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Effect of Access to Health Services on Neonatal Mortality in Uganda

Imelda Atai Madgalene Musana
Walden University

Walden University

College of Health Sciences

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Imelda Magdalene Atai Musana

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Review Committee
Dr. John Oswald, Committee Chairperson, Health Services Faculty
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Dr. Tina Cunningham, University Reviewer, Health Services Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
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Abstract

Since 2006, Uganda has experienced a nonchanging neonatal mortality rate of 27 out of 1,000 live births, which is higher than the global average of 19 deaths for every 1,000 live births. The purpose of this retrospective cross-sectional study was to determine factors affecting access to health services and their impact on newborn deaths in Uganda. Mosley and Chen's model for child survival in developing nations provided the framework for the study. Secondary data from the 2016 demographic and health survey (UDHS) collected by Uganda Bureau of Statistics (UBOs) was used. A total of 7,538 cases were used and analyzed using binary logistic regression and one-way analysis of covariance (ANCOVA). The results showed attending less than 4 antenatal care (ANC) visits during pregnancy increased the odds of neonatal deaths 1.57 times, while not taking antimalarial drugs during pregnancy increased the odds of neonatal deaths 1.67 times. However, receiving 4 or more tetanus toxoid (TT)vaccine doses before pregnancy was not statistically associated with increased risk of neonatal death ($p = .597$). Also, there was no significant relationship between neonatal mortality and whether distance to health facilities was a challenge ($p = .276$) or receiving medical assistance during childbirth ($p = .420$). While there were significant differences in deaths of newborns in geographic regions while controlling for number of ANC visits ($p = .023$), there were no differences while controlling for all three covariates, $F(4, 117) = 2.00$, $p = .098$. Findings may be used to inform government policies on ANC and malaria prevention during pregnancy, which may reduce neonatal mortality rates in Uganda.

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Dedication

I dedicate this thesis to my father, Papa Clement William Aeko (RIP), and my mother, Toto Crencentia Aeko, for raising me from childhood and putting me through school. I also dedicate this study to my late paternal and maternal grandparents Ludovico Engorait, Maria Theresa Asekenye, and Veronica Akiteng for their love as I was growing up. Appreciation also goes to my late siblings Angela Felistus Agadi-Omagino for being my role model despite her age, George Robert Patrick Odelei who died at infancy, and Rosemary Brenda Atai who succumbed to neonatal death. Appreciation goes to my siblings, Joseph, Rev. Sr Salome, Beatrice Florence, Fr. Bernard Martin, Mary Goretti, Christine, Ann P. H., Catherine, Rosemary Brenda, and brother in law Henrik L. for all their tremendous love and support throughout this academic journey. Special recognition goes to Fr. Simon Peter Engorait for his love and care during the residency sessions in U.S.A. To my children, nieces, and nephews (Angela, Carl Clement, Emmanuel A., Emmanuel A.O., Francis, George, Gabriella, Graciella, Joel A., Joseph C., Michael, Rachel F., Raphael F., Simon Peter, and Valeria), accept my appreciation for your continuous encouragement.

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Chapter 1: Introduction to the Study

Mortality, which is the death of babies ages 0 to 28 days, is considered a significant health problem in the world (United National Children's Fund (UNICEF), 2018). The worldwide neonatal mortality rate stands at 19 deaths per 1,000 live births. In Uganda the rate has remained high and stagnant at 27 deaths per 1,000 live births since 2000-01 an issue of concern to policymakers (Uganda Bureau of Statistics (UBOs), 2017a). According to Batista, de Carvalho, and Vasconcelos (2018), the status of national health systems and the extent to which health care services are accessible to the community impacts infant mortality as evidenced in the smaller states of Brazil. In Uganda, no evidence exists to explain access factors impacting the stagnant neonatal mortality.

The UBOs in the 2016 UDHS showed improvements in health care services in Uganda. Pregnant women receiving ANC services from a skilled health professional at least once increased from 90% in 2000 to 97% in 2016 (Uganda Bureau of Statistics (UBOs), 2017a). Also, 8 out of 10 women received the TT vaccine in 2016 (UBOs, 2017a). Despite these improvements, UBOs in the 2016 UDHS showed neonatal mortality rate had remained stagnant at 27 deaths per 1,000 live births, presenting a significant health concern requiring an investigation in Uganda as indicated by UBOs. The lack of explanation for the stagnant neonatal mortality justified this study to determine access factors to health care services among women of reproductive age impacting on neonatal deaths. Such data may inform the policy direction by government

and health care practitioners to develop appropriate interventions for reducing the neonatal mortality in the country.

In Chapter 1, I provide the background to the study on neonatal deaths and summarize facts about the problem, highlighting the knowledge gap in this study. The chapter also includes the purpose of the study, research questions, hypotheses, theoretical framework, and nature of the study. Finally, the chapter includes definitions of variables and key terms, assumptions, scope, limitations, delimitations, significance, and a summary.

Background

About 6 out of 10 deaths of children occur among neonates worldwide. Globally, about 98% of newborn deaths occur in underdeveloped countries with Southern Asia experiencing 39% and sub-Saharan Africa 38% (UNICEF, 2017). In sub-Saharan Africa, the neonatal mortality rate is 27 out of 1,000 live births, compared to 19 deaths per 1,000 live births elsewhere in the world (UNICEF, 2018). About 3.3 million babies die out of the 8.2 million deaths of children aged 5 years and below, with 1.2 million deaths occurring in sub-Saharan Africa (Lawn et al., 2014), and daily about 13,000 neonates die averaging nine deaths per minute. In Uganda, while the neonatal mortality rate reduced to 27 deaths per 1,000 live births in 2006 from 33 deaths out of every 1,000 live births in 2000-01, no other changes have been experienced (UBOs, 2017a). According to UNICEF, reducing the high neonatal mortality rate in sub-Saharan Africa is critical in realizing the target of inclusive development as advocated for in the 2015 Sustainable Development Goals (SDGs). The SDGs are a set of 17 interconnected goals with 169

targets adopted by the 193 countries of the United Nations in 2015 (World Health Organization (WHO), 2015). According to the WHO the focus of the SDGs is leaving no one behind, improving people's well-being and livelihood by 2030, eliminating poverty, and combating climate change.

Studies by Diego and Beatriz (2017), You et al. (2015), and Ahmed and Won (2017) indicated access to antenatal care (ANC), health financing, delivery by trained medical personnel during childbirth, and distance to the health facilities as critical in reducing the risk of neonatal deaths. Addressing the challenge of newborn deaths is essential in ensuring a healthy working population contributing to the economy of the country (Lawn et al., 2014). Izugbara (2016) examined persistent neonatal deaths in sub-Saharan Africa, specifically in Sierra Leone, Burkina Faso, and Burundi. Researchers showed that age of the mother was related to child survival. Women ages 40 years and above were at a higher risk of adverse perinatal outcomes compared to younger women.

Mengesha and Sahle (2017) investigated seven hospitals in the Tigray region in Ethiopia to understand the risk factors for death of neonates born in the months of April, May, June, and July 2014. Findings revealed that 63 deaths occurred out of every 1,000 live births with leading causes of death being prematurity (34%) and birth asphyxia (31%). However, no information existed on the effect that ANC attendance, receipt of TT vaccine before pregnancy, and taking antimalarial treatment has on neonatal deaths, which was the focus of this study.

Kananura et al. (2016) examined the relationship between birth outcomes and access to and utilization of maternal services in eastern Uganda. Attendance to ANC was

singled out as a critical access factor because babies born to mothers attending ANC clinics 4 or more times during pregnancy had higher chances of survival, which was partly attributed to increased awareness and education on neonatal and maternal deaths. Kananura et al. underscored the value of attending ANC because health workers teach mothers to identify danger signs during pregnancy and embrace deliveries supervised by qualified medical personnel.

Semwanga, Nakubulwa, and Adam (2016) developed a nonrepresentative neonatal simulation model (NEOSIM) aimed at determining possible solutions for better newborn health care in Uganda. The NEOSIM targeted population, service delivery, mothers' health, and choice of health service. The NEOSIM model has been used to test the effects of interventions such as improving access to health services by the mother, and other factors like distance to the facility, antimalarial drugs, tetanus vaccine and anaemia, education campaigns, provision of birth kits during childbirth, and free transport (motorcycle) (Semwanga, Nakubulwa, & Adam, 2016). From the analysis, the provision of free birth kits during delivery and free transportation for easy access to a health facility had the most significant impact. Another qualitative study to understand the stagnant neonatal mortality rate in Kampala city indicated the importance of ANC attendance (Rwashana, Nakubulwa, Nakakeeto-Kijjambu, & Adam, 2014).

To have a healthy world population free of disease, the United Nations in the 2015 SDGs set target 3.2 requiring all countries in the world to reduce all preventable deaths of newborn babies so that by 2030 the target of 12 babies dying out of 1,000 live births is achieved (WHO, 2018a). Identifying and addressing the access factors to health

care services among women of reproductive age may inform the policy direction and interventions by government to address the continued burden of neonatal deaths in the country. There is limited information on access factors to health services impacting neonatal deaths, and addressing this gap may inform the policy direction of government and health practitioners to develop appropriate interventions that could reduce the stagnant neonatal mortality rate in the country.

Problem Statement

The death of babies ages less than 1 month is challenge worldwide, where on average 19 babies die out of every 1,000 live births (UNICEF, 2017). According to the United Nations, the 2015 SDGs were a result of the summit held in 2000 to review achievements of the eight millennium development goals. While goal 4 of the millennium development goals aimed to curb the global mortality rate of under-five by 67%, only a 50% reduction was achieved by the year 2015 (United Nations, 2014). In Uganda from the under-five mortality rate reduced from 128 deaths per 1,000 live births in 2006, to 90 deaths for every 1,000 live births in 2011, and 64 deaths for every 1,000 live births in 2016 (UBOs, 2017a). Infant mortality rates fell from 71 deaths per 1,000 live births in 2006, to 54 deaths per 1,000 live births in 2011, and to 43 deaths per 1,000 live births in 2016. Over the same period neonatal deaths remained stagnant at 27 deaths for every 1,000 live births as indicated by UBOs. To solve the challenge of high neonatal mortality rates UNICEF stated that 2015 SDGs of the United Nations were designed to address possible reduction of preventable deaths of newborn babies by 2030 to a maximum of 12 babies dying out of every 1,000 born alive. While in Uganda 72% of the population lives

within 5 kilometers of any health facility and 73% of pregnant women deliver in health facilities, the unchanging rate of death of neonates in Uganda remains a concern. Despite studies on the correlates of neonatal mortality, minimal information existed on the effect that proximate and socioeconomic factors, including their interrelations, had on neonatal deaths. No scholarly evidence existed to explain the stagnant neonatal mortality rate in Uganda, revealing the knowledge gap. The general problem was determining proximate and socioeconomic access factors to health care services and their impact on neonatal deaths among women of reproductive age in Uganda. The specific problem was determining how access to ANC services, TT vaccine, antimalarial medicine, supervised delivery, age of the mother, and distance to health facility impacted the mortality rate of newborns in Uganda. Mothers of reproductive age constituted the study population, and Mosley and Chen's (2003) model for child survival in developing countries provided the framework for the study. I conducted the research to fill this gap to add knowledge and provide empirical evidence to inform the policy direction of government on health services and possibly contribute to the realization of the SDG target of reducing neonatal mortality to 12 deaths of newborns per 1,000 live births by 2030.

Purpose of the Study

The principal reason for the retrospective cross-sectional study was determining proximate and socioeconomic factors impacting health services access and their effect on newborn deaths in Uganda applying the Mosley and Chen's framework. The study focused on women of ages 15 to 49 years in Uganda with children aged less than 1 month. The independent variables were proximate and socio-economic factors. The

proximate determinants were ANC attendance, TT vaccine before pregnancy, antimalarial medicine received during pregnancy, delivery by a medical professional. The socio-economic factors were distance to a health facility (whether it is a challenge), and geographical region. The covariates were age of the mother at first birth, ANC visits, and TT vaccine doses received before pregnancy. The dependent variable was neonatal deaths.

Research Questions and Hypotheses

Research Question 1: Are there associations between personal illness control factors (number of ANC visits, number of TT injections received before pregnancy, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda?

H_o1: There are no statistically significant associations between personal illness control factors (number of ANC visits, number of TT injections received, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda

H_a1: There are statistically significant associations between personal illness control factors (number of ANC visits, number of TT injections received, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda.

Research Question 2: What are the significant predictive relationships between community-level factors (supervised childbirth by a skilled health care professional,

distance to a health facility) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda?

H_o2: There are no statistically significant predictive relationships between community-level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda.

H_a2: There are statistically significant predictive relationships between community-level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda.

Research Question 3: What are the differences in neonatal deaths across geographical regions while controlling for maternal factor (age of the mother), personal illness control factor (number of ANC visits, number of TT injections received before pregnancy), among women ages 15 to 49 years in 2016 in Uganda?

H_o3: There are no statistically significant differences in neonatal deaths across geographical regions while controlling for the maternal factor (age of the mother), personal illness control factors (number of ANC visits, number of TT injections received before pregnancy) among women ages 15 to 49 years in 2016 in Uganda.

H_a3: There are statistically significant differences in neonatal deaths across geographical regions while controlling for the maternal factor (age of the mother), personal illness control factors (number of ANC visits, number of TT injections received before pregnancy) among women ages 15 to 49 years in 2016 in Uganda.

Theoretical and Conceptual Framework

Mosley and Chen's (1984) model for child survival in developing countries was used to examine the way in which socioeconomic determinants impact neonatal deaths in Uganda. The model presupposes that all social and economic determinants of health function through a common set of proximate or biological factors influencing the survival or death of a child. I selected the model for the following reasons:

- The model focus is children in developing countries, a category to which Uganda belongs.
- Inclusion of socioeconomic determinants of health such as distance to the health facility and geographical region is provided for in the Mosley and Chen's model.
- Mosley and Chen's model combines both social and biological variables into one framework, which informed this study.

The study focused on proximate factors (personal factors) and socioeconomic factors impacting neonatal death. In the Mosley and Chen (1984) model, the socioeconomic determinants influence how newborns transition from health to sickness, while personal factors of the mother affect prevention and recovery after treatment. For this study, the access factors were personal illness control factors including access to and use of preventive medical services like TT vaccine, receipt of antimalaria prophylactics, attendance to ANC, delivery by a qualified medical professional, and age of the mother at first birth. The socioeconomic access factors were distance to a health facility and geographical region. Adoption of the model helped me isolate access factors, impacting

neonatal deaths in Uganda. Findings may inform the development of appropriate policies by the government for implementation by different stakeholders, including communities, health care practitioners, household members, and mothers. Such policies may guide the development of appropriate interventions and systems that could aid the reduction of neonatal mortality in Uganda, which has stagnated at 27 deaths per 1,000 live births for more than 10 years. The analytical framework for neonatal deaths is presented in Chapter 2 of this study.

Nature of the Study

This study was retrospective using survey data from the 2016UDHS collected by the Uganda Bureau of Statistics. The survey collected data from women of ages of 15 to 49 years in Uganda. I selected a correlational cross-sectional design guided by Campbell and Stanley (1966) and Vogt, Gardner, and Haeffele (2012). I used binary logistic regression to assess the effect of predictor variables on neonatal mortality similar to the method used by e. I used analysis of covariance (ANCOVA) to determine whether differences exist in neonatal deaths by geographical region while controlling for the age of the mother, ANC visits, and TT vaccine doses. The design supported utilization of secondary data from the 2016 UDHS to establish possible access factors to health services impacting the primary outcome binary variable neonatal deaths.

Definitions

Some of the definitions in this study include the following:

Age of the mother: The completed years of the mother at the time of her first birth.

Antenatal care (ANC): The medical attention given to the mother during pregnancy in a health facility and recorded as yes/no. Such care includes obtaining a record of the mother's medical history, health requirements, and providing health education on the value of ANC and the unborn child. Also, it includes giving advice on personal hygiene, the unborn child, undertaking screening tests, and receiving treatment for infections (WHO, 2016). The requirement by WHO is a minimum of 4 visits during pregnancy.

Antimalarial medications: The medicines prescribed and taken for malaria prevention like SP/Fansidar. The other types of malaria drugs include "chloroquine, mefloquine, atovaquone, chloroguanide, artesunate, doxycycline, pyrimethamine, hydroxychloroquine, or primaquine" (Organization of Teratology Information Specialists, 2017, p. 1).

Distance to health facility a challenge: Whether pregnant women consider distance to the any nearest health facility, (private or public), a challenge.

Geographical region: The grouping of districts with similar characteristics in Uganda. They include central, eastern, northern, west Nile, and western.

Neonatal deaths: The cessation of the life of newly born baby within the first 28 days of life.

Neonatal mortality rate: The number of babies who die during the first 28 days expressed out of every 1,000 babies born alive.

Neonatal tetanus: A disease developed by a newborn baby between 3 and 14 days after birth in which neonates develop a stiff jaw/neck, body spasms, and rigidity of the abdominal and muscles (Blencowe, Lawn, Vandelaer, Roper, & Cousens, 2010).

Neonates/newborn: A newborn baby age less than 1 month.

Odds: The chance of a situation happening. In this study refers to the chance of dying within 30 days.

Odds ratio (OR): The association between exposure and outcome. The OR represents the odds that an outcome like neonatal death will occur given a particular exposure like attending ANC visits and compares this to the odds of not experiencing neonatal deaths in the absence of that exposure. The OR refers to the odds of an event in the treatment group compared to the odds of an event in the control group (Schnell, n.d.). The odds of an event like neonatal deaths is the number of women experiencing neonatal deaths divided by the number of women not experiencing neonatal deaths. The odds of neonatal death depend on the interplay of the dependent variables that include supervised delivery and whether the distance to the health facility is a challenge.

Proximate factors: Measurable determinants of health that are categorized into maternal factors (age of the mother) and personal illness control factors (ANC attendance, TT vaccine, antimalarial drugs, supervised delivery) in line with Mosley and Chen's model.

Socioeconomic determinants: Factors that function through the proximate determinants broadly categorized into household factors like wealth index and community factors of distance to the health facility and geographical region. Whether

distance to the health facility is a challenge is a categorical variable measured as yes/no. Geographical region is a categorical variable referring to the 4 five regions in the country: central, eastern, northern, west Nile, and western.

SP/Fansidar: Sulfadoxine/pyrimethamine is an antimalarial drug developed in the 1960s for the treatment of malaria.

Supervised delivery: Delivery of an expectant mother under the supervision of a health professional. Through supervised delivery health professional can identify, manage, and treat pregnancy and newborn complications early (WHO, 2005).

Tetanus: A potentially fatal disease of sudden onset and caused by a spore-forming gram-positive obligate anaerobic bacterium found primarily in the soil and present in the animal and human waste. The bacteria enter the body through open wounds, use of nonsterile equipment, and other means resulting in stiffening of body muscles (Guimara et al., 2002).

Tetanus toxoid: A vaccine administered to pregnant women during ANC visits to prevent tetanus.

Uganda: A country in sub-Saharan Africa, specifically East Africa. Uganda is a landlocked country circumscribed by the Democratic Republic of Congo, Kenya, Southern Sudan, Tanzania, and Rwanda.

Uganda Demographic and Health Survey (UDHS): A study undertaken every 5 years by UBOs and partners.

Assumptions

I assumed that records of neonatal deaths collected from the 2016 UDHS were representative of all deaths of newborns in Uganda. The focus of the research was on mothers who were alive during the survey, excluding the dead mothers. However, estimates are still representative because mother's death is a rare event. I also assumed that the interviewers administered the questionnaires correctly, translations to the local languages were precise, and data were accurately recorded. Another assumption was that all women interviewed provided accurate responses.

Scope and Delimitations

The study included women aged 15 to 49 years covered in 2016 UDHS for the entire country. The study consisted of newborn babies born alive but who died before 28 days. The study excluded deaths of neonates that had occurred with their mothers also dead because nobody was present to report the death. The survey excluded mothers of reproductive age who were either expatriate, wives to expatriates, non-Ugandans working with different national and international non-government organizations, women living in political institutions. barracks of the armed forces, or any other specialized institution due to their lack of representativeness.

