mortality and secondary and higher education, maternal occupation, educational attainment, marital status, or maternal age between 20 and 44. Therefore, I failed to reject the null hypothesis that there were no significant differences between the predictor variables and maternal mortality.

The third research question examined associations between household sociodemographic characteristics and maternal mortality in women between 15 and 49 in Liberia. The results of logistic regression analysis showed that maternal mortality was significantly associated with public transport, walking, Muslim women, South Central, South Eastern A, South Eastern B, North Central, HIV-related breastfeeding, and the ability to read only parts of a sentence. I rejected the null hypothesis that there was a significant difference between the predictor variables and maternal mortality.

Factors including distance to the nearest facility, bicycle, wheelbarrow, other methods, place of delivery in other homes, government health facility, traditional religion, no religion, ANC visits, and the ability to read a whole sentence did not significantly affect maternal mortality. Thus, I failed to reject the null hypothesis that there was no significant difference between the predictor variables and maternal mortality.

In contrast to previous research, my study found no significant impact of wealth, distance to health facilities, ANC visits, and PNC checkups after delivery on maternal mortality. This lack of association between distance to a health facility dis-confirmed the findings of the WHO (WHO, 2019). My research contradicts Feitosa-Assis and Santana's (2020) findings that there is no link between maternal occupation and maternal mortality. Bomela's (2020) study affirms the correlation between maternal age and an increase in maternal mortality, aligning with previous research findings. This study expanded our understanding of the associations between unmet needs for family planning, modes of transportation, women's literacy, rural living, religious beliefs, and maternal mortality. The study revealed a correlation between maternal mortality and women's primary education. This study was guided by the socioecological model. Four constructs are included model: intrapersonal, interpersonal, community, and societal factors. The model in this study analyzes how participants' background characteristics, socioeconomic factors, and household sociodemographic characteristics affect maternal mortality in Liberia.

Limitations of the Study

The study has some limitations. Secondary data from the 2013 LDHS was used for the analysis. The study's design had limitations because of recall and sample bias, which only allowed for one outcome based on a retrospective risk factor assessment. Only women between 15 and 49 were included in the study's sampling frame. The generalization of the findings may not apply to ethnic groups.

Recommendations

To understand the significance of maternal mortality, future researchers should reassess nonsignificant variables in this study, considering the problem statement, research questions, and hypotheses. Understanding additional clinical, sociodemographic, and sociocultural factors could shed light on maternal mortality. Government hospitals must urgently improve delivery, childbirth, and prenatal care services.

Implications

Creating better social and physical environments can contribute to maternal health improvement and a decline in maternal mortality risk. Policymakers and the government should consider customized maternal health programs to include social support, education, and promotion. Address the biased practices in the healthcare system that perpetuate disparities among women between 15 and 49. Support culturally informed maternal health needs through community social networks. Supporting pregnant women and their network and addressing their concerns during and after delivery can improve maternal health outcomes.

Conclusion

I conducted a quantitative, retrospective case-control study comparing cases and controls. The number of maternal mortality cases was 8,937. While ANC visits and PNC checkups after delivery do not seem to affect maternal mortality rates, they might influence the use of maternal care services. Increasing the number of quality government hospitals might improve maternal health outcomes. Addressing the unmet need for family planning could positively impact decreasing maternal mortality. The evidence from the study has the potential to enhance maternal health education and reduce maternal mortality. Using the socio-ecological model, this study offers insights into the factors contributing to maternal mortality. The findings of my study will expand the existing knowledge on how participants' background characteristics, socioeconomic factors, and household sociodemographic characteristics contribute to maternal mortality in public health. The results aim to improve rural environments, living conditions, and maternal care services. When spreading awareness about the study's findings on maternal health behaviors and their impact on reducing maternal mortality, it is crucial to acknowledge factors beyond individual and interpersonal influences. To design effective maternal care policies and social support, it is essential first to grasp the evidence surrounding maternal mortality and its sociodemographic causes.

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