Limitations

A significant limitation of the 2016 UDHS data was that estimates could only be provided at national level and not for each district possibly limiting the usefulness of data at district level. During the analysis inference was for the entire population with findings at national level as such policy makers may use this to inform decision making. Another

limitation was that the 2016 UDHS only related to surviving mothers at the time of the survey, this may affect validity and reliability because information on mothers who succumbed to death was excluded. In this study this had minor effects on the overall estimates since the sample for the study was large enough (7,538) taking care of such exclusions. Another limitation was that the 2016 UDHS relied on respondent recall for a reference period of the previous 5 years a likely source of inaccuracy. However, because death is a rare event a respondent may easily recall an event, and a shorter reference period would provide less observations for the study. Overall, despite these limitations, the data of the UDHS 2016 reflected the prevailing situation in Uganda.

Significance

Despite the fixed neonatal mortality at 27 deaths per 1,000 live births since 2000-01, researchers have not examined factors impacting on access to health services and their impact on the death of neonates. The following are the anticipated benefits:

Significance to Theory

This study may contribute to existing scholarly evidence on neonatal deaths. The study findings validated the theory by Mosley and Chen because the results showed proximate factors (ANC attendance and antimalarial drugs during pregnancy) had a significant effect on neonatal deaths. Thus, the findings may contribute information on neonatal deaths and validate the framework similar to the study on the survival of neonates in Nigeria by Akinyemi, Bamgboye, and Ayeni (2015). This study may increase the body of knowledge on access factors to health services impacting on neonatal deaths, an area with limited literature in Uganda. Identification of the access factors to health

care services impacting neonatal mortality may not only inform the policy direction in Uganda but similar developing nations.

Significance to Practice

The study findings provide information on factors impacting neonatal deaths that may support the development of targeted interventions at national, community, and household levels. Another implication for social change is a better understanding among health care professionals of neonatal mortality prevention beyond medical prescriptions and increased awareness to mothers on the benefits of attending ANC at least 4 times. The results may enhance partnerships between the different stakeholders in promoting ANC services for all pregnant women and encouraging mothers to attend ANC at least 4 times and take antimalarial drugs during pregnancy. The information may inform government budget allocations to the health sector and guide the development of policies at national and local government levels that may form a basis for implementation of specific neonatal programs in the country. By so doing, Uganda may thereby contribute to the achievement of the global agenda of leaving no one behind and reducing the proportion of neonatal deaths by 2030 (UNICEF, 2018).

Significance to Social Change

This study may inform the establishment of community health groups to advocate, educate, and sensitize members of households on the importance of ANC attendance, and malarial prevention during pregnancy. This may lead to increased ANC attendance by women and taking malarial prevention drugs. Another positive social change is the initiation of adult learning classes translating into increased knowledge which could lead

to increased uptake of ANC services leading to a reduction in neonatal deaths. With increased knowledge and appreciation of the importance of ANC services, households, communities, and the entire country may experience low rates of neonatal deaths and realize savings on resources that would be used to meet medical expenses. The savings may be put to more productive economic activities like commercial agriculture, agro-processing, and household wealth, which could result in better household incomes. At the national and global levels, the study findings may serve as a wake-up call to policymakers, politicians, and development partners in advocating for ANC attendance, which could translate into people they serve living in healthier environments. At the international level, positive social change may include a reduction in deaths in line with the SDGs and saving 116 million lives that would otherwise be lost, as indicated by Lawn et al. (2014). The result may be a healthier adult population without any disability, contributing positively to economic development in Uganda and the world.

Summary

In Chapter 1 broad information on neonatal deaths was provided. About 9 out of 10 neonatal deaths occur in developing countries (Sankar et al., 2016). Relevant information on predictors of neonatal deaths was presented showing the extent to which previous researchers understudied neonatal deaths. In the background section, I reviewed studies on neonatal mortality focusing on neonatal tetanus mortality in Africa, predictors of neonatal mortality in Asia and Africa, and neonatal deaths in Uganda. Chapter 1 also included the problem statement, study purpose, and variables. It presented information on the research questions, hypotheses, and theoretical framework informing the study.

Chapter 1 further presented the nature of the research, definitions of terms, assumptions, delimitations, limitations, and significance of the study. The contribution of this research is on provision of information on access factors impacting neonatal deaths in Uganda necessary in informing the policy direction. Findings may could contribute to the attainment of the SDG goals by 2030. Chapter 2 presents a synthesis of previous researcher's studies related to the research questions.

Chapter 2: Literature Review

The purpose of the study was to determine access factors to the use of health services and how they impact neonatal deaths in Uganda because nearly 99% of neonatal deaths occur in developing countries (see Sankar et al., 2016). Despite the reduction of neonatal mortality in the world to 19 deaths per 1,000 live births, Uganda has experienced stagnant neonatal mortality rates, a potential threat to a healthy and productive population. This study focused on the effect that ANC visits, delivery by skilled medical personnel, receipt of TT vaccine, receipt of SP/Fansidar, and distance to the health facility had on neonatal mortality. I also examined the differences in neonatal deaths across geographical regions while controlling for mothers age at first birth, the number of ANC visits, and number of TT vaccines received before pregnancy.

In this chapter, I review peer-reviewed articles relating to access factors to health services, especially ANC attendance, because through ANC attendance pregnant mothers receive the TT vaccine, antimalarial drugs, and encouragement to deliver using a qualified health professional. I also review studies on socioeconomic factors that could have an impact on neonatal mortality, like, distance to the health facility and geographical region. The limited knowledge regarding access to and use of health care services and the factors impacting the stagnant neonatal mortality rate in Uganda justified this study. The review of literature highlighted gaps identified by previous researchers and contributions to the existing research on neonatal deaths which may help Uganda and other developing countries create appropriate policies to curb the high mortality rates of newborn babies.

The first part of the literature review presents the introduction to the problem and purpose of the study. The next section includes methods employed in the literature search, including the library databases, key search terms, timeframe, exclusions, and inclusions. The next part presents literature related to the theoretical underpinnings, specifically Mosley and Chen's framework, rationale for choice of theory, and relationship to the study on neonatal mortality. The conceptual framework and literature review focus on proximate and socioeconomic variables related to neonatal mortality. This chapter provides a synthesis of findings, gaps, and an overview of the study's methodology.

Literature Search Strategy

The search strategy to identify the relevant articles on neonatal mortality was diverse. It included a review of relevant articles underlying the theoretical foundations, conceptual framework, and significant causal factors of neonatal mortality especially in developing countries. The search strategy focused on quantitative research that addressed the relationship between access factors and use of health care services and newborn deaths. The key elements were the number of ANC visits during pregnancy, receipt of antimalaria drugs during pregnancy, TT vaccine doses obtained, age of the mother, and medically supervised childbirth. Other access variables were socioeconomic factors such as distance to a health facility, and geographical region. The databases searched were Dissertations and Theses @ Walden University, ProQuest Central, ProQuest Dissertations & Theses Global, Medline, PsycINFO, PubMed, the Cochrane Library, Google Scholar, ScienceDirect, Public Health, Health & Medical Collection, and Nursing

and Allied Health. In some cases, the research was narrowed to Uganda by including *developing countries*, *sub-Saharan Africa*, and *Uganda* in the search terms. Also, the review covered articles from the bibliographies of previous studies and doctoral dissertations on neonatal mortality. The journals accessed included *Biosocial Science*, *Environmental Research and Public Health*, *Pediatrics*, *Malaria*, *Global Health*, *Global Public Health*, and *Social Indicators Research*. Others were *Medunab*, *Lancet*, *Lancet (ScienceDirect), Lancet Infectious Disease*, *International Journal of Population Research*, *African Journal on Reproductive Health*, *Maternal Research and Treatment, Reproductive Health*, and the *BMC Pregnancy and Childbirth*. Also accessed were *BMC Health Policy*, *BMS Pediatric*, *Lancet Health Policy*, *Asian Journal of Nursing Education Pregnancy and Childbirth, Health and Social Behavior*, *Health Services*, and *Research* and *Management Epidemiology*. The literature review on different theoretical frameworks for the analysis of neonatal mortality was undertaken focusing on the Mosley and Chen's model. It included a systematic review of peer-reviewed studies, a search of papers, abstracts, publications obtained from abstracts, and conference presentations relevant to this research. All the articles selected were from peer-reviewed journals, credible websites of specific national and multinational organizations (World Bank, WHO, UNICEF, Centers for Disease Control and Prevention, and SDGs). This literature review, therefore, enhanced the study design and choice of the independent variables.

Key Search Terms

Keywords applied include neonates, neonatal mortality, neonatal deaths, mortality, neonatal tetanus mortality, infant & under-five mortality, Mosley and Chen's

theory/framework, and binary regression model. Others were ANC attendance and neonatal mortality/deaths, age of the mother, TT vaccine and neonatal mortality, malaria prevention and neonatal mortality, supervised delivery, and distance to health facility. Also, the search strategy included Africa, sub-Saharan Africa, developing countries, and Uganda.

Inclusion and Exclusion Criteria

English articles were selected on quantitative studies on neonatal deaths; predictors of newborn deaths, and the survival of neonates. Others were access to health services, preterm births, antenatal attendance and immunization. The review covered articles with the women of ages 15 to 49 years as study population and some qualitative studies on newborn deaths. Exclusions were studies on disease causation, disease outbreak investigation, disease surveillance, screening etc. and involving women of ages 15 to 49 years related to persons living in institutions or armed forces. The literature review focused on articles on neonatal mortality/deaths, child and infant mortality but excluded studies exclusively on maternal deaths with no relationship to pregnancy or child deaths. Also excluded were articles published in other languages. Despite the restriction to articles in peer-reviewed journals, some exceptions were articles related to the Mosley and Chen's model. Also, because there were limited articles on neonatal deaths in Uganda, there was no restriction on the date of publication and majority of researchers undertook studies in developing countries.

Data for Literature Review

The information extracted in the review of literature were identifiers of the study namely name of author, date, year of study, statistical method applied, theoretical framework, results, risk factors, and recommendations for future research. Others were assumptions, limitations, and study conclusions. The focus on peer-reviewed articles was because they are organized, easy to analyze, valid, and reliable.

Early Studies on Neonatal Deaths

Early studies on neonatal deaths were linked to the safe motherhood initiative and focused on the role of traditional birth attendants (TBA) on neonatal deaths, and the administration of the TT vaccine (De Brouwere, Tonglet, & Van Lerberghe, 1998). The researchers underscored the importance of embracing modern health care and ANC attendance as opposed to the use of TBA. Yoonjoung and Kenneth (2006) used historical data for England and Wales from 1905 to 1997 to compare neonatal mortality rates. Findings showed that developing countries experienced a decline of 2% per year in early childhood mortality during the decade of the 2000's because of the slow decline in neonatal mortality rate. The researchers Yoonjoung & Kenneth showed that while reductions in neonatal deaths were higher in the south Americas and the Caribbean Islands, north Africa, sub-Saharan Africa, and the Arab States registered slower reductions in neonatal deaths due to the gradual decrease in early neonatal mortality rate. During the same period, England and Wales experienced a decline in infant deaths from 132 deaths to 6 deaths per 1,000 live births similar to trends of late neonatal mortality rate (LNMR) and post-neonatal mortality rate (PNMR). However, decline in early

neonatal mortality rate (ENMR) was slower up to 1950 and faster from 1975 (Yoonjoung & Kenneth, 2006). The researchers showed that in the eastern, southern, central, and western Africa, ENMR was higher than LNMR different from the historical data of England and Wales. Whereas the researchers suggested a possibility of age heaping and omission in reporting the age of death of babies by the mothers, they underscored the need to understudy impact of health service access factors on neonatal deaths.

Hug, Sharrow and Danzhen (2017) also showed that between 1990 and 2016 child mortality rates reduced from 93 deaths for every 1,000 live births to 41 deaths for every 1,000 live births. In the same period neonatal mortality rate decreased from 37 deaths for every 1,000 live births to 19 deaths for every 1,000 live births over the same period. According to the researchers sub-Saharan Africa accounted for 38% of these deaths and southern Asia 39%. Neonates were at a higher risk of death compared to infants and children aged five years and below. The researchers showed that survival rate of children aged five years and below in sub-Saharan Africa was 1 per 13 children compared to 1 per 189 children in developed countries. Also, 60 million deaths of children under five years of age were predicted between 2017 and 2030 with 50% of them being neonates. The researchers argued that realizing the United Nations 2030 target of reducing neonatal deaths requires a concerted effort on prevention of diseases, injuries, and other neonatal complications through ANC attendance.

The researchers Bakshi and Dixit (2017) presented the outcome of infant deaths as interplay of government policies and socioeconomic status of a household. Bakshi and Dixit attributed the high persistent infant mortality in developing countries to personal

and biological characteristics of the child, individual behavior of the child's mother, and socioeconomic characteristics of the household and community. Other determinants of childhood deaths in developing countries identified include access to health facilities, supervised childbirths, ANC attendance, iron and folic acid tablets, and proper nutrition. The researcher's Hug, Sharrow, and Danzhen (2017) identified home deliveries, access to unsafe water, the umbilical cord, and intestinal tract infection as risk factors to neonatal deaths in East Africa. A systematic analysis by Ahmed and Won (2017), and You et al. (2015) underscored the importance of embracing effective neonatal programs in lowering the prevalence of newborn deaths. Ahmed and Won recommended developing countries to adopt specific policies and programs for children to track progress in achieving SDG goal 3. The history on neonatal deaths justifies this study to determine factors affecting access to health services and their impact on neonatal deaths in Uganda.

Theoretical Foundation

The Mosley and Chen's model for child survival in developing countries informed this study.

Theory Origin

From the conceptual framework, socioeconomic determinants of health function directly or through proximate determinants to impact on either mortality or morbidity of children (see Figure 1).

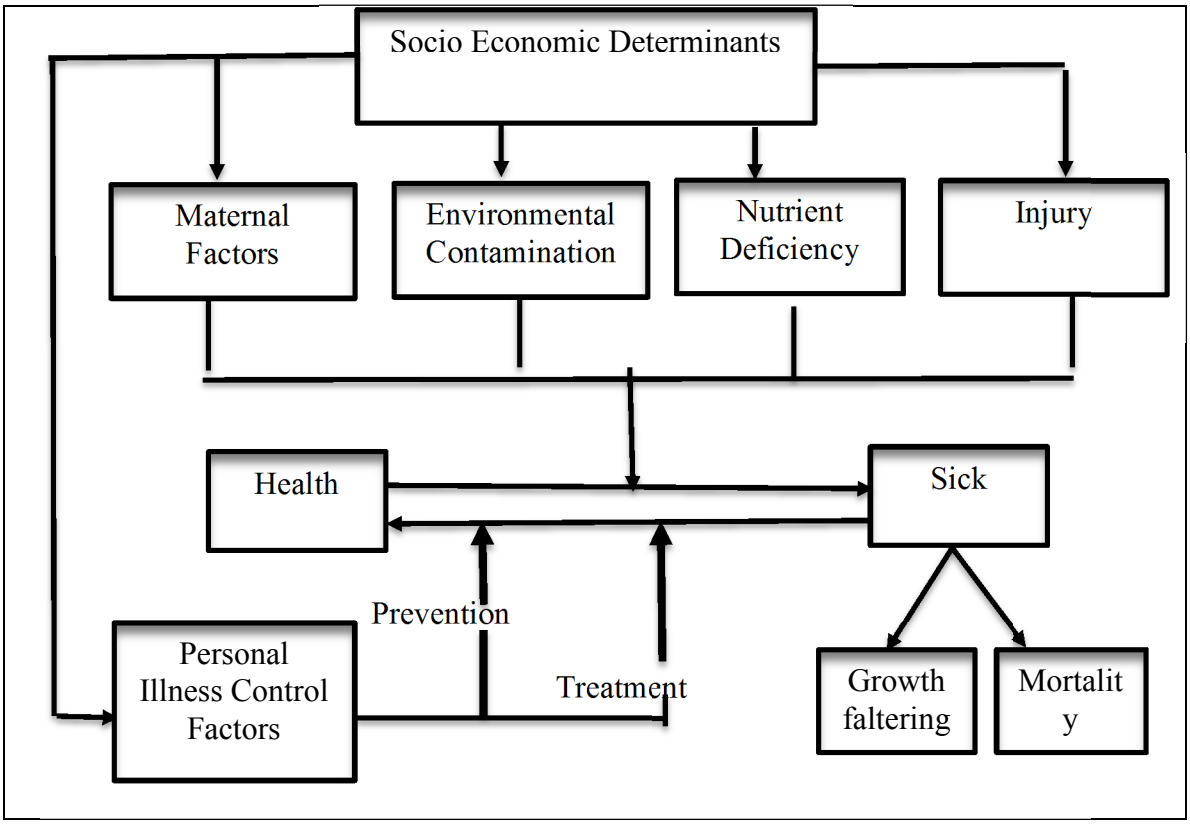

Figure 1. The Mosley and Chen's proximate determinants. From "An analytical framework for the study of child survival in developing countries," by W. H. Mosley and L. C. Chen, 2003, *Bulletin of the World Health Organization, 81(2)*

The framework showed how proximate determinants of health (maternal, environmental contamination, nutrient deficiency, injury, and personal illness control factors) operate through socio-economic factors to influence health/sickness which could result in death or morbidity. Specifically, "…the personal illness control factors influence both the rate of illness (through prevention) and the rate of recovery (through treatment)" (Mosley and Chen's, 2003, p.142), resulting in a healthy or sick population. From the framework mortality in children is not only a function of one disease episode but interplay between the socioeconomic and proximate determinants thus merging traditional approaches with medical methods.

Major Theoretical Propositions and Assumptions

The Mosley and Chen's (2003) model assumes that 9.7 out of every 10 babies born could survive death and live through the first five years of birth. Another assumption is that in surviving population biological factors such as nutrient deficiency and specific diseases could function through proximate determinants to cause mortality or morbidity. Finally, the model assumes that death or mortality in children is a result of bio-social interactions that directly increase the risk of sickness or death in children. In this study socioeconomic factors (distance to health facility and geographical region) were assumed to operate directly or through the proximate determinants (ANC attendance, TT vaccine, antimalarial drugs, delivery by a skilled medical professional, age of the mother) to influence neonatal deaths.

Previous Literature and Research Applying the Theory

Nass (2016) acknowledged the usefulness of the Mosley and Chen's framework in evaluating the effectiveness of the tetanus surveillance systems in Nigeria. The author understudied personal elements and found that neonatal tetanus (NNT) mortality mainly occurred among newly borne babies whose mothers had received only a single dose of tetanus vaccine.

Khadka, Lieberman, Giedraitis, Bhatta, and Pandey (2015) applied the theory to explore the impact of socioeconomic factors and proximate determinants on infant deaths using the Nepal demographic and health survey with a sample of 5,391.

The researchers Batista, de Carvalho, and Vasconcelos (2018), also applied the Mosley and Chen's model in the case-control study on health service factors affecting neonatal deaths in Brazil.

Another research in Ethiopia by Gebretsadik and Gabreyohannes (2016) applied the model to understudy under-five mortality using the 2011 Ethiopia demographic and health survey.

Danawi and Ogbonna (2014) used the Mosley and Chen's framework to study infant mortality in Abia state in Nigeria among 475 women of ages 15 to 49 years while Adedini et al. (2015) sought to determine whether infant and child mortality varied by region using the same model.

Rationale for the Choice of the Theory

Mosley and Chen's model provided a multi-disciplinary approach which facilitated the analysis of social, economic, and proximate factors effecting neonatal

deaths in Uganda. Uganda operates both private and public health care system with no universal health insurance scheme with provision of private health services at the discretion of individuals making the model appropriate. The government budget allocations to the health sector have increased from 7.4% in 2013-14 to 9.2% in 2018-19 (Ministry of Finance, Planning and Economic Development, 2017). Such increments could partly explain the health improvements registered where ANC attendance increased from 90% in 2000-01 to 97% in 2016, and receipt of TT vaccine rose to 80% in 2016(UBOs, 2017a). Also, both under fine and infant mortality rates reduced over the same period. Despite the marked improvements the neonatal mortality rate remained stagnant at 27 deaths per 1,000 live births presenting a health concern requiring an investigation. Also, the absence of a universal health insurance scheme as highlighted by Ministry of Health (MoH) (2015), could limit the effectiveness of health services in the regions. The Mosley and Chen's framework (1984) offered me an opportunity to analyze socio-economic and proximate determinants that could be impacting on neonatal deaths in Uganda.

Rational of the Choice of the Theory to Neonatal Mortality

Applying the Mosley and Chen's model informed the determination of factors affecting access to health services and their effect on neonatal deaths in Uganda. The proximate or intermediate factors were personal control illness factors (ANC visits, TT vaccine doses received before pregnancy, receipt of anti-malarial drugs during pregnancy, supervised childbirth by a qualified health professional), and age of mother at

first birth. The socio-economic factors were geographical region and distance to a health institution. Accordingly, the guiding research questions were:

Research Question 1: Are there associations between personal illness control factors (number of ANC visits, number of TT injections received before pregnancy, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda?

Research Question 2: What are the significant predictive relationships between community-level factors (supervised childbirth by a skilled health-care professional, distance to a health facility) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda?

Research Question 3: What are the differences in neonatal deaths across geographical regions while controlling for maternal factor (age of the mother at first birth), personal illness control factor (number of ANC visits, number of TT injections before pregnancy), among women of ages 15 to 49 years in 2016 in Uganda?

The Mosley and Chen's (1984) model guided the study on neonatal mortality. The model presupposed death of a child as an interplay of socioeconomic factors functioning through proximate determinants to cause sickness or death (Batista, de Carvalho, & Vasconcelos, 2018). The socio-economic factors were distance to the nearest health facility and geographical region while of proximate determinants were personal control factors and maternal access factors.

Table 1.

Mosley and Chen's Proximate Variables

Class	Examples
Environmental Pollution	Fuel for cooking, indoor spraying for mosquitos, and type of toilet facility
Maternal	Mothers' age, childbearing ability and child spacing
Nutrient Deficiency	Child weight for age, consumption of iodized salt during pregnancy
Injury	Injuries during pregnancy or injury-related disabilities
Personal Illness control factors	ANC visits, post-birth care, anti-malaria drugs, tetanus vaccine, delivery by a qualified health personnel, and chord treatment

Synthesis of Previous Writings by Key Theorists Related to Neonatal Mortality

The researchers Davis and Blake (1956) applied the Mosley and Chen's model to determine the effect that fertility factors (conception before intercourse, after intercourse, and birth outcome after conception) had on childhood mortality. While Caldwell (1979), and Strauss and Thomas (1995) developed other child survival models, they focused on sanitation factors, disparities in health, nutrition and socioeconomic status, but excluded the effect that proximate determinants could have on neonatal mortality. Link and Phelan (1995) on the other hand developed the fundamental cause model (FCM) with social variables that were considered as underlying causes of morbidity because they acted as a gateway to health by exploiting the existence of other factors like financial resources, social networks, and communication. According to the FCM, families could utilize existing socio-economic factors like money and ownership of transport to seek medical treatment and prevent disease and disease outcomes. The model, however, ignored the personal illness control factors like ANC attendance as elaborated by Mosley and Chen's in their model considered in this study.

Other researchers Semwanga, Nakubulwa, and Adam (2016) used the dynamic synthesis methodology to develop a non-parametric neonatal simulation model (NEOSIM) to determine potential policy options for better child mortality rates in Uganda. The model focused on population, demand for services, facility use, mother's health, and clinical care options to test the effectiveness of the various possibilities in improving health outcomes. Whereas the NEOSIM model identified the most effective package as the provision of free delivery kits, it mainly applied *what if* conditions and ignored the relationship between social, economic and biological variables. This study, on the other hand, focused on determining whether accessing a health facility was a significant challenge faced by pregnant women. Also, this study looked at the effect of access to antimalarial drugs during pregnancy and the TT vaccine before childbirth on neonatal deaths. Instead of the NEOSIM model, this study applied the Mosley and Chen's model using data from the 2016 UDHS.

Meegama (1980) developed a classical model of infectious diseases focusing on biological factors and their effect on childhood deaths but excluded the role socio-economic factors could have on disease processes. In his model, Meegama argued that reduction in childhood mortality rates in Bangladesh were a result of interventions in the public health programs that addressed disease borne through water, air, and food. However, Meegama focused on only biological factors excluding socioeconomic factors that could limit the study on neonatal deaths. This study looked at both proximate and socio-economic factors.

Nigatu, Worku, and Dadi (2015) undertook a study to determine the extent of mothers' knowledge on dangers of neonatal deaths in north west Ethiopia. The empirical evidence by researchers collaborated findings by Semwanga, Nakubulwa, and Adam (2016), and Rwashana et al. (2014) who underscored ANC attendance as a key factor in reducing neonatal deaths. However, limited information exists to explain the stagnating levels of mortality in Uganda necessary to inform the policy direction, thus the focus of this study.

A study on neonatal mortality in Uganda by Kananura et al. (2016) was limited in geographical coverage. While the researchers applied the Mosley and Chen's framework for child survival, findings were not nationally representative because the population covered accounted for only 3% of national population (930,200 persons). Another study by Rwashana et al. (2014) on correlates of neonatal mortality was only in Kampala city, with no information on access factors to health services impacting on neonatal mortality. This study attempted to address the gap using the 2016 UDHS representative of the entire country.

Key Statements and Definitions Related to the Conceptual Framework

This study on determining access factors to health services impacting on neonatal mortality in Uganda was informed by the Mosley and Chen's (1984) framework that combines both the social and biological factors. The definition of neonatal mortality as the death of babies within 28 days of birth was based on the World Health Organization standard (WHO, 2018a). The outcome was a binary variable considered as a success (1 = if the death of the newly born baby occurred within 28 days of life) or failure (0 = if the

newborn baby did not die within the specified period). Independent variables were ANC visits, TT vaccine, receipt and consumption of antimalarial drugs (SP-Fansidar) during pregnancy, supervised childbirth by a skilled health care professional, and age of the mother. ANC is the specialized medical care received by women and girls during pregnancy provided by a qualified medical professional for the mothers' and baby's' health (WHO, 2018a). Normally, TT is received by mothers during pregnancy for protection from tetanus as recommended by World Health Organization (WHO, 2018c). According to World Health Organization mothers with unknown immunization status were expected to receive two doses of the TT vaccine within a month's interval during pregnancy and a repeat dose within 14 days before delivery. Accordingly, receiving two doses of TT vaccine provided protection against tetanus for up to three years, three dosses for five years, and five doses permanently during childbirth years. This study sought to determine whether receiving TT vaccine before pregnancy had any effect on neonatal deaths. Antimalarial drugs refer to the medicine provided to women of ages 15 to 49 years during pregnancy for protection against malaria. According to the Organization of Teratology Information Specialists (2017), the probability of mothers giving birth to a disabled baby due to malaria disease was between 3% and 5%. Antimalarial medicine (SP-Fansidar) is a drug taken during pregnancy to prevent malaria for both the mother and baby. Delivery by a skilled health professional refers to the trained medical personnel assisting the mother during childbirth. Mother's age refers to the age of the mother when the first baby was born, and distance to a health facility was whether pregnant women considered distance a challenge in accessing health services.

Geographical location refers to the sub-grouping of districts in Uganda into regions, namely central, eastern northern, west Nile and western. The study population constituted mothers of ages 15-49 years in the 2016 UDHS. Finally, the theoretical underpinning was the Mosley and Chen's theory of child survival in developing countries.

Studies Conducted Globally Regarding Constructs of Interest

The constructs of interest in this study were ANC visits, TT vaccines doses received before pregnancy, receipt of antimalarial drugs during pregnancy, delivery by a skilled medical practitioner, age of the mother at first birth, whether distance to the health facility was a challenge, and geographical region. The assumption was that each of these constructs directly or indirectly had an association with neonatal deaths. Researchers like Sankar et al. (2016) showed that on average 6 out of every 10 neonatal deaths (62%) occurred within 0 to 3 days of life. The main contributory factors were preterm births, secondary infections like sepsis and pneumonia requiring prenatal and postnatal care. A prospective cohort study by Ndombo et al. (2017) in Cameroon showed that deaths of babies were at 16% with a leading cause being complications from preterm births (69%) collaborating other researcher findings on the importance of ANC. A significant criticism of findings by Ndombo et al. was their focus on only neonates re-admitted to the Bamenda Regional Hospital ignoring other hospitals in Cameroon.

Mason et al. (2014) also underscored investments in health services and development of action plans to support newly borne babies for policy and investment decisions. The researchers Diego and Beatriz (2017) highlighted health care financing, availability of trained medical personnel, distance to the facility, and service delivery as

major contributory factors. According to Mason et al., the first week of the life of a baby sets the basis for more than double the return on future investments providing an opportunity for a healthy and stable population that could make it possible for the country to reap from the likely benefits of a demographic dividend. Both Mason et al. and Ndombo et al. (2017) underscored the need for appropriate interventions to reduce neonatal deaths.

Literature on Selected Variables and Concepts

The individual control factors as elaborated in the Mosley and Chen's model influence sickness through prevention and process of recuperation. Such considerations were number of ANC visits, receipt of antimalarial drugs, TT vaccines, and delivery by qualified health personnel.

Antenatal Care Attendance during Pregnancy and Neonatal Deaths

In pregnancy mothers are required to undertake routine and systematic medical reviews by attending ANC and being checked by trained health care professionals from conception to delivery to facilitate diagnoses of disease or likely birth complications. The recommendation by the World Health Organization and UNICEF is that at least 4 ANC visits should be undertaken during pregnancy with the first visit during the gestational week (WHO report, 2007). The importance of ANC visits was collaborated by findings of Makate and Makate (2017). During ANC, the health workers conduct physical examinations of the pregnant women and undertake relevant laboratory tests to assess the quality of health of mother and baby to provide necessary treatment as documented by WHO. The pregnant women are checked by a qualified health worker who screen for

diseases, identify stress signs, take preventive health measures, administer TT vaccine, and intermittent preventive treatment in pregnancy (IPTp) for malaria prevention. Shafique Sani et al. (2017) underscored ANC as critical during pregnancy because in addition to treatment awareness was created on maternal and newborn health critical in averting neonatal deaths and improving pregnancy outcomes. The researchers Gurusamy and Janagaraj (2018) in Rwanda also underscored the importance of ANC highlighting that 3 out of every 10 maternal deaths were a result of inadequate ANC services.

The researchers Ezeh, Agho, Page, Dibley, and Hall (2014), Gurusamy and Janagaraj (2018), and Makate and Makate (2017) showed neonatal mortality as still a challenge in the world responsible for over 60% of infant deaths due to treatable or preventable diseases which could be identified during the ANC. A study by Moundzika-Kibamba and Nakwa (2018) in Leratong hospital in South Africa showed fundamental causes of neonatal deaths as preterm delivery, low weight at birth, and caesarian births. According to Moundzika-Kibamba and Nakwa (2018) curbing high death rates in babies requires provision of high care ANC services, improving access to health services, and early detection of perinatal asphyxia. Another study by Gimeno, Parra-Llorca, and Vento (2017) showed that deaths of newborn babies especially early neonatal mortality death period significantly contributed to infant mortality. According to Lehtonen, Gimeno, Parra-Llorca, and Vento, while post-natal infant mortality in Ghana, Brazil and Uganda reduced significantly, neonatal deaths were not reducing. The researchers identified birth asphyxia, early perinatal infections, and prematurity as the primary causes. The researchers Lehtonen et al. (2017) highlighted ANC attendance and TT vaccine as

yielding positive results in developed countries. The literature underscored the importance of ANC attendance because pregnant women were assured of a continuum of health care to forestall any complications during pregnancy. In Uganda, limited information existed on the effect that ANC access has on neonatal death.

Another prospective cross-sectional study by Kananura et al. (2016) among 2,293 women in eastern Uganda showed that the combined deaths of neonates were higher at 34 deaths per 1,000 live births. About 75% of the deaths were during the first six days after delivery and they underscore ANC attendance as key in reducing neonatal deaths. However, Kananura et al. understudied only three rural districts, excluded urban areas, and covered only 3% of Uganda's population making the findings not nationally representative. Also, the researchers excluded non-resident pregnant women, women who had experienced abortions within 20 weeks, and stillbirths. This study while retrospective covered the entire country. This study did not only focus on ANC attendance but also investigated the effect that access to the TT vaccine before pregnancy, antimalarial drugs during pregnancy, and delivery by a qualified health worker could have on death of neonates.

While Kananura et al. (2016), Rwashana et al. (2014), and Semwanga, Nakubulwa, and Adam (2016) undertook studies in Uganda, the samples were too small to be nationally representative. Also, Braun et al. (2016) conducted a qualitative study focusing on the uptake of antimalarial medicine IPTp but excluded ANC attendance. This study instead was quantitative covering the entire country using the nationally representative data from the 2016 UDHS determine the effect of ANC attendance on

neonatal deaths. The Mosley and Chen's model informed this study while the binary logistic regression and ANCOVA were used in analysis.

TT Vaccine and Neonatal Deaths

The TT vaccine is given through injection to individuals to curb tetanus infection. Tetanus, caused by a bacterium (clostridium tetani), is characterized by convulsion and rigidity of muscles (Parker, 2006). The TT vaccine was first developed by Pierre Descombey in 1924 and widely used by the United States military in World War II to prevent tetanus infection among soldiers. Following the discovery of the vaccine, the incidence of tetanus reduced in developed countries and the vaccine is now widely used to eliminate diseases in the developing countries (Blencowe et al., 2010). In a bid to minimize the global impact of neonatal tetanus among the newly born babies, administration of the TT vaccine to pregnant women was introduced by the World Health Organization (Singh et al., 2012). The administration of the TT vaccine at different stages is to protect pregnant women, the unborn, and newborn children from tetanus. For effectiveness, storage of the vaccine is at 2 and 8 degrees Celsius to ensure potency and administered in a controlled environment in a health facility (WHO, 2018d & WHO, 2006). According to the Guiding principles for development of ACIP recommendations for vaccination during pregnancy and breastfeeding (2008), even if adults may receive immunization against tetanus before pregnancy, during pregnancy, it is important for expectant mothers to be vaccinated to curb tetanus. Therefore, receiving the vaccine during ANC is critical in strengthening the immune system to fight the tetanus bacteria. For women without a previous history of TT vaccination or whose TT immunization

status is not known, WHO also recommends two doses of TT vaccine before giving birth with a one month's interval between vaccine doses. Rather than focus on receipt of TT vaccine during pregnancy, this study sought to find out the effect of receiving TT vaccine before pregnancy on neonatal deaths among women of ages 15 to 49 years.

A retrospective cross-sectional study was undertaken by Shafique Sani et al. (2017) in Nigeria and they analyzed 4 events associated with NNT namely ANC visits, TT vaccines, where childbirth takes place, and cord care for the newborn. The researchers revealed that receiving only 1 dose of NNT vaccine increased chances of death by 4% compared to receiving 2 or more TT injections. A significant criticism was the restriction of researchers to 4 predictors of NNT ignoring other factors like access to antimalarial drugs for the prevention of malaria, and distance to a health facility. Also, the researchers used data from 7 health facilities not representative of the entire population.

Another study in Cameroon by Ndombo et al. (2017) on reasons for infant hospital deaths highlighted preterm births responsible for nearly 7 out of every 10 deaths (69%) due to lack of oxygen (23%) and infections (6%) partly attributed to failure to attend ANC. These results were in tandem with previous findings by Nass (2016) and Sani et al. (2017) on the importance of ANC, supervised delivery, and treatment of neonatal infections.

Nass (2016) also undertook a quantitative study to explain neonatal deaths in the Katsina state of Nigeria using surveillance and survey data applying the Mosley and Chen's model. The researcher found that mothers who received TT vaccine during pregnancy experienced lower NNT mortality because of the associated improved

immunity of the infants by 60% attributed to awareness creation during ANC visits. Specifically, ANC attendance, receiving at least 4 TT vaccines during pregnancy, delivery in a hospital, and cord care were contributory factors. From the literature review, an incomplete dosage of TT vaccine reduced the ability of the immune system of the pregnant woman to produce adequate anti-tetanus antibodies to counter any passive immunity against neonatal tetanus infection within the first 30 days which could result in death.

Another cross-sectional study in Nigeria on the prevalence of NNT by Saleh (2015) highlighted training traditional birth attendants (TBAs) on umbilical cord treatment as critical in neonatal deaths. The researchers showed that receiving TT vaccine, delivery by trained health workers, and umbilical cord hygiene could contribute to the elimination of NNT. While Ndombo et al. (2017) and Saleh undertook studies on NNT and highlighted the importance of TT vaccine the coverage was not representative of the country. The focus of this research was assessing the impact of accessing TT vaccine before pregnancy on neonatal deaths for the entire country.

Antimalarial Drugs (SP/Fansidar) and Neonatal Deaths

World over malaria accounts for 11% of neonatal deaths leading to low birth weight, anaemia, and premature births (Manu, Boamah-Kaali, Febir, Ayipah, Owusu-Agyei, & Asante, 2017). Preventive treatment against malaria is a recommendation by the World Health Organization such that all pregnant women receive IPTp-SP/Fansidar from the second trimester (WHO, 2018b). The disease discovered by Charles Louis Alphones Laveran in Algeria in 1880, results from a bite of a female anopheles mosquito

infected with apicomplexan parasite plasmodium falciparum which could cause morbidity or mortality (CDC, 2018). According to Eisele et al. (2012) and Mengesha and Sahle (2017), about 3·3 million neonatal deaths result from low birth weight with 3 out of every 10 deaths in developing countries. The need to strengthen the continuum of health care to prevent neonatal deaths was critical. According to Eisele et al. Infection of pregnant women with plasmodium falciparum during pregnancy was one factor contributing to the low weight in newborns and increased the risk of death especially in sub Saharan Africa. The researchers Chan, Fowkes, and Beeson (2014) showed that plasmodium falciparum was deadly to children and expectant women and in severe cases caused cerebral malaria, respiratory distress, and severe anemia. During each ANC visit, pregnant women were expected to receive antimalarial drugs for malaria prevention. As such administration of antimalarial drugs- SP/Fansidar is recommended during each ANC visit with a one month's interval between doses (WHO, 2007). The researchers Eisele et al. undertook a systematic review to compare pregnant women who received no protection with those who received IPTp therapy. Findings showed that women receiving IPTp experienced a reduced incidence of neonatal mortality. The effectiveness of antimalarial drugs was demonstrated by Eisele et al. and Uganda embraced the Malaria policy in 2000 requiring all expectant mothers to receive antimalarial drugs during ANC visits. Also, the researchers Amek et al. (2018) in the verbal autopsy of child-deaths underscored reducing the incidence of malaria transmission through receipt of the IPTp and use of insecticide-treated mosquito nets (ITNs) to mitigate neonatal deaths.

Another community-based cohort study by Kulmala et al. (2000) in 795 expectant mothers receiving ANC in a health facility in Malawi was undertaken to determine the predictors of neonatal deaths. The researchers showed preterm births, low birth weight, maternal malaria, age of the mother, maternal anaemia, and antenatal attendance accounting for the highest proportion of peri and neonatal deaths in line with the Mosley and Chen's model. While the researchers suggested a possible risk of preterm birth due to the prevalence of malaria among pregnant women, the researchers recommended further research in this area a gap that this study attempted to address by including receipt of the antimalarial medicine (SP/Fansidar) during pregnancy as proximate variable. Gates and Binagwaho (2014) also highlighted the persistently high stagnating mortality rates for newly born babies with 2.9 million babies dying within 28 days. According to Gates and Binagwaho, these deaths were not due to ignorance but absence of attention and limited investment in health care systems. Therefore, improving the continuum of care could contribute to reduced neonatal deaths. The researchers Braun et al. (2016) in their qualitative study in western Uganda on neonatal deaths highlighted that despite the knowledge of the dangers of malaria during pregnancy, there was limited uptake of the SP/Fansidar underscoring provision of malaria drugs during ANC. This study thus applied quantitative methods to analyze how access to the IPTp-SP/Fansidar during pregnancy impacts on neonatal deaths in Uganda which could provide a policy direction.

Delivery by a Skilled Professional and Neonatal Mortality

Delivery by a skilled professional is a recommendation by the World Health Organization requiring all pregnant women to be delivered by a medical person (Atuoye

et al., 2017). The researchers Amouzou et al. (2017), Atuoye et al. (2017), and Kawakatsu et al. (2014) showed that odds of early neonatal deaths were higher when no skilled medical professional supervised a delivery. The researchers applied the chi-square tests and multivariate logistic regression to analyze data and show that newborns delivered by skilled medical professionals are 16% less likely to die within 2 to 27 days while children born without help have a 95% risk of death.

Also, Kawakatsu et al. (2014) in their study show that non-medical experts supervise 1 in every 2 births in Kenya. Through the multivariate analysis, the key contributory factors to neonatal mortality in Kenya were education level of the mother, mother's knowledge of health information, ANC visits, spacing of births, wealth of the household, number of people in the household, and distance to a health facility. The researchers Kawakatsu et al. (2014) recommended a minimum of 4 ANC visits, education, and access to a health facility. They advocated for targeted policy interventions.

Another nationally representative demographic and geographical survey (the million-death study (MDS) undertaken by Fadel et al. (2017) among 1·3 million households in India to determine the trends and causal factors of neonatal and infant-month mortality. Fadel et al. showed a faster drop in child mortality and a slower reduction of newborn deaths especially in rural areas. According to Fadel et al., key factors were premature births and low birthweight possibly linked to quality of ANC services. Findings by Atuoye et al. (2017), Bellizzi, Sobel, Betran, and Temmerman (2018), Kawakatsu et al. (2014), and Soubeiga, Gauvin, Hatem, Johri (2014) underscored

delivery in health facilities as critical in reducing neonatal deaths in developing countries. While utilizing skilled health professional was reported as beneficial in reducing deaths of mother and the newborn baby, limited information existed on how this ws impacting on neonatal deaths in Uganda. This study sought to fill the gap by understudying the effect that delivery by skilled personnel has on newborn deaths.

Mothers' age at first birth and Neonatal Mortality

The age at which the mother gives birth to her first born has a relationship with child survival following the retrospective cross-sectional study by Izugbara (2016) on infant mortality in Burkina Faso, Burundi, and Sierra Leone. Also, Almeida, Almeida, and Pedreira. (2015) show in their study that the odds of preterm and post□term births are higher for the women of ages 41 years and above and lower for women of ages 21 to 34 years. The researchers highlighted that the risk of neonatal deaths could be mitigated depending on mothers' level of education. Another retrospective study by Salem Yaniv et al. (2011) undertaken to investigate the effect of the advanced age of the mother on perinatal outcomes in India shows a significant relationship to neonatal deaths. Maniruzzaman et al. (2018) in a study to determine factors influencing child and neonatal deaths in Bangladesh show using multiple regression analysis that mothers' age was a key contributory factor. In their findings, mothers of ages 25 to 44 years are at a lower risk compared to the mothers of ages 12 to 24 years. These results collaborated previous findings while age alone could not independently predict neonatal deaths. In this study, I analyzed the difference in neonatal deaths across geographical regions using analysis of

covariance while controlling for mother's age at first birth, ANC visits and TT vaccine received before pregnancy.

Distance to a Health Facility and Neonatal Mortality

Socio-economic factors refer to three broad categories, namely: individual-level factors related to culture household factors, and community level factors (Mosley & Chen, 2003). The socio-economic factors that I considered in this study were distance to a health facility and geographical regions.

The researchers Kawakatsu et al. (2014) in their study on determinants of the health facility utilization for childbirth in rural western Kenya, showed the main factors affecting access to skilled delivery as age of the mother, birth order, distance/availability of transportation to the facility, household assets including ability to meet medical expenses. The researchers Koffi et al. (2017) undertook a verbal autopsy of 2,057 child deaths based on 2013 Nigerian DHS to explain childhood mortality. One factor Koffi et al. identified was the culture of poor health care seeking behavior where caregivers failed to take sick children to a formal health care provider. The main reasons advanced for failure to seek treatment were absence of transport (34.2%), inability to afford means of transportation (24.3%), and distance to health facilities (15.1%). The researchers illuminated the crucial role that the distance to a health facility could play in child survival. Koffi et al. (2017) underscore the importance of timely recognition of illness among children and seeking medical treatment for the disease in addition to embracing preventative measures through taking anti-malaria drugs and receiving TT vaccine. From the review, no specific research focused on the combined effect that distance to a health

facility and delivery under supervised care on neonatal deaths, a gap that this study attempted to fill.

Geographical region and Neonatal Mortality

Adedini et al. (2015) in their study on infant and child mortality by region using the Mosley and Chen model in Nigeria looked at effect of individual and community factors on health. Using hazard analysis, the researchers show that while community factors (region, residence etc.), and individual level factors (education, wealth etc.) are important correlates of neonatal deaths, community factors were more critical in explaining regional differences. This study focused on the differences in neonatal deaths across regions while controlling for selected covariates.

Research Methodologies Found

Most of the research on neonatal mortality utilized quantitative approaches based on. primary data with majority using secondary data from DHSs. Other studies used hospital records, health surveillance sites, or verbal autopsies. Some researchers undertook meta-analysis and systematic reviews on correlates of neonatal deaths. While some studies were qualitative very few applied mixed methods. However, while the approaches provided critical information on neonatal deaths, they had limitations. An advantage of qualitative studies is that small populations are targeted and enable inclusion of persons excluded in quantitative studies. Also, qualitative studies provide an understanding of the reasons and experiences of mothers on access to health services and effect on neonatal mortality. For instance, de Danzine (2014) in his research on perceptions of urban African American women toward infant mortality using the

ecological model showed that environmental factors could influence individual health. The researcher studied livid experiences of mothers and the main challenges faced were limited education, inadequate health services, income poverty, inaccessible health care services, and absence of health insurance. Another limitation of qualitative studies as documented by Bower et al. (2016), Creswell (2009), and Frankfort-Nachmias & Nachmias (2008) was that they were usually restricted to single locations because of the cost and elaborate IRB requirement.

Mixed studies are beneficial because they combine qualitative and quantitative approaches essential in data validation. The researcher Kozuki (2015) employed the mixed methods approach to examine risk factors associated with neonatal deaths. The qualitative study focused on the understanding degree of awareness on use of ANC services and competences of health workers on the use of portable ultrasound machines during ANC. The in-depth interviews highlighted education of health workers and mothers as critical. The qualitative findings are valuable in validating the quantitative results and providing explanations behind the numbers. Such studies have the advantage of giving participants a chance of delivering in-depth personal feelings and experiences on factors affecting access to health services and their impact on neonatal mortality. However, the mixed approach is expensive, requires a lot of resources, and interviewer time.

The benefit of quantitative studies, on the other hand, is the large population size enabling researchers to apply scientific approaches in determining the sample size and providing for non-response as highlighted by Frankfort-Nachmias and Nachmias (2008).

Also, quantitative methods facilitate the application of proper statistical analyzes in the examination and presentation of information using graphs and tables. Ezeh et al. (2014) and Ndombo et al. (2017) conducted quantitative studies on neonatal deaths in Nigeria. For quantitative surveys birth primary and secondary data can be used. While primary data collection is very expensive, use of secondary is cheap. This research was quantitative using secondary data from the 2016 UDHS covering the entire country.

Summary and Conclusions

Relevant Factors in the Literature

The literature shows existence of a relationship between factors impacting on access to health services and neonatal deaths. Specifically, the review shows that TT vaccine, place of birth, cord hygiene, and preterm births have an effect on neonatal deaths. Supervised delivery, especially among women in the rural areas in sub-Saharan Africa is key in averting neonatal deaths. Also, ANC attendance during pregnancy increases the probability of mothers knowing the danger signs of neonatal deaths.

Gaps in the Research

The death of neonates has remained high since 2000 with 27 babies drying for every 1,000 live births. Risk factors to neonatal mortality identified by Batista, de Carvalho, and Vasconcelos (2018) are socioeconomic class, history of child death, peregrination in antepartum, lack of prenatal care, unsupervised delivery, long waiting time for delivery, preterm birth, and disability. The suggested multiple causes underscore the need to analyze factors affecting access to health services and their effect on neonatal deaths among women of ages 15 to 49 years. Studies on delivery in hospitals found this

to be key in controlling neonatal deaths, but this finding was limited because the place of birth was imputed. Also, while ANC attendance was significant in controlling neonatal mortality, studies conducted were in other countries other than Uganda. Further studies were recommended on the effect that accessing antimalarial drugs during pregnancy could have on neonatal mortality a gap that I attempted to fill.

Overall despite several researchers undertaking studies on determinants of neonatal mortality, this study was necessary to determine factors affecting access to health services and their impact on neonatal deaths in Uganda using the 2016 UDHS. To address this gap, this study understudied the effect that selected proximate factors (ANC attendance, receipt of anti-malarial drugs, TT vaccine doses received before pregnancy, delivery by qualified health worker, age of the mother at first birth), and socio-economic factors (distance to health facility and geographical region) have on neonatal deaths. In Chapter 3, I document the methodology for undertaking this study, target population, source of data, variables, validity, reliability, and ethical issues.

Chapter 3: Research Method

The goal of the study was to determine factors impacting access to health services and their effect on neonatal deaths in Uganda. I used the 2016 UDHS data to assess the reasons for the nonchanging status of neonatal deaths and provided policy recommendations that government officials could embrace to reduce the incidence of newborn deaths. This study was guided by the following research questions: What is the predictive relationship between the number of ANC visits, TT doses received before pregnancy, malarial prevention during pregnancy, and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda? What is the relationship between supervised childbirth and whether distance to a health facility is a challenge and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda? What is the difference in neonatal deaths across the regions while controlling for mothers' age at first birth, ANC attendance, and TT doses received before pregnancy among women of ages 15 to 49 years in 2016 in Uganda? The independent variables were number of ANC visits, TT vaccine doses received before pregnancy, antimalarial drugs, delivery by qualified medical personnel, age of the mother at first birth, geographical region, and distance to the health facility. The dependent variable was neonatal deaths. Table 2 provides a structured view of the three hypotheses, the independent variables, the dependent variable, and the statistical analysis techniques used for testing the hypotheses.

Table 2.

Research Questions, Hypotheses, and Dependent and Independent Variables

Research question	Analysis method	Null hypothesis	Alternative hypothesis	Independent and dependent variables
RQ 1: Are there associations between personal illness control factors (number of ANC visits, number of TT injections received before pregnancy, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda?	Binary logistic regression	Null Hypothesis (H01): There is no statistically significant associations between personal illness control factors (number of ANC visits, number of TT injections received before pregnancy, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda .	Alternative Hypothesis (HA1): There are a statistically significant associations between personal illness control factors (number of ANC visits, number of TT injections received before pregnancy, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda	Independent Variables: ANC visits– this is a categorical variable referring to the number of visits during pregnancy coded as (0= <4 visits vaccines, 1=>=4 visits); TT vaccine is a categorical variable that refers to the number of times a pregnant woman received the TT injections before pregnancy coded as (0= <4 TT doses, 1=>=4 TT doses); receipt of antimalarial drugs -SP/Fansidar- a binary variable that refers to whether or not pregnant women received antimalarial medicine during pregnancy coded as (1-Yes received; 0-No, not received) . Dependent Variables: Neonatal deaths - This is a binary variable which refers to whether a newborn is dead or alive and coded as 1-Yes, Death occurred, and 0-No, Death did not occur.
RQ 2: What are the significant predictive relationships between community level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda?	Binary logistic regression	H01: there are no statistically significant predictive relationships between community level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda.	HA2: There are statistically significant predictive relationships between community level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda.	Independent Variables: supervised childbirth by a skilled health care professional is a binary variable that refers to whether the mother was delivered by a qualified health personnel, coded as (1=Yes, delivered by a medical professional 0=No, not delivered by a medical professional). Distance to health facility refers to whether distance to the health facility was a major challenge in accessing health services codes as (1= Yes, it is a challenge, 0= No, Not a challenge) Dependent Variables (DV): Neonatal deaths - A binary variable referring to whether a newborn is dead or alive and coded as (1=Yes, death

Research question	Analysis method	Null hypothesis	Alternative hypothesis	Independent and dependent variables
				occurred, and 0=No, death did not occur.
RQ3.What are the differences in neonatal deaths across geographical regions while controlling for maternal factor (age of the mother at first birth), personal illness control factor (number of ANC visits, number of TT vaccines received before pregnancy), among women of ages 15 to 49 years in 2016 in Uganda?	Analysis of covariance (ANCOVA)	HO3. There are no statistically significant differences in neonatal deaths across geographical regions while controlling for the maternal factor (age of the mother), personal illness control factors (number of ANC visits, number of TT vaccines received before pregnancy) among women of ages 15 to 49 years in 2016 in Uganda	HA3. There are statistically significant differences in neonatal deaths across geographical regions while controlling for the maternal factor (age of the mother), personal illness control factors (number of ANC visits, number of TT vaccines received before pregnancy) among women of ages 15 to 49 years in 2016 in Uganda	Independent Variables (IV): geographical region is a categorical variable coded as: (, 1 = central, 2 = eastern, 3 = northern, = west Nile, 5 = western) Covariate: mothers age at first birth- a continuous variable referring to the age of the mother at first birth ANC visits– this is a continuous variable referring to the number of ANC visits during pregnancy; TT vaccine is a continuous variable that refers to the number of times a pregnant woman received the tetanus injection before pregnancy); Dependent Variables (DV): Neonatal deaths- A continuous variable referring to the number of deaths of neonates

In Chapter 2, I reviewed studies on neonatal death to address the factors impacting access to health services and the effect on neonatal deaths around the world, especially in sub-Saharan Africa.

In Chapter 3, I describe the steps undertaken in this study. I focus on the research questions and corresponding hypotheses, dependent and independent variables, design and research approaches, research methodology, study population and locations, confidentiality, data management and analysis, reliability and validity, and dissemination of study findings.

Research Design and Rationale

Study Variables

The dependent variable neonatal deaths referred to the death of a neonate from 0 to 28 days and is a success (1 = yes) if death occurs or failure (0 = no) if no newborn dies as. reported by the women in the 2016 UDHS. Proximate determinants were ANC attendance, receipt of tetanus injection before pregnancy, anti-malarial drugs; and age of the mother. The socio-economic factors were distance to the health facility and geographical region. The selected variables facilitated the direct analysis of factors influencing access to health services and their impact on neonatal deaths among women of childbearing age (Mosley, & Chen, 2003). This study used secondary data from the 2016 UDHS to answer the research questions.

Research Design

A research design is a plan of the study aligned to the study problem, specifies the data collection method and analysis relevant to the research questions (Frankfort-Nachmias & Nachmias (2008). This study was quantitative and used the stratified two-stage cluster sampling design. The 2014 Uganda national population and housing census was the populations frame for the 2016 UDHS covering all the 112 districts, 20,900 households and 18,000 women of ages 15 to 49 years (UBOs, 2017b). The study population was 7,538 women of ages 15 to 49 years. This study thus used the 2016 UDHS data to establish possible causal factors of neonatal deaths. The quantitative approaches used in this study were descriptive and correlational in line with Frankfort-Nachmias and Nachmias (2008)

Rationale for the Design

The cross-sectional study design provided an opportunity to answer the research questions on neonatal deaths in Uganda. The design presented the foundation to study the relationship between the independent variables and the dependent variable neonatal deaths applying the Mosley and Chen model (Creswell, 2009). The 2016 UDHS data was readily, available, accessible, with comprehensive data on children necessary for the measurement of neonatal mortality. Also, the 2016 UDHS was conducted by UBOs using professional and ethical guidelines ensuring reliability and validity of the data. The 2016 UDHS sample was nationally representative facilitating deductions for the country. Also, saved time and resources

A limitation of using secondary data is the unclear temporal associations between causes and effects, and some researchers making deductions even when none exist (Creswell, 2009; & Frankfort-Nachmias and Nachmias, 2008). Another limitation is that while national level estimates can be provided, generation of small area estimates was a challenge that could limit data use The data for this study related to only children whose mothers were surviving and present during the survey excluding children whose mothers were dead or absent which could affect the validity and reliability. Also, the 2016 UDHS used respondent recall in providing answers with a reference period of the previous five years which could be a likely source of bias, but since death is rare a shorter reference period would provide limited observations for analysis. Despite the limitation, the correlation design helped to determine factors affecting access to health services and their impact on neonatal deaths among women of ages 15 to 49 years.

Methodology

This study employed a correlational retrospective design using data from the 2016 UDHS the 6th following previous surveys in 1988-89, 1995, 2000-01, 2006 and 2011. The 2016 UDHS was conducted from June to December 2016 as recommended by ICF Macro International with technical and financial support from development partners and government of Uganda. The areas addressed in the 2016 UDHS were population, maternal, child health household and respondents' characteristics, and mortality. Data collection was in both English and other local languages spoken by a majority of the population (UBOs, 2017a).

Target Population and Size

This study was in Uganda using data from the 2016 UDHS data. The projected population of Uganda in 2019 is 40.3 million people; with a population growth rate of 3.02% (UBoS, 2017b). The target population of this study was 7,538 women of ages 15 to 49 years with children aged 0 to 28 days, dead or alive.

Sample and Sampling Procedure

The sample size for this study was based on the 2016 UDHS and applied a stratified two-stage cluster design. Stage 1 constituted 697 enumeration areas (EAs), stage 2, 10 households from each EA and finally 19,088 women of ages 15 to 49 years were interviewed. On average an EA had 200 households and overall only 696 EAs were covered and 18,506, women responded ((97%) (UBOs, 2017a). the sample for this study sample was 7,538 women of ages 15 to 49 years with children aged 0 to 28 days dead or alive.

Acquisition of Secondary Data

The 2016 UDHS was current with a representative sample for the entire country. The data used for this study was from the children's module, woman's module, and household module. To acquire the data, a formal application was made to the Executive Director Uganda Bureau of Statistics explaining the purpose of this study. The data request included the IRB clearance from Walden University and the Uganda National Council of Science and Technology. I signed a data use agreement to access the 2016 UDHS. A requirement was to ensure data confidentiality, not to share data with a third-party, use the limited data set as per agreement, and report violations of the agreement. The data use agreement was signed by an executive officer of the UBOs and the author.

Data Collection

The UBOs collected the 2016 UDHS using mini-computers with pre-programd e-questionnaires developed using census and survey processing system (CSPro) software. The survey protocol was approved by the ICF Institutional Review Board. For data transfer each tablet was equipped with Bluetooth technology.

Recruitment, Participation, and Data Collection

A total of173 staff undertook the survey selected after training and evaluation taking care of gender balance. Monitoring was undertaken jointly with stakeholders like Ministry of Health staff. The data collection for the 2016 UDHS was for 6 months from June 20, 2016to December 16, 2016.

Instrumentation

The survey used 4 structured questionnaires, namely: the household, the women's, the man's, and biomarker questionnaires. A separate self-administered field work questionnaire was used collect data on field staff. Questionnaire development was consultative covering all stakeholders. the main questionnaires were in English and also translated into 8 languages mainly spoken in Uganda. The questionnaires addressed health issues in Uganda and the respondents were usual residents in the household. The household questionnaire collected information on the household structure, demographic characteristics education, sex and age. The woman's questionnaire obtained information on birth history, child mortality, ANC, fertility, family planning methods, childbirth, postnatal care, immunization, malaria, and childhood diseases. The men's questionnaire collected similar information bud excluded maternal and child issues. Other questionnaires administered were the listing and field worker identification questionnaires.

Exclusions

One enumeration area in the Acholi Subregion due to conflict over land boundaries. Also, not covered were women who declined to consent expatriate women or spouses to expatriates, and women living in institutions like barracks.

Data Management

The data for this study was the 2016 UDHS stored in the central server. Partially anonymized data was provided by the Director in charge of Information Technology after

presentation of the signed agreement. The data was delivered in a Compact Disc (CD) and downloaded to my computer.

Data Analysis Plan

The data analysis followed the research questions and hypothesis. Editing and validation was done using the structured analysis software (STATA) with analysis of the sample of 7,538 done using the statistical package for the social sciences (SPSS) version 24

Pre-analysis and Data Screening

I generated frequencies and cross-tabulations on relevant demographic data and compared with previous findings from other surveys. Cell frequencies were checked to ensure expected frequencies were at least 10 as required in binary logistic regression (Warner, 2013).

Variables and Measures

The dependent variable for this study was neonatal deaths aa binary outcome. Independent variables/Covariate variables were maternal factors (age of the mother at first birth), personal control illness factors (number of ANC visits, number of TT injections received before pregnancy, receipt of antimalarial drugs-SP/Fansidar during pregnancy, supervised childbirth by a skilled health care professional), and community factors (distance to a health facility, geographical region).

Descriptive Variables

Neonatal death was examined against all independent variables classified into personal illness control factors, maternal factors and community level factors as

illustrated in Table 3. The dependent variable neonatal death was a success if death occurred (1 = Yes), and a failure if no death occurred (0 = No).

Table 3.

Definition and Categorization of Independent Variables

Variable category	Variables	Categorization
Community factors	Geographical region	A categorical variable coded as (1 = central, 2 = eastern, 3 = northern, 4 = west Nile, 5 = western)
	Distance to health facility	Whether accessing a health facility during pregnancy was a challenge due to distance. A binary variable coded as (1 = Yes, a challenge; 0 = Not a challenge)
Maternal factors	Maternal age	A continuous variable showing the age of the mother in completed years at first birth.
Personal illness control factors	Supervised childbirth at a health facility by qualified medical personnel	A binary variable that referred to whether the mother gave birth under supervision of medical practitioners coded as (1 = Yes childbirth supervised by qualified medical personnel; 0 = No, childbirth not supervised by a qualified medical personnel)
	antimalarial drug-SP/Fansidar for malaria prevention	a binary variable which referred to whether the woman took antimalarial drug-SP/Fansidar coded as (1 = Yes, took SP/Fansidar; 0 = No; did not take SP/Fansidar)
	ANC visits	A categorical variable that referred to whether expectant women attended 4 or more visits, or less than 4 visits coded as (0 = < = 4 ANC visits, 1 = > = 4 ANC visits)
	TT vaccine	A categorical variable that referred to the number of times a pregnant woman received the TT vaccine doses before childbirth coded as (0 = < 4 TT vaccines, 1 = > = 4 TT vaccines)

There were two community-level factors namely distance to the health facility and geographical region. The maternal factor was age of the mother at first birth while the personal control illness factors were the number of ANC visits, receipt of the TT vaccine doses before pregnancy and whether the mother received the antimalarial drug-SP/Fansidar during pregnancy.

Research Questions and Hypotheses

Research Question 1: Are there associations between personal illness control factors (number of ANC visits, number of TT injections received before pregnancy,

whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda?

H_o1: There are no statistically significant associations between personal illness control factors (number of ANC visits, number of TT injections received, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda

H_a1: There are statistically significant associations between personal illness control factors (number of ANC visits, number of TT vaccine injections received, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda.

Research Question 2: What are the significant predictive relationships between community-level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda?

H_o2: There are no statistically significant predictive relationships between community-level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda

H_a2: There are no statistically significant predictive relationships between community-level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda.

Research Question 3: What are the differences in neonatal deaths across geographical regions while controlling for maternal factor, (age of the mother at first birth), personal illness control factor (number of ANC visits, number of TT vaccine injections received before pregnancy), among women of ages 15 to 49 years in 2016 in Uganda?

H_o3: There are no statistically significant differences in neonatal deaths across geographical regions while controlling for the maternal factor, (age of the mother at first birth), personal illness control factors (number of ANC visits, number of TT vaccine injections received before pregnancy) among women of ages 15 to 49 years in 2016 in Uganda.

H_a3: There are statistically significant differences in neonatal deaths across geographical regions while controlling for the maternal factor (age of the mother at first birth), personal illness control factors (number of ANC visits, number of TT vaccine injections received before pregnancy) among women of ages 15 to 49 years in 2016 in Uganda.

Statistical Analysis

Descriptive Statistics

Descriptive statistics, according to Trochim (2006), are statistics that explain simple characteristics of quantitative data and include sum, average, and variance measures (Frankfort-Nachmias & Leon-Guerrero, 2015). The descriptive statistics related to the mean and standard deviation for the independent variables personal control factors (ANC visits, receipt of the TT vaccine and whether the mother received the antimalarial

during SP/Fansidar during pregnancy), community-level factors (distance to the health facility and geographical region) and maternal factor (age of the mother). I also computed descriptive statistics on selected demographic characteristics of population indicating counts and percentages.

Inferential Analysis

The binary logistic regression was applied, and the odds ratio of neonatal deaths computed. Testing the predictive relationships in the first null hypothesis was done using the binary logistic regression. Also, for hypothesis two, the binary logistic regression was applied to investigate the effect that the binary independent variables (delivery by qualified health personnel, distance to a health facility) had on neonatal deaths. The odds ratios were used to explain the associations between risk factors for neonatal deaths at a 95% confidence intervals (CIs). The *alpha* or *p* values of less than .05 were statistically significant. Screening of data was undertaken to determine the spread of the neonatal deaths as advanced by Warner, 2013. For categorical variables such as ANC visits, cell frequencies were computed to ensure there were more than 5 observations per cell. Care was taken to code the first category as the group of reference as guided by Warner (2013).

In this study, analysis of covariance (ANCOVA) was used to test hypothesis three that sought to determine whether there were any statistically significant differences in neonatal deaths across the geographical regions while controlling for the age of the mother at first birth, number ANC visits, the number of TT vaccine doses received before pregnancy. The application of ANCOVA facilitated the comparison of mean scores of

neonatal deaths across regions when a statistical adjustment was made to control for age of the mother at first birth, the number of ANC visits and TT vaccine doses received before pregnancy as demonstrated by Warner (2013). The ANCOVA was preferred to the simple analysis of variance (ANOVA) test because ANOVA only assesses differences among groups at the same time but does not provide a means to determine whether neonatal deaths differed by geographical region while controlling for scores of covariates (Warner, 2013). As such the ANCOVA while similar to the one-way ANOVA, was different because it looked at differences in the mean between factors and focused on variations in the mean between a factor while controlling for scores of one or more covariates. Also, ANCOVA has the assumption of homogeneity of regression slopes not included in ANOVA. The application of ANCOVA required satisfaction of the assumptions of ANOVA, namely normality, homogeneity of variances, and linearity of scores of dependent and independent variables (Warner, 2013). Assumptions specific for the application of ANCOVA was measurement of the covariates to ensure absence of interaction between the dependent variable and covariates. Also, ANCOVA assumed covariates were reliable with no adjustments made following the conduct of the demographic and health survey. Care was taken in the interpretation of ANCOVA because it "required absence of interaction between the A treatment and the X covariate" (Warner, 2013, p.688).

Interpretation of Results

In the interpretation of the various statistical tests, confidence intervals were used where necessary to indicate the range within which a population parameter was likely to

be found. The intervals for each null hypothesis were in line with this study sample set at a 95% confidence level, which was equivalent to *alpha* (α) level of significance of 0.05. The lower the α level, the higher the standard for rejecting the null hypothesis which occurred if the value of p was smaller or equal to the predetermined α. In the 1st and 2nd null hypotheses interpretation of output of the binary logistic regression was done using the *wald* test statistic and values of p. The results of ANCOVA were interpreted using the values of p and the F statistic.

Threats to Validity

Threats to validity could be a result of internal factors, external factors, construct issues, statistical analysis or deductions.

Threats to External Validity

These occur when study findings from the sample are used to infer for the entire population whose location, settings and positions in the future may differ. According to Creswell (2014), external validity threats occur when the sample findings are generalized leading to incorrect deductions. The remedy to this is ensuring an adequate sample with regional representative populations to allow for grossing up of the data, an issue addressed by the UBOs (UBOs, 2016). In this study, the selection of the respondents by the researchers in each Subregion was undertaken using probability proportional to size, thus ensuring representation at regional and national levels. Also, threats to validity were minimized due to the use of computer-assisted personal interview for data collection, separation of duties between the data collector, and the supervisor, and continuous monitoring. Verification of data was undertaken in a hierarchical manner from data

collector, team leader, supervisor and analyst thus minimizing errors (UBOs, 2017b). The Uganda Bureau of Statistics coordinated, implemented and monitored the entire survey process working closely with Macro International. During data collection threats to external validity threats were minimized through training and conduct of pretest. Also, threats to external validity were addressed by generalizing findings only to similar populations groupings in the sample.

Threats to Internal Validity

According to Creswell (2014) these threats occur if the respondents' previous experiences affect the context and quality of answers to questions affecting conclusions. A potential threat to internal validity was selection bias where a respondent previously selected for another survey is selected for the 2016 UDHS which could bias the responses. This was prevented because the sampling for surveys was mutually exclusive. Another threat was exclusion of babies whose mothers had died during the period immediately after sampling and the actual interview. For the 2016 UDHS, the challenges to internal validity were limited by embracing the cross-sectional survey design without experiments. Stratification of the country into regions and random sampling of the participants provided for the spread of probability of equal distribution of characteristics across the sample, thus addressing threat to internal validity.

Threats to Construct Validity

These occur when study variable definitions and measures are inadequate (Creswell, 2014). In the 2016 UDHS, the standard definitions and measures of neonatal deaths and other independent variables and covariates was embraced. Thus, the

definitions of ANC, tetanus vaccine, delivery by a health professional, health facility, anti-malaria drugs were in line with the definitions of the World Health Organization. In this study, the same definitions and measures were maintained.

Statistical Conclusion Validity Threats

These arise when wrong deductions are made because of limited statistical power and violation of key statistical assumptions (Creswell, 2014). Addressing this threat required an adequate sample of women of ages 15 to 49 years to achieve a computing power of 80 or more on all independent variables. With an effect size of 0.15, an alpha level of 0.05, a computing power = 0.80 and 5 categories, the minimum sample size for ANCOVA was 351women of reproductive age as guided by (Faul et al., 2012).For binary logistic regression the minimum sample size was 568 as such the sample of7,538 was adequate for both ANCOVA and binomial logistic regression. Also, I tested the theorized assumptions of for ANCOVA and binomial logistic regression.

Ethical Procedures

In the entire research process, the primary concern in ethics was promotion of participants right and resultant data. In this study, I utilized secondary data from the 2016 UDHS and as such issues on personality like ethnicity and language, did not arise. Prior to the research consent was sought from the independent review committee on the extent of adherence to requirements of the IRB as elaborated by Klitzman (2013).

Protection of Participants' Rights

In this study, I utilized secondary data of the 2016 UDHS as such I did not interact with respondents. While there was no primary data collection from participants

requiring informed consent and IRB clearance number 05-28-19-0654908 was obtained to ensure that I upheld ethical standards of Walden University. The first step in protecting the participant's rights was improving skills and knowledge in researching human subjects. To achieve this, I read available literature, revised modules on advanced research and undertook web-based training. In requesting for data from the UBOs a restriction was made to only the variables of interest. The 2016 UDHS sought participants consent before the conduct of the survey and only those willing completed the tool. Out of the 19,088 eligible women, a total of 18,506 women consented to the interview (97%). Before the conduct of the survey, the UBOs survey staff informed the respondents of the study objectives, tests to be administered like anaemia, malaria, and vitamin A deficiency. Also, consent was sought, and assurance of data confidentiality provided to participants.

Data Protection

To protect the data and since the study was international (undertaken outside the United States of America), I obtained clearance from the IRB working closely with the local IRB in Uganda. Another precaution for the secondary data was ensuring proper documentation of the methods used in data collection of the 2016 UDHS. I only accessed secondary data after the IRB had reviewed the data list variables and the coding schema. Since the UBOs implemented the 2016 UDHS, I made a written request showing the general objective of this research with the specific data requirements. I stored final data in a central server, copies stored in a laptop, and external drive backups for only research. To ensure data protection, data was presented in aggregate to ensure participants privacy.

Dissemination of Results

The results will be disseminated UBOs staff and policymakers including officials from the ministries of health, and finance, the media, and the general public. Further dissemination of the results will be done during international seminars and articles written for publication in journals.

IRB Approval

On May 28, 2019, I received a communication from the Institutional Review Board (IRB) confirming that this doctoral capstone met the Walden University's ethical standards with approval number 05-28-19-0654908.

Summary

In undertaking this study, I employed a retrospective correlation design and applied the Mosley and Chen's framework. I used secondary data from the 2016 UDHS collected by the UBOs, focusing on women of ages 15 to 49 years in 2016. This study had 7,538 women of ages 15 to 49 years in 2016with children of ages 0 to 28 days, alive or dead. Before the conduct of this study, I sought approval from the Walden University IRB to ensure validity and adherence to ethical requirements. In this study the dependent variable was neonatal deaths and independent variables were personal control factors (ANC visits, TT vaccine doses received before pregnancy, receipt of antimalarial drugs SP/Fansidar during pregnancy), community factors (distance to the health facility and geographical region), while mothers age at first birth, number of ANC visits, and number of TT vaccines received doses received before pregnancy were the covariates. I

undertook analysis using SPSS. Inferential statistics were computed using the binary logistic regression and ANCOVA. In Chapter 4, I present the study findings.

Chapter 4: Results

The purpose of this study was to determine proximate and socioeconomic factors impacting access to health care services and their influence on deaths of newborn babies among women ages 15 to 49 years in 2016 in Uganda. Three research questions with the corresponding hypotheses informed this study.

Research Questions and Hypotheses

Research Question 1: Are there associations between personal illness control factors (number of ANC visits, number of TT injections received, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda?

H_o1: There are no statistically significant associations between personal illness control factors (number of ANC visits, number of TT injections received, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda.

H_a1: There are statistically significant associations between personal illness control factors (number of ANC visits, number of TT injections received, whether pregnant women received antimalarial drugs-SP/Fansidar) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda.

Research Question 2: What are the significant predictive relationships between community-level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda?

H_o2: There are no statistically significant predictive relationships between community-level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda.

H_a2: There are statistically significant predictive relationships between community-level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women ages 15 to 49 years in 2016 in Uganda.

Research Question 3: What are the differences in neonatal deaths across geographical regions while controlling for maternal factor (age of the mother), personal illness control factor (number of ANC visits, number of TT vaccine injections), among women ages 15 to 49 years in 2016 in Uganda?

H_o3: There are no statistically significant differences in neonatal deaths across geographical regions while controlling for the maternal factor (age of the mother), personal illness control factors (number of ANC visits, number of TT vaccine injections) among women ages 15 to 49 years in 2016 in Uganda.

H_a3: There are statistically significant differences in neonatal deaths across geographical regions while controlling for the maternal factor (age of the mother), personal illness control factors (number of ANC visits, number of TT vaccine injections) among women ages 15 to 49 years in 2016 in Uganda.

Data Collection

This retrospective study used data from the 2016 UDHS. The 2016 UDHS was a cross-sectional survey with a nationally representative sample undertaken among women ages 15 to 49 years from June to December 2016. The survey applied the stratified two-stage cluster sampling design. In stage 1 there were 697 enumeration areas (EA) and stage 2 had 10 households in each EA. Data collection was undertaken using a computer-assisted personal interview with preloaded e-questionnaires while digital maps provided the boundaries between EAs. Of the 19,088 women in the sample, only 18,906 women were responded indicating a 97% response rate (UBOs, 2017a). A total of 7,538 women with children dead or alive ages 0 to 28 days constituted the sample for this study (see Table 4).

Table 4.

Summary Statistics on the Data Used for the Study from the 2016 UDHS

Sample of women targeted	19,088
Women aged 15-49 covered	18,506
Response rate	97.00%
Eligible women with children of ages0 to28 days	7,538

Descriptive Statistics by Variable of Interest

The key variables for analyzing access factors to health services impacting newborn deaths were personal factors including the number of antenatal care (ANC) visits, the number of TT injections received, and taking antimalarial drugs-SP/Fansidar during pregnancy. The community-level factors were supervised childbirth by a skilled

health care professional and distance to a health facility. The maternal factor was the age of the mother at first birth. The socioeconomic factor was geographical region. The descriptive statistics included women ages 15 to 49 years with neonate's dead or alive in line with the listed variables.

I undertook a cross-tabulation of selected independent variables with neonatal deaths. Out of a sample of 7,538 women in the study, 5% experienced neonatal deaths, and 96% had no neonatal deaths. Overall, 36% of the women ages 15 to 49 years attended less than 4 ANC visits while 64% attended 4 or more ANC visits. Concerning the receipt of the TT vaccine, about 8 out of every 10 women (86%) received less than 4 doses of the TT vaccine before pregnancy. Only 14% of the women received 4 or more doses of the TT vaccine. Seventy-nine per cent of the women received antimalarial drugs-SP/Fansidar during pregnancy and 21% did not take any antimalarial medicine. The highest proportion of women not experiencing neonatal deaths were those taking antimalarial drugs (68%). The distribution of women included in the study by age at first birth showed that the majority, (64%), were ages 14 to 19 years, and women of more than 30 years were 1%. From the analysis 77% of the women received assistance during childbirth compared to 23% who did not receive any assistance, while 58% of women reported distance to a health facility as problem. A comparison by residence showed that 83% of women experiencing neonatal deaths were in rural areas. Distribution of the study population by age of mother at first birth showed that the youngest was 12 years and the oldest 44 years. About 6 out of every 10 women (64%) were aged 14 to 19 years, women aged 20 to 24 years were 28%, and women aged more than 24 years were only 5%. A

cross-tabulation with neonatal deaths showed that only 1 woman of more than 30 years of age experienced a neonatal death contravening the requirement of at least 10 cases per cell as elaborated by Warner (2013). As a result, I combined the categories as follows 0 = less than 14 years, 1 = 14-19 years, 2 = 20-24 years, 3 = greater than or equal to 25 years (presented in Table 5). The findings of this study showed women from the eastern region were majority (29%) while women in Kampala region were only 5%. Overall, the eastern region had the highest proportion of neonatal deaths. About 58% of the women conceded the distance from home to any hospital as a problem compared to the 42% considering distance not a problem.

Table 5.

Descriptive Statistics for Independent Variables with Neonatal Deaths

	Neonatal deaths				Total	%
	Child alive	%	Child Dead	%		
Number of ANC visits						
<4 ANC visits	2,608	36.3%	137	39.7%	2,745	36.4%
> = 4 ANC visits	4,585	63.7%	208	60.3%	4,793	63.6%
Total	7,193	100.0%	345	100.0%	7,538	100.0%
Number of TT vaccine doses						
< 4 TT doses	6,258	87.0%	252	73.0%	6,510	86.4%
> = 4 TT doses	935	13.0%	93	27.0%	1,028	13.6%
Total	7,193	100.0%	345	100.0%	7,538	100.0%
Distance to health facility from home						
Distance not a problem	4,164	57.9%	209	60.6%	4,373	58.0%
Yes, distance is a problem	3,029	42.1%	136	39.4%	3,165	42.0%
Total	7,193	100.0%	345	100.0%	7,538	100.0%
Whether received antimalarial drugs (SP/Fansidar)						
No antimalarial drugs received	1,407	21.1%	85	32.2%	1,492	21.5%
Yes, antimalarial drugs received	5,257	78.9%	179	67.8%	5,436	78.5%
Total	6,664	100.0%	264	100.0%	6,928	100.0%
Geographical region						
Central	1,488	20.7%	80	23.2%	1,568	20.8%
Eastern	2,134	29.7%	92	26.7%	2,226	29.5%
Northern	1,238	17.2%	64	18.6%	1,302	17.3%
West Nile	513	7.1%	28	8.1%	541	7.2%
Western	1,820	25.3%	81	23.5%	1,901	25.2%
Total	7,193	100.0%	345	100.0%	7,538	100.0%
Age of mother at first birth						
< 14 Years	162	2.3%	6	1.7%	168	2.2%
14 to 19 years	4,623	64.3%	216	62.6%	4,839	64.2%
20 to 24 years	2,039	28.3%	108	31.3%	2,147	28.5%
25 to 29 years	324	4.5%	13	3.8%	337	4.5%
30 to 34 years	34	0.5%	2	0.6%	36	0.5%
> = 35 years	11	0.2%	-	0.0%	11	0.1%
Total	7,193	100.0%	345	100.0%	7,538	100.0%
Assistance by health professional during childbirth						
Not assisted	1,662	23.1%	85	24.6%	1,747	23.2%
Assisted	5,531	76.9%	260	75.4%	5,791	76.8%
Total	7,193	100.0%	345	100.0%	7,538	100.0%

Descriptive Statistics of Demographic Indicators

In this section I present descriptive statistics by selected demographic variables namely age of the husband, children ever born, household size, residence (rural/urban), wealth category, educational level, and marital status. These were cross tabulated with the dependent variable neonatal deaths. The categorization ensured at least 10 cases per cell. The age of the husband was categorized as 17 to 30 years, 31 to 40 years, 41 to 50 years, and more than 50 years. From the analysis husbands aged less than 40 years were the majority (69%) while those aged 41 to 50 years were the least (13%). On average, 39% of women (39%) had given birth to less than three children, 27% had three to 4 children, only 2% had more than 9 children. Nearly half (49%) of the women belonged to households with 1 to 5 members followed by those with 6 to 10 members (44%). About 82% of women lived in rural areas and 18% in urban areas. From the analysis 27% of the women lived in the lowest quintile and 16% in the wealthiest quintile. With respect to marital status 43% of the women were living with their partners, 41% were married, and only 9% were divorced, separated or widowed. Finally, 62% of the women had primary level of education as the highest level of education, 20% had a secondary education qualification, and 6% had post-secondary education (see Table 6).

Table 6.

Descriptive Statistics by Selected Variable of Interest and Neonatal Deaths

	Neonatal deaths				Total	%
	Child alive	%	Child dead	%		
Age of husband						
<31 years	2727	37.9%	124	35.9%	2851	37.8%
31 to 40 years	2237	31.1%	98	28.4%	2335	31.0%
41 to 50 years	909	12.6%	48	13.9%	957	12.7%
>50 years	1320	18.4%	75	21.7%	1395	18.5%
Total	7193	100.0%	345	100.0%	7538	100.0%
Children ever borne						
1-2 children	2823	39.2%	134	38.8%	2957	39.2%
3 to 4 children	1992	27.7%	74	21.4%	2066	27.4%
7 to 10 children	1270	17.7%	59	17.1%	1329	17.6%
7 to 10 children	997	13.9%	61	17.7%	1058	14.0%
> 10 children	111	1.5%	17	4.9%	128	1.7%
Total	7193	100.0%	345	100.0%	7538	100.0%
Number of household members						
1 to 5 members	3474	48.3%	210	60.9%	3684	48.9%
6 to 10 members	3184	44.3%	112	32.5%	3296	43.7%
>10 members	535	7.4%	23	6.7%	558	7.4%
Total	7193	100.0%	345	100.0%	7538	100.0%
Highest education level						
No education	860	12.0%	55	15.9%	915	12.1%
Primary	4489	62.4%	212	61.4%	4701	62.4%
Secondary	1430	19.9%	64	18.6%	1494	19.8%
Higher	414	5.8%	14	4.1%	428	5.7%
Total	7193	100.0%	345	100.0%	7538	100.0%
Marital status						
Never married	409	5.7%	17	4.9%	426	5.7%
Married	3003	41.7%	118	34.2%	3121	41.4%
Living with partner	3121	43.4%	169	49.0%	3290	43.6%
Separated/divorced/widowed	660	9.2%	41	11.9%	701	9.3%
Total	7193	100.0%	345	100.0%	7538	100.0%
Residence						
Urban	1311	18.2%	61	17.7%	1372	18.2%
Rural	5882	81.8%	284	82.3%	6166	81.8%
Total	7193	100.0%	345	100.0%	7538	100.0%
Wealth category						

(table continues)

	Neonatal deaths				Total	%
	Child alive	%	Child dead	%		
Poorest	1,937	26.9%	98	28.4%	2,035	27.0%
Poorer	1,564	21.7%	69	20.0%	1,633	21.7%
Middle	1,347	18.7%	68	19.7%	1,415	18.8%
Richer	1,201	16.7%	62	18.0%	1,263	16.8%
Richest	1,144	15.9%	48	13.9%	1,192	15.8%
Total	7,193	100.0%	345	100.0%	7,538	100.0%

Descriptive Statistics for the ANCOVA

The one-way ANCOVA with 1 independent variable geographic region was run to determine whether there were any significant differences in neonatal deaths while controlling for mothers' age at first birth, number of ANC visits, and number of TT vaccine doses received before pregnancy among women ages 15 to 49 years in Uganda. Out of 125 cases 11 were in west Nile and 40 in the western region. Overall, the unadjusted mean number of neonatal deaths per region was 1.8 west Nile had 3.5, and western region had an average of 1 death (see Table 7). From the results, neonatal deaths were recorded at (2.37 ± 3.7) in the central region compared to the west Nile region that recorded the highest deaths (3.55 ± 3.5) and the least deaths (.80 ± 2.0) were in the western.

Table 7.

Descriptive Statistics of Neonatal Deaths Across Geographical Region

Dependent variable: number of neonatal deaths			
Geographical region	Mean	Standard. deviation	N
Central	2.37	3.745	19
Eastern	2.48	4.273	27
Northern	1.61	3.236	28
West Nile	3.55	3.503	11
Western	.80	1.977	40
Total	1.82	3.334	125

Statistical Assumptions

In answering research questions 1 and 4, neonatal death was a binary variable coded as 0 = no neonatal deaths experienced and 1 = yes, neonatal deaths experienced thus satisfying assumption 1. The independent variables were categorical satisfying assumption 2 and they were number of ANC visits (0 = <4 visits 1 = > = 4 visits), and number of TT vaccine doses received before pregnancy (0 = < 4 TT vaccine doses, and 1 = > = 4 TT vaccine doses). Others were antimalarial drugs received and taken during pregnancy coded (1 = yes received, and 0 = not received), assistance during childbirth by a health care professional labelled (1 = yes, assisted by a health professional and 0=not assisted by a health professional), and distance to health facility from home coded (1 = yes, distance was a challenge, 0 = no, distance not a challenge). The 3rd assumption of independence of observations was satisfied. Also, assumption 4 on the need for categories of dichotomous dependent variable and the independent variables to be

mutually exclusive and exhaustive were satisfied because the data for the study was the 2016 UDHS. The women aged 15 to 49 years in this study were randomly selected through the stratified two-stage sample design with stage 1 covering enumeration areas and stage 2 households with observations independent of each other and mutually exclusive. Also, there were a minimum of 15 cases for each independent variable as required for analysis with a nationally representative sample (7,538 observations) (see Table 8). Assumption 5 required a linear relationship between the continuous independent variables and the logit transformation of the dependent variable. Since all the independent variables were categorical, this assumption was not relevant. Assumption 6 required the data not to show any multicollinearity and the results showed none of the independent variables had correlations of greater than 0.7, (see Tables 8 & 9).

Table 8.

Testing Assumption of Multicollinearity

		Neonatal mortality	ANC 2	tetanus toxoid vaccine2	Antimalarial-spfansidar
Pearson Correlation	Neonatal mortality	1.000	-.050	-.012	-.052
	ANC visits2	-.050	1.000	.132	.113
	Tetanus toxoid vaccine doses2	-.012	.132	1.000	.009
	Antimalarial-SP/Fansidar	-.052	.113	.009	1.000
Sig. (1-tailed)	Neonatal mortality	.	.000	.150	.000
	ANC visits2	.000	.	.000	.000
	Tetanus toxoid vaccine doses2	.150	.000	.	.230
	Antimalarial-SP/Fansidar	.000	.000	.230	.
N	Neonatal mortality	6928	6928	6928	6928
	ANC visits2	6928	6928	6928	6928
	Tetanus toxoid vaccine doses2	6928	6928	6928	6928
	Antimalarial-SP/Fansidar	6928	6928	6928	6928

Table 9.

Testing Multicollinearity Assumption in Logistic Regression for RQ2

		Neonatal mortality	Is distance to health facility a problem	Assistance during childbirth
Pearson Correlation	Neonatal mortality	1.000	-.011	-.008
	Is distance to health facility a problem	-.011	1.000	-.139
	Assistance during childbirth	-.008	-.139	1.000
Sig. (1-tailed)	Neonatal mortality	.	.161	.255
	Is distance to health facility a problem	.161	.	.000
	Assistance during childbirth	.255	.000	.
N	Neonatal mortality	7538	7538	7538
	Is distance to health facility a problem	7538	7538	7538
	Assistance during childbirth	7538	7538	7538

Also, all the tolerance values were greater than 0.1 with the lowest as 0.97 showing no problem with multicollinearity, (see Tables 10 & 11).

Table 10.

Statistics for Testing the Assumption of Multicollinearity

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	0-order	Partial	Part	Tolerance	VIF
1	(Constant)	.066	.005		12.002	.000	.055	.077					
	ANC visits2	-.017	.005	-.044	-3.601	.000	-.026	-.008	-.050	-.043	-.043	.970	1.031
	Tetanus toxoid vaccine doses 2	-.005	.010	-.006	-.515	.606	-.024	.014	-.012	-.006	-.006	.983	1.018
	Antimalarial-SP/Fansidar	-.022	.006	-.047	-3.861	.000	-.033	-.011	-.052	-.046	-.046	.987	1.013

a. Dependent Variable: Neonatal deaths

Table 11.

Statistics for Testing the Assumption of Multicollinearity

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	0-order	Partial	Part	Tolerance	VIF
1	(Constant)	.052	.006		9.091	.000	.040	.063					
	Distance to health facility is problem	-.005	.005	-.013	-1.091	.275	-.015	.004	-.011	-.013	-.013	.981	1.020
	Assisted childbirth	-.005	.006	-.009	-.803	.422	-.016	.007	-.008	-.009	-.009	.981	1.020

a. Dependent variable Neonatal deaths

Assumption 7 required data not to have any significant outliers and the analysis showed 250 cases with standardized residuals of more than two standard deviations as seen the Casewise Diagnostics results. For RQ2 a total of 345 cases had standardized residuals of more than two standard deviations violating assumption 7 requiring an absence of significant outliers. No transformations or exclusions were done as such despite the violation all data were all kept in the analysis as I elaborate in Chapter 5.

ANCOVA was used to examine the differences in the mean values of neonatal deaths across regions while controlling for effect of covariates in research question 3. The covariates were age of the mother at first birth, number of ANC visits, and number of TT vaccines doses received before pregnancy. Application of the one-way ANCOVA was to remove the extraneous variation from the dependent variable neonatal deaths. Assumption 1 was satisfied because the dependent variable number of neonatal deaths had a scale measure as required. Assumption 2 required an independent variable with more than 1 groups which was satisfied because geographical region had five

independent categories of 1 = central, 2 = eastern, 3 = northern, 4 = west Nile, and 5 = western. Assumption 3 required covariates measured on a continuous scale and all the covariates (age of the mother at first birth, number of ANC visits, & number of TT vaccine doses received before pregnancy) were continuous. The 4th assumption required independence of observations with no relationship between observations in each category or between the groups themselves. It implied that the participants in each region could not be the same in another area. This assumption was satisfied because the 2016 UDHS applied the stratified cluster two-stage sampling and respondents were independent of one another. Assumption 5 required covariates to be linearly related to the dependent variable (neonatal deaths) for each region. The scatterplots showed no linear relationship between the covariate's mothers age at first birth number of TT vaccine doses before pregnancy, number of ANC visits and neonatal deaths across regions. The ANCOVA assumption of parallel lines was not met (see Figures 2,3, & 4).

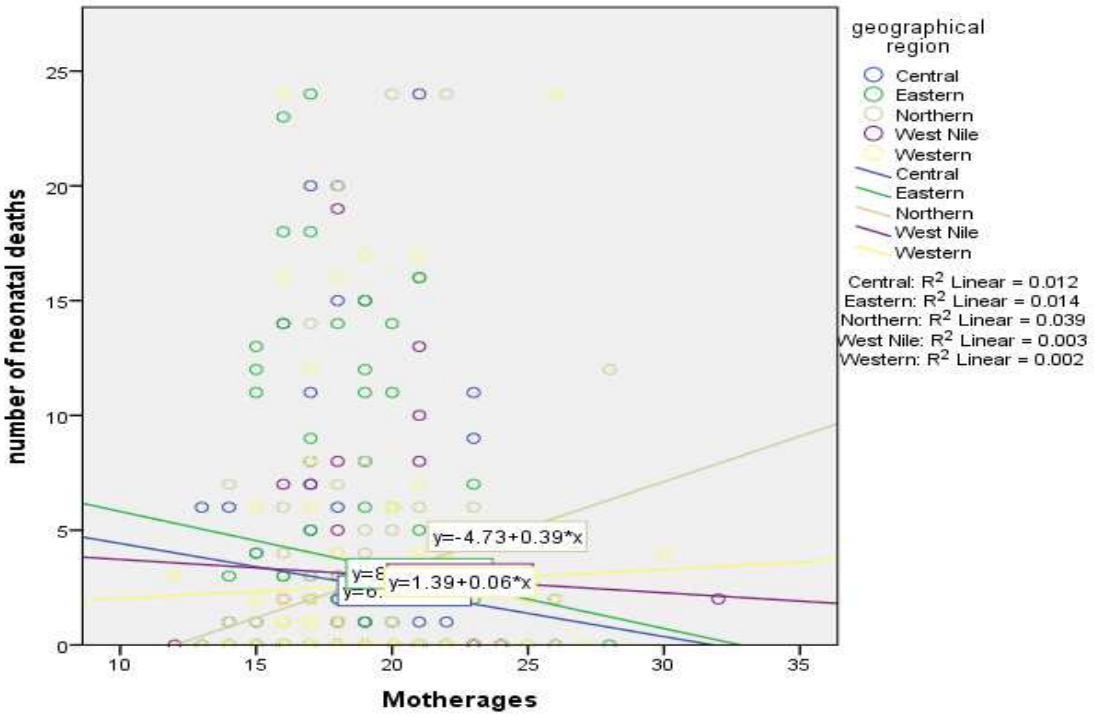

Figure 2. Grouped scatter plot of neonatal deaths by mothers age at first birth across geographical regions.

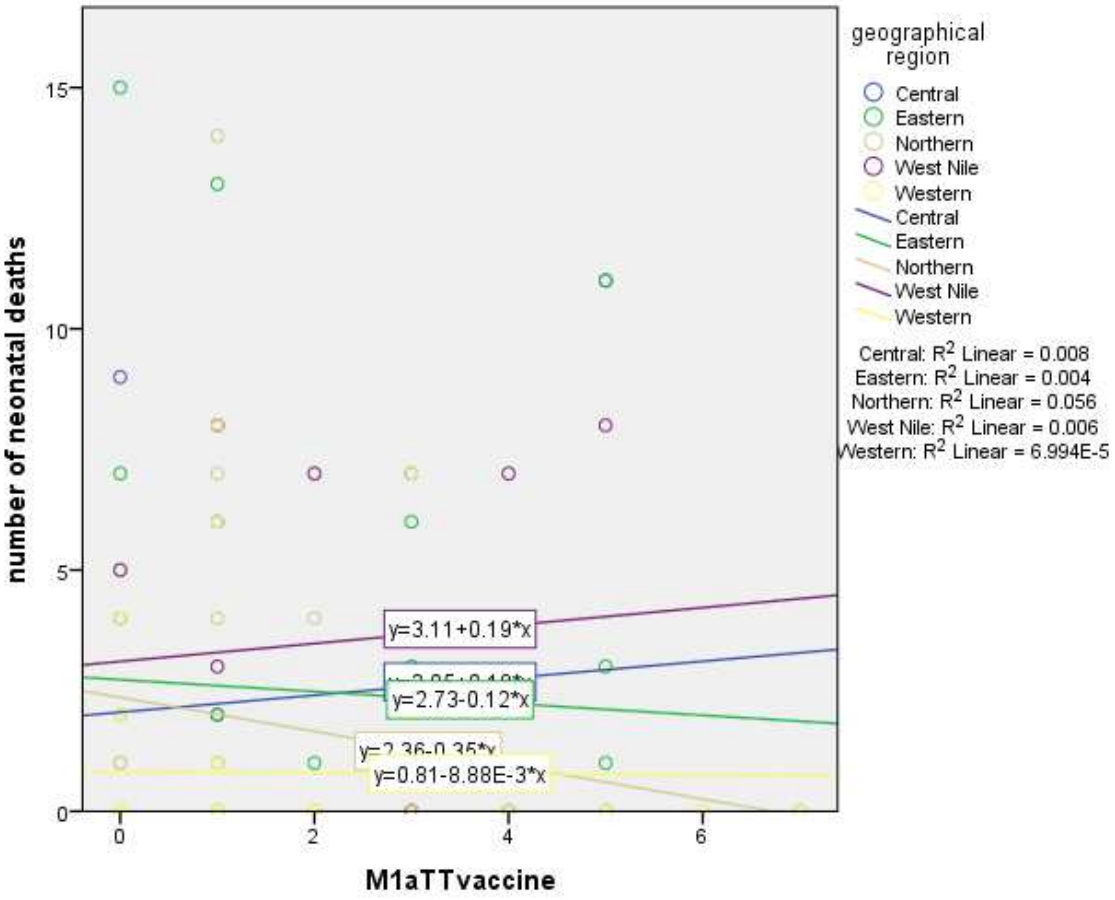

Figure 3. Grouped scatter plot of neonatal deaths by number of TT vaccines received before birth across geographical regions.

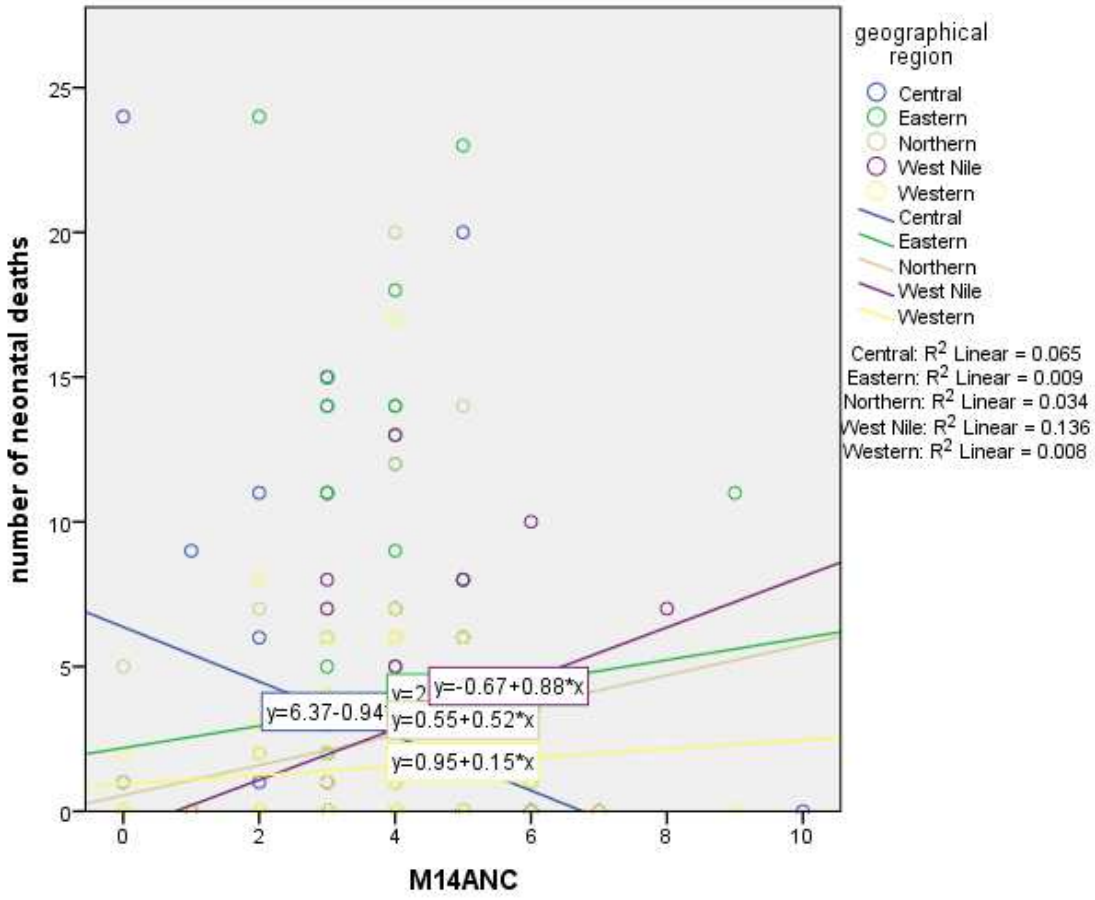

Figure 4. Grouped scatter plot of neonatal deaths by number of ANC visits during pregnancy across the geographical regions.

Assumption 6 of ANCOVA required homogeneity of regression slopes with no interaction between the covariates and independent variable. I used the generalized linear model to test the significance of the interaction and the results showed the interaction not statistically significant. The assumption of homogeneity of regression slopes was satisfied because the interaction term between the independent variable (geographical region) and the covariates were not statistically significant, $F(5, 104) = .482$, $p = .789$, (see Table 12).

Table 12.

Results of the Tests Between Subject Effects on Homogeneity of Regression Slopes

Dependent Variable: number of neonatal deaths

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	318.644[a]	20	15.932	1.564	.076	.231
Intercept	20.880	1	20.880	2.050	.155	.019
Mother age at first birth	30.728	1	30.728	3.016	.085	.028
ANC visits	61.520	1	61.520	6.039	.016	.055
Tetanus toxoid vaccine	12.479	1	12.479	1.225	.271	.012
Geographical region * Mothers age at first birth	36.335	4	9.084	.892	.472	.033
Geographical region * ANC visits	76.076	4	19.019	1.867	.122	.067
Geographical region * Tetanus toxoid vaccine	36.261	4	9.065	.890	.473	.033
Geographical region * Mothers age at first birth * ANC visits * Tetanus toxoid vaccine e	24.529	5	4.906	.482	.789	.023
Error	1059.484	104	10.187			
Total	1794.000	125				
Corrected Total	1378.128	124				

a. R Squared = .231 (Adjusted R Squared = .083) Antimalarial-spfansidar

The assumptions of normality, homoscedasticity, homogeneity of variance, and outliers were tested using the predicted values and standardized residuals (errors) and not against the actual observations as recommended by Warner (2013). The Shapiro-Wilk test was used because cases in each area were less than 50 and the results showed that normality assumption was only satisfied for west Nile region (p = .166) but violated in other region (p = .000). Overall, results of the Shapiro-Wilk's test for the standardized residuals were not normally distributed, (p = .000 <*alpha* = .05), across geographical regions (see Table 13). The result of the Levene's analysis also showed the group variances to be statistically significant, (p = 0.009 < p = .05), violating the assumption of

homogeneity of variances. Despite the violation I applied ANCOVA in RQ3 since other assumptions like homogeneity of regression slopes were satisfied, and data was actual from the 2016 UDHS (see Tables 14 &15).

Table 13.

Results of the Test of the Assumption of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Geographical region	Statistic	df	Sig.	Statistic	Df	Sig.
Standardized Residual for neonatal deaths	Central	.292	19	.000	.777	19	.001
	Eastern	.262	27	.000	.764	27	.000
	Northern	.290	28	.000	.728	28	.000
	West Nile	.236	11	.087	.896	11	.166
	Western	.194	40	.001	.808	40	.000

a. Lilliefors Significance Correction

Table 14.

Results of the Test of the Assumptions of Normality

	Tests of Normality					
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual for number of neonatal deaths	.205	125	.000	.815	125	.000

a. Lilliefors Significance Correction

Table 15.

Results of Levene's Test of Equality of Error Variances for ANCOVA

Dependent Variable: number of neonatal deaths			
F	df1	df2	Sig.
3.562	4	120	.009

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Motherages + M14ANC + M1aTTvaccine + Geographical region * Motherages + geographicalregion * M14ANC + geographicalregion * M1aTTvaccine + geographicalregion * Motherages * M14ANC * M1aTTvaccine

The assumption of homoscedasticity of error variances was tested within each group (the independent variable “Control”, “Int_1” and “Int_2” groups) and required error variances to be equal between groups (Huitema, 2011). The scatter plot of the standardized residuals (errors of prediction), ZRE_1 of neonatal deaths, were equal across the predicted values when paneled against the geographical regions (see Figure 5). The spread of standardized residuals of the dependent variable neonatal deaths in the scatterplot for all geographic areas were randomly spread at an approximately even spread along the y-axis thus assumption of homoscedasticity was satisfied.

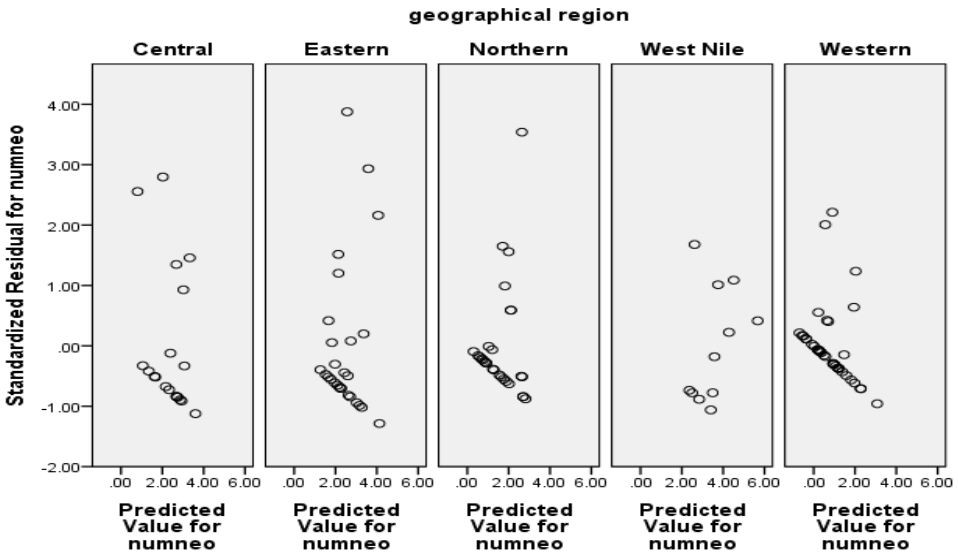

Figure 5. Simple scatter plot of Standardized residuals for neonatal deaths by predicted value of neonatal deaths by Geographical region.

Finally, the assumption of outliers of scores was tested using the standardized residuals to determine if they were any higher than ±3 standard deviations. An inspection of the data showed that out of 125 cases included in the analysis standardized residuals ranged from -1.29 to +3.88 with only two instances above 3 SDs (positive values) and

none below 3 SDs (negative values). This assumption was satisfied save for the two outliers which existed because data were from a cross-sectional survey. Despite the existence of outliers, no data were excluded from the analysis.

Statistical Analysis Findings

Personal Control Factors Effect on Neonatal Deaths

The first research question (RQ1) sought to determine whether there were associations between personal illness control factors (number of ANC visits, number of TT injections received before pregnancy, access to antimalarial drugs-SP/Fansidar) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda? The corresponding hypotheses were:

- H_o1: There are no statistically significant associations between personal illness control factors (number of ANC visits, number of TT injections received before pregnancy, access to antimalarial drugs-SP/Fansidar), and neonatal deaths among women of ages in 2016 in Uganda.
- H_a1: There are statistically significant associations between personal illness control factors (number of ANC visits, number of TT injections received before pregnancy, access to antimalarial drugs-SP/Fansidar), and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda.

I undertook the analysis with the 2016 UDHS using binary logistic regression and the independent variables are in Table 16.

Table 16.

Dependent and Independent Variables for RQ1

Variables		Description
Dependent variable	Y	Neonatal Mortality, neonate dead or alive
	0	Neonatal deaths experienced
	1	Neonatal deaths not experienced
Independent variables	X1	ANC visits attended during pregnancy
	0	Less than 4 ANC visits
	1	4 or more ANC visits
	X2	Tetanus toxoid vaccine doses received before pregnancy
	0	Less than 4 doses of TT vaccine
	1	4 or more doses of TT vaccine
	X3	During pregnancy, did you receive the antimalarial drug-spfansidar?
	0	Antimalarial drug (spfansidar) not received during pregnancy
	1	Antimalarial drug (spfansidar) received during pregnancy

A total of 6,928 out of 7,538 cases were used because 610 cases had missing data. The results using the omnibus test showed that the model was statistically significant, $p = .000 < \alpha = .05$, as such was adequate in predicting the effect of the independent variables on neonatal deaths (see Tables 17 & 18).

Table 17.

Omnibus Tests of Model Coefficients for RQ1 of the Binary Logistic Regression

		Chi-square	df	Sig.
Step 1	Step	30.418	3	.000
	Block	30.418	3	.000
	Model	30.418	3	.000

Table 18.

Model Summary for RQ1 of Binary Logistic Regression

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	2212.567[a]	0.004	0.016

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

From the analysis, the inclusion of the independent variables number of ANC visits, number of TT vaccine doses received before pregnancy, and administration of antimalarial drugs during pregnancy improved the overall prediction of cases into their observed categories of the dependent variable neonatal death. The percentage accuracy in classification was 96.2%, as I present in Table 19.

Table 19.

Classification Table for RQ1 of the Binary Logistic Regression

Classification Table[a,b]

			Predicted Neonatal deaths		
	Observed		No	Yes	Percentage Correct
Step 0	Neonatal deaths	No	6664	0	100.0
		Yes	264	0	.0
	Overall Percentage				96.2

a. Constant is included in the model.
b. The cut value is .500

From the results presented in Table 20, the *Wald test* statistics on the statistical significance showed that while the number of ANC visits (p = .000) and taking antimalarial-SP/Fansidar during pregnancy (p = .000) added significantly to neonatal deaths, the number of TT vaccine doses taken before pregnancy did not considerably contribute to neonatal deaths, (p = .597). The odds of neonatal deaths were 0.454 lower for women attending 4 or more ANC visits as opposed to women attending less than 4 ANC visits. Using the data in *Exp(B),* for each unit reduction in the number of ANC visits during pregnancy the odds of neonatal deaths increased by a factor of 1.57, (1/0.635 = 1.574). Also, the odds of neonatal deaths were 0.511 lower for women receiving antimalarial drug-SP/Fansidar during pregnancy compared to women not receiving any drug. The findings presented in Table 20 showed that a one-unit decrease

in the consumption of antimalarial drug-SP/Fansidar increased the odds of neonatal deaths by a factor of 1.67 (1/0.600 = 1.668). Therefore, the coefficients of the model were $Li = -2.596 - 511x_1 - 0.160x_2 - 0.454x_3$, where x_1, x_2 and x_3 represented anti-malarial vaccine-SP/Fansidar, TT vaccine, and ANC visits respectively. I used binary logistic regression to determine whether there were any associations between the number of ANC visits, TT vaccine injections received before pregnancy, and whether pregnant women received antimalarial drugs-SP/Fansidar during pregnancy, and death of newborn babies. The findings were statistically insignificant since, $\chi 2$ (4) = 2.445, p = .654 (see Table 20). The model and the predictor variables explained only 2% of neonatal deaths. Therefore, I rejected the null hypothesis in favor of the alternative.

Table 20.

Output of Binary Logistic Regression Analysis (n = 6,928)

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Antenatal2(1)	-.454	.128	12.554	1	.000	.635	.494	.817
	Tetanus toxoid vaccine doses2(1)	-.160	.303	.279	1	.597	.852	.470	1.544
	Antimalarial-SP/Fansidar(1)	-.511	.136	14.074	1	.000	.600	.459	.783
	Constant	-2.596	.123	447.422	1	.000	.075		

a. Variable(s) entered on step 1: antenatal2, tetanus toxoid vaccine doses2, SP/Fansidar.

Community Factors and Neonatal Mortality

In the 2nd research question I sought to determine whether there were any significant predictive relationships between community-level factors (assistance by a health professional during childbirth, distance to any health facility), and neonatal deaths

among women of ages 15 to 49 years in 2016 in Uganda. The corresponding hypotheses were:

- H_o2: There are no statistically significant predictive relationships between community-level factors (assistance by a health professional during childbirth, distance to a health facility) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda.
- H_a2: There are statistically significant predictive relationships between community-level factors (assistance by a health professional during childbirth, distance to any hospital) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda.

I used the binary logistic regression and the independent variables presented in Table 21.

Table 21.

Dependent and Independent Variables for RQ2

Variables		Description
Dependent variable	Y:	Neonatal mortality experienced
	0-	Neonatal deaths not experienced
	1-	Neonatal deaths experienced
Independent variables	X1:	During childbirth, were you supervised/assisted by a health professional?
	0-	Childbirth not supervised by a health professional/no assistance received
	1-	Childbirth supervised by a health professional/assistance received
	X2:	For accessing ANC services, was distance from home to a health facility a challenge?
	0-	Distance not a challenge
	1-	Distance a challenge

I ran a binary logistic regression using 7,538 cases with 95% of dependent variables correctly predicted in the null model. The results from the omnibus test showed the model not statistically significant, $p = .444 <$ alpha $= .05$, thus the model did not adequately predict the effect of the independent variables on neonatal deaths (See Tables 22 & 23).

Table 22.

Analysis Results of the Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	1.624	2	.444
	Block	1.624	2	.444
	Model	1.624	2	.444

Table 23.

Analysis Results Showing Model Summary for RQ2

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	2800.415[a]	.000	.001

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

The -2 Log Likelihood statistic showed that the explained variation in the model using both the Nagelkerke R Square and Cox and Snell R square for variables in the model explained almost nothing (0%) of neonatal deaths. From the results, inclusion of the independent variables improved the overall prediction of cases into their observed categories of the dependent variable with 95% (see Table 24).

Table 24.

Classification Results for RQ2 of the Binomial Logistic Regression

Classification Table[a]					
			Predicted		
	Observed		No Neonatal mortality (Child is alive)	Neonatal mortality (Child is dead)	Percentage Correct
Step 1	Number of neonatal deaths	No Neonatal mortality (child is alive)	7193	0	100.0
		Neonatal mortality (child is dead)	345	0	.0
	Overall Percentage				95.4

a. The cut value is .500

Results of the statistical significance test showed that assistance by a medical professional during childbirth, (p = .276), distance to any health facility, (p = .420), were not statistically significant and did not influence neonatal deaths among women ages 15 to 49 years in 2016 in Uganda (see Table 25). From the analysis I found that inclusion of predictor variables did not predict the odds of neonatal mortality better, ($\chi 2$ (2) = 1.528, p = .466). Also, the predictor variables explained almost nothing of neonatal deaths. There was no statistically significant predictive relationship between distance to a health facility and assistance during childbirth by a health personnel on neonatal mortality (see Table 26). Therefore, I accepted the null hypothesis and rejected the alternative.

Table 25.

Results of the Chi-Square Statistics

Hosmer and Lemeshow Test		
Chi-square	df	Sig.
1.528	2	.466

Table 26.

Variables in the Equation for RQ2 (n = 7,538)

							95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Distance health facility problem(1)	.124	.114	1.188	1	.276	1.132	.906	1.415	
Assisted Childbirth(1)	.104	.129	.651	1	.420	1.110	.861	1.430	
Constant	-3.136	.097	1045.364	1	.000	.043			

a. Variable(s) entered on step 1: distancehealthfacilityproblem, assist.

Differences in Neonatal Mortality by Geographic Region

In the 3rd research question I sought to determine the differences in death of neonates across regions while controlling for the maternal factor (mothers' age at first birth), personal illness control factor (number of ANC visits, number of TT injections received before pregnancy), among women of ages 15 to 49 years in 2016 in Uganda? The corresponding hypotheses were:

- H_o3: There are no statistically significant differences in death of neonates across regions while controlling for the maternal factor (mothers' age at first birth), personal illness control factor (number of ANC visits, number of TT vaccine injections received before pregnancy), among women of ages 15 to 49 years in 2016 in Uganda.
- H_a3: There are statistically significant differences in the death of neonates across geographic areas while controlling for the maternal factor (mothers' age at first birth), personal illness control factor (number of ANC visits,

number of TT vaccine injections received before pregnancy), among women of ages 15 to 49 years in 2016 in Uganda.

The dependent variable was the number of neonatal deaths and the independent variables and covariates were continuous variables presented in Table 27.

Table 27.

Dependent, Independent, and Covariate Variables for One-Way ANCOVA for RQ3

Variables		Description
Dependent variable	Y	Number of neonatal deaths registered
Independent variable	X1	Geographic region
	1	Central
	2	Eastern
	3	Northern
	4	West Nile
	5	Western
Covariates	Xc1	Mothers age at first birth in complete years
	Xc2	Number of ANC visits
	Xc3	Number of TT vaccine doses received

The results from the adjusted mean showed that neonatal deaths in the central were (2.2.3 ± 0.74) compared to west Nile with (3.61 ± 0.98). The statistics after adjusting for covariates showed that the adjusted mean number of neonatal deaths were highest in west Nile, (3.6 deaths), followed by the eastern region, (2.5 deaths) (see Tables 28 & 29).

Table 28.

ANCOVA Statistics with Adjusted Means

Dependent Variable: number of neonatal deaths				
			95% Confidence Interval	
geographical region	Mean	Std. Error	Lower Bound	Upper Bound
Central	2.227[a]	.739	.763	3.690
Eastern	2.459[a]	.620	1.232	3.686
Northern	1.546[a]	.615	.328	2.763
West Nile	3.611[a]	.978	1.674	5.548
Western	.908[a]	.516	-.115	1.930

a. Covariates appearing in the model are evaluated at the following values: Motherages = 18.46, M14ANC = 3.12, M1aTTvaccine = 1.82.

Table 29.

Adjusted and Unadjusted Means and Variability for Neonatal Deaths by Geographical Region

		Unadjusted		*Adjusted*	
	N	Mean	Std. Deviation	Mean	Std. Error
Central	19	2.37	3.745	2.227[a]	0.739
Eastern	27	2.48	4.273	2.459[a]	0.62
Northern	28	1.61	3.236	1.546[a]	0.615
West Nile	11	3.55	3.503	3.611[a]	0.978
Western	40	0.8	1.977	.908[a]	0.516

The results of ANCOVA without considering the age of the mother at first birth, number of ANC visits during pregnancy, and the number of TT vaccine doses received before pregnancy were not statistically significant, $F(4, 117) = 2.00$, $p = .098$, (see Table 30). I confirmed this with results of the pairwise comparison which showed that at a 95% confidence interval, the mean difference in neonatal deaths in all regions was not statistically significant since all the confidence intervals contained a 0, (ranging from a negative interval to a positive interval presented in Table 31). From the results, there were no statistically significant differences in the number of neonatal deaths across all

regions when controlling for mothers' age at first birth, the number of ANC visits during pregnancy and the number of TT vaccines received before pregnancy. I accepted the null hypothesis.

Table 30.

Results of Treats of Between Subjects Effects Without Interaction

Dependent Variable: number of neonatal deaths

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	173.717a	7	24.817	2.411	.024	.126
Intercept	56.122	1	56.122	5.452	.021	.045
Motherages	32.458	1	32.458	3.153	.078	.026
ANC Visits	54.974	1	54.974	5.340	.023	.044
tetanustoxoidvaccine	9.064	1	9.064	.881	.350	.007
Geographicalregion	82.517	4	20.629	2.004	.098	.064
Error	1204.411	117	10.294			
Total	1794.000	125				
Corrected Total	1378.128	124				

a. R Squared = .126 (Adjusted R Squared = .074)

Table 31.

Results of the Pairwise Comparisons of Neonatal Deaths Across Geographical Regions

Dependent Variable: number of neonatal deaths

(I) Geographical region	(J) geographical region	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
Central	Eastern	-.232	.965	1.000	-2.994	2.530
	Northern	.681	.963	1.000	-2.075	3.437
	West Nile	-1.384	1.222	1.000	-4.882	2.114
	Western	1.319	.903	1.000	-1.264	3.902
Eastern	Central	.232	.965	1.000	-2.530	2.994
	Northern	.913	.867	1.000	-1.567	3.394
	West Nile	-1.152	1.160	1.000	-4.471	2.167
	Western	1.552	.812	.584	-.771	3.874
Northern	Central	-.681	.963	1.000	-3.437	2.075
	Eastern	-.913	.867	1.000	-3.394	1.567
	West Nile	-2.065	1.161	.778	-5.386	1.255
	Western	.638	.813	1.000	-1.688	2.964
West Nile	Central	1.384	1.222	1.000	-2.114	4.882
	Eastern	1.152	1.160	1.000	-2.167	4.471
	Northern	2.065	1.161	.778	-1.255	5.386
	Western	2.703	1.107	.161	-.464	5.871
Western	Central	-1.319	.903	1.000	-3.902	1.264
	Eastern	-1.552	.812	.584	-3.874	.771
	Northern	-.638	.813	1.000	-2.964	1.688
	West Nile	-2.703	1.107	.161	-5.871	.464

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

Summary

In Chapter 4, I presented findings to the three research questions. The 1st research question looked at associations between personal illness control factors (number of ANC visits, number of TT injections received before pregnancy, pregnant woman's access to antimalarial drugs-SP/Fansidar during pregnancy) and death of neonates among women of ages 15 to 49 years in 2016 in Uganda. The 2nd research question sought to determine whether there were any significant predictive relationships between community-level factors (supervised childbirth by a skilled health care professional, distance to a health facility) and neonatal deaths among women of ages 15 to 49 years in 2016 in Uganda. The 3rd research question was to determine whether there were differences in neonatal deaths across geographic areas while controlling for maternal factor (mothers' age at first birth), personal illness control factor (number of ANC visits, number of TT injections received before pregnancy), among women of ages 15 to 49 years in 2016 in Uganda?

Answers to RQ1 - Personal Control Factors and Neonatal Mortality

Results of the binary logistic regression analysis showed that women attending less than 4 ANC visits during pregnancy had 1.57 times higher odds of experiencing neonatal deaths than women attending 4 or more ANC visits. At a 95% confidence interval, a one unit increase in women attending less than 4 ANC visits during pregnancy increases the odds of experiencing neonatal deaths by a factor of 1.57. Women attending less than 4 ANC visits were 61% more likely to experience neonatal deaths. Also, at 95% confidence interval women not taking antimalarial drugs-SP/Fansidar during pregnancy increase the odds of neonatal deaths by a factor of 1.67 compared to women taking

antimalarial drugs. At 95% confidence interval women not taking any antimalarial drugs during pregnancy have a 63% probability of neonatal deaths. These results from the study also showed that receiving 4 or more TT vaccine doses before pregnancy had no statistically significant influence on neonatal mortality, $p = 0.597 > \alpha = .05$). Overall, the combined effect of attending ANC visits, taking antimalarial drugs .and receiving 4 or more TT vaccine doses before pregnancy on neonatal deaths was not statistically significant, $\chi 2(4) = 2.445$, $p = 0.654 > .05$, explained 2.0% (*Nagelkerke R2*) of the variance in neonatal deaths, and correctly classified 962% of the cases (see Table 32). At a 95% confidence interval the odds of neonatal deaths were insignificant therefore, I failed to reject the null hypothesis in favor of the alternative.

Table 32.

Binomial Logistic Regression Predicting Likelihood of Neonatal Deaths RQ2

							95% C.I.for Odds ratio	
	B	S.E.	Wald	df	Sig.	Odds ratio	Lower	Upper
ANC antenatal2(1)	-0.45	0.13	12.55	1	0.000	1.57	0.49	0.82
Tetanus toxoid vaccine2(1)	-0.16	0.30	0.28	1	0.597	1.17	0.47	1.54
Antimalarial-SP/Fpfansidar(1)	-0.51	0.14	14.07	1	0.000	1.67	0.46	0.78
Constant	-2.60	0.12	447.42	1	0.000	13.41		

a. Variable(s) entered on step 1: antenatal2, tetanustoxoidvaccine2, spfansidar.

Answers to RQ2 - Community Access Factors and Neonatal Mortality

In the 2nd research question, I applied the binary logistic regression to determine whether there were any significant predictive relationships between supervised childbirth by a health care professional and distance to any health facility and neonatal deaths

among women of 15 to 49 years of age in 2016 in Uganda. Six of the assumptions were fulfilled with the only violation being assumption seven where 345 cases were outliers. The analysis included all the 7,538 cases with no data transformations. The binomial logistic regression model was not statistically significant because $\chi 2(2) = 1.528$, $p = 0.466 > .05$, while the model explained 0.0% (Nagelkerke $R2$) of the variance in neonatal deaths and correctly classified 95% of cases. The results of the predictor variables were not statistically significant distance to a health facility, ($p = .276$), receiving assistance during delivery childbirth, ($p = .420$). The odds of not experiencing neonatal mortality were statistically insignificant for women considering the distance a problem compared. Also, the odds of neonatal deaths were statistically insignificant for women assisted during childbirth compared to women not assisted during delivery (see Table 33). With these findings, I failed to reject the null hypothesis.

Table 33.

Logistic Regression Predicting Likelihood of Neonatal Deaths RQ2

								95% C.I. for Odds Ratio	
		B	S.E.	Wald	df	Sig.	Odds ratio	Lower	Upper
Distancehealthfacility problem(1)	-0.12	0.11	1.19	1	0.28	1.13	0.71	1.10	
Assisted Childbirth(1)	-0.10	0.13	0.65	1	0.42	1.11	0.70	1.16	
Constant	-2.91	0.13	534.02	1	0.00	18.31			

a. Variable(s) entered on step 1: Distancehealthfacility_problem, Assisted Childbirth.

Answers to RQ3 - Neonatal Deaths Across Geographic Regions While Controlling for Maternal and Personal Illness Control Factors

In testing the assumptions, I found no linear relationship between the covariate's mothers' age at first birth, number of TT vaccines doses number of ANC visits and neonatal deaths across regions. While there was homogeneity of regression slopes the assumptions on homogeneity of variances in neonatal deaths were violated. At a 95% confidence interval the adjusted mean of neonatal deaths across regions were not statistically significant. These findings showed no statistically significant differences in neonatal deaths across geographical regions while controlling for the age of the mother at first birth, number of ANC visits, and the number of TT vaccine doses received before pregnancy $F(4, 117) = 2.00$, $p = .098$), thus, I failed to reject the null hypothesis for the alternative.

In Chapter 5, results are discussed, and findings synthesized while comparing with previous research studies and existing literature.

Chapter 5: Discussion, Conclusions, and Recommendations

Neonatal mortality is a global concern and on average 19 babies ages 0 to 28 days die out of every 1,000 live births (United Nations, 2014). The situation is worse in Uganda where the neonatal mortality rate is not only higher than the global average but has remained stagnant since the 2006 UDHS (UBOs, 2017). The global effort to reduce the proportion of neonatal deaths to 12 deaths per 1,000 live births under target 3.2 of the 2015 SDGs require countries to develop mechanisms of minimizing neonatal deaths (UNICEF, 2017). The retrospective cross-sectional study addressed proximate and socioeconomic factors limiting access to health services and their impact on the death of neonates in Uganda. The proximate factors were number of ANC visits during pregnancy, number of doses of TT vaccine received before pregnancy, access to antimalarial medicine during pregnancy, and assistance from medical personnel during childbirth. The socioeconomic factors were distance to a health facility and geographical region. The sample constituted women 15 to 49 years of age with children ages 0 to 28 days from the 2016 UDHS. Mosley and Chen's (1984) model for child survival in developing nations provided the framework for the study. I used a cross-sectional design to answer three research questions. To answer that 1st research question, I used binary logistic regression to determine whether there were associations between the number of ANC visits, the number of TT injections received before pregnancy, and access to malaria drugs-SP/Fansidar and neonatal deaths. To answer the 2nd research question I used binomial logistic regression to determine whether there were any significant predictive relationships between supervised childbirth by a skilled health care

professional and distance to any hospital and death of newborn babies ages 0 to 28 days. In the 3rd research question I used a one-way ANCOVA to determine whether there were differences in deaths of neonates across geographic areas while controlling for the mother's age at first birth, the number of ANC visits, and the number of TT vaccine doses received before pregnancy.

Summary of Key Findings

Of the total sample of 7,538 cases, I found that 5% of women had experienced neonatal deaths and 64% were in their teenage years (14 to 19). Findings from descriptive statistics indicated that 6 out of 10 women attended at least 4 ANC visits while only 14% received 4 or more doses of TT vaccine doses. Only 21% of the women in this study never took any antimalarial drug, 77% had supervised childbirth, and 58% did not consider distance to the health facility a problem. Demographic findings showed that nearly 4 out of 10 women (39%) had given birth to one or two children, 82% were living in rural areas, and 27% were living in households in the most deficient wealth category.

Personal Control Factors Effect on Neonatal Deaths

Regarding the 1st research question, the study findings showed that attending less than 4 ANC visits during pregnancy increases the odds of experiencing neonatal deaths by a factor of 1.57 among pregnant women compared to attending 4 or more ANC visits. Another finding was that not taking antimalarial drugs during pregnancy increases the odds of neonatal deaths by 1.67 times among women of reproductive age compared to taking antimalarial drugs. Receiving 4 or more TT vaccine doses before pregnancy has no statistically significant influence on neonatal mortality ($p = 0.597$). While this model

correctly classified 96.2% of cases, the binomial logistic regression model was not statistically significant ($\chi2(4) = 2.445$, $p = 0.654$) and explained 2.0% (Nagelkerke R2) of the variance in neonatal mortality. Accordingly, I failed to reject the null hypothesis for the alternative.

Community Factors Effect on Neonatal Deaths

I performed a binomial logistic regression to determine whether assistance by a health professional during childbirth and distance to the health facility has impact on deaths of neonates among women ages 15 to 49 years in 2016 in Uganda. I found that the logistic regression model is not statistically significant, $\chi2(2) = 1.528$, $p < .466$. The model explains almost nothing of the variance in neonatal deaths as demonstrated by the Nagelkerke R2 but correctly classifies 95.4% of cases. The two predictor variables in the model (distance to the health facility and assistance during childbirth by a medical professional) are not statistically significant. The odds of not experiencing neonatal mortality are statistically insignificant whether women consider distance to a health facility a problem or not. Similarly, the odds of neonatal deaths are statistically negligible whether women receive assistance from medical professionals during childbirth or not. The null hypothesis was not rejected.

Differences in Deaths of Neonates Across Geographic Area

For the 3rd research question I ran the one-way ANCOVA to determine whether there are any significant differences in deaths of newborn babies (0 to 28 days) across geographical regions while controlling for mothers' age at first birth, the number of ANC visits during pregnancy and the number of TT vaccine doses received before pregnancy.

While these results showed the number of ANC visits as significantly impacting on neonatal deaths (p = .040), the mothers' age at first birth had no significant effect on neonatal deaths (p =0.120) and similarly the number of TT vaccine doses received before pregnancy had no significant effect on neonatal deaths across the regions (p = 0.871). Overall, the findings showed no statistically significant differences in deaths of newborn babies across the five geographical areas while controlling for the mothers' age at first birth, number of ANC visits during pregnancy, and number of TT vaccine doses received before pregnancy, $F(4, 117) = 2.00$, p = .098. I failed to reject the null hypothesis.

Interpretation of the Findings

As highlighted by Lehtonen et al. (2017) in their study on the persistently high neonatal deaths globally, the quantitative cross-sectional retrospective study also aimed to determine the reasons for the stagnating neonatal deaths in Uganda. The focus was determining factors impacting on access to health services and their effect on the death of neonates in Uganda using information in the 2016 UDHS. The conceptual framework guiding this study was Mosley and Chen's study for child survival in developing countries (Mosley & Chen's, 1984). This research focused on immediate determinants (the number of ANC visits during pregnancy, number of TT vaccine doses received before pregnancy, access to anti-malarial medicine during pregnancy, assistance during child birth by a health expert), and socioeconomic factors (whether distance to a health facility is a challenge, and geographical region) as independent variables with neonatal deaths as the dependent variable. I used the binomial logistic regression analysis to answer the 1st and 2nd research questions, and ANCOVA for the 3rd research question.

The interpretations of the outcomes of the three research questions of this research are provided.

Personal Control Factors and Neonatal Deaths

The analysis from this study shows that attending less than 4 ANC visits during pregnancy increases the odds of neonatal deaths by 1.57 times as compared to when pregnant women attend 4 or more ANC visits. This finding supports the recommendation by the World Health Organization and UNICEF on the importance of attending at least 4 ANC visits as explained in the WHO report. Makate and Makate (2017) also documented similar findings in their study to examine the impact of prenatal care quality on neonatal deaths in Zimbabwe. In their results women who undertook and completed 4 or more ANC visits during pregnancy reduced the occurrence of neonatal deaths by about 1.41 percentage points collaborating this study findings. ANC attendance is, therefore, a relatively cheap and efficient intervention in curbing early neonatal deaths as highlighted by Lehtonen et al. (2017). This is because during ANC visits pregnant women receive a comprehensive medical checkup and undertake medical tests such that any ill health is addressed reducing incidences of neonatal deaths as documented by WHO (2018b). Malaria is a significant health concern during pregnancy as highlighted by the World Health Organization in their report. The World Health Organization recommends that during pregnancy women should receive IPTp against malaria from the second trimester to prevent incidences of malaria. Kulmala et al. (2000) in his study of predictors of neonatal deaths among expectant mothers receiving ANC in Malawi highlighted malaria prevalence among mothers as a critical factor contributing to neonatal deaths and

recommended further research, a gap that this study has filled. A key finding from this research is that pregnant women who do not receive any antimalarial drugs- SP/Fansidar during pregnancy increase the odds of neonatal deaths 1.67 times compared to women taking antimalarial drugs. The finding from this study also supported the systematic review by Eisele et al. (2012) showing that pregnant women receiving preventive treatment against malaria reduced death of newborn babies. These findings responded to the request for further research as highlighted by Braun et al. (2016) following their conclusions of qualitative research on the dangers of malaria during pregnancy in western Uganda. This study supported that limited uptake of IPTp during pregnancy increased the incidence of newborn deaths among women of aged 15 to 49 years.

Literature from the World Health Organization recommends women without any prior record of TT vaccine should receive at least two doses of TT vaccine before becoming pregnant (WHO, 2018d). According to WHO receiving the TT vaccine could minimize neonatal tetanus among neonates. Also, the guiding principles for development of ACIP recommendations for vaccination during pregnancy and breastfeeding (2008) require women to receive TT vaccine during pregnancy irrespective of whether they received any TT vaccine before pregnancy. The study findings showed that receiving 4 or more TT vaccine doses before pregnancy had no statistically significant influence on neonatal mortality collaborating the guiding principles. Shafique Sani et al. (2017) in their study on causes of neonatal mortality in Nigeria highlighted that receiving only one dose of NNT vaccine increased the possibility of newborn deaths by 4%. The study findings did not collaborate this finding by Shafique Sani et al. because this study

focused on TT vaccine doses received before pregnancy as opposed to TT vaccine doses received during pregnancy. I recommend more studies to understand the impact that receiving 4 or more TT vaccines during pregnancy could have on neonatal mortality.

Community Factors and Neonatal Deaths

Binomial logistic regression was undertaken to determine whether distance to the health facility was a challenge to neonatal deaths and receiving assistance from a health professional during childbirth had any association with neonatal deaths. From the results odds of not experiencing neonatal deaths were insignificant whether women consider the distance to a health facility a challenge or not. Also, odds of neonatal deaths were not significant whether women received assistance during childbirth or not possibly pointing on existence of other factors. Kawakatsu et al. (2014) revealed in their research in western Kenya that access to skilled delivery, distance to a hospital, and availability of transportation were critical factors on newborn deaths, results from this study did not support this finding. Also, the verbal autopsy by Koffi et al. (2017) in Nigeria to explain childhood mortality revealed that failure to seek treatment when a neonate is sick due to the distance to the health facility accounts for 15% of neonatal deaths. I also recommend further research like a verbal autopsy to collaborate with previous findings.

Differences in Neonatal Deaths Across Geographic Regions While Controlling for Maternal and Personal Illness Control Factors

The researchers Izugbara (2016) highlighted the impact that mother's age had on neonatal deaths in Burundi, Sierra Leone, and Burkina Faso. Researchers using binomial regression analysis showed the age of the mother as having a significant contribution to

neonatal mortality collaborating Maniruzzaman et al. (2018) study findings on correlates of child and newborn deaths in Bangladesh. Maniruzzaman et al. showed mothers aged 25 to 44 years had a lower risk of child and infant deaths compared to women aged 12 to 24 years. As opposed to other researchers, this research applied ANCOVA to determine if there were any differences in neonatal deaths across regions while controlling for the age of the mother at first birth, the number of ANC visits and the number of TT vaccine doses received before pregnancy. While the adjusted mean number of neonatal deaths were highest in the west Nile region compared to the central area, the mean differences at 95% confidence intervals were not statistically significant. Thus, controlling for the mothers' age at first birth, number of ANC visits, and number of TT vaccine doses received before pregnancy did not result in any statistically significant differences in deaths of newborn babies in all geographical regions, (p = .098).

The implications for social change are the need to promote attendance to ANC during pregnancy (at least 4 visits) through sustained advocacy and awareness creation with appropriate government policy.

In summary, this study showed attending at least 4 ANC visits reduced the odds of neonatal deaths 1.57 times, and a decision not to take antimalarial drugs during pregnancy increased the odds of neonatal deaths by 1.67 times. But, taking 4 or more TT vaccine doses before pregnancy had an insignificant effect on neonatal mortality. Overall, the combined effect of number of ANC attendance, receiving antimalarial drugs during pregnancy and receiving 4 or more TT vaccine doses before pregnancy had no significant influence on neonatal mortality. Also, the odds of not experiencing neonatal mortality

was statistically insignificant irrespective of whether distance to a health facility was considered a challenge by women or not. Assistance by medical personnel during childbirth had an insignificant effect on neonatal deaths. Both findings contradicted previous findings by Kawakatsu et al. (2014). Finally, no statistically significant differences in deaths of newborn babies existed across all geographic areas while controlling for the combined effect of age of the mother at first birth, the number of ANC visits and number of TT vaccine doses received before pregnancy.

Limitations of the Study

This study was retrospective using data from the 2016 UDHS and the analyzes were for only selected independent variables and covariates. This study excluded other access factors to health facilities factors that could have impacted on neonatal deaths like the availability of birth kits and personal hygiene.

The UBOs in the UDHS relied on recall and since death is painful achieving quality results could be a challenge. The training of enumerators by the UBOs ensured that they understood the concepts and questionnaire administration and interpretation.

A potential limitation was that neonatal deaths included in this study were for mothers who had lost children and were still alive. This study excluded neonatal deaths relating to mothers already dead which could have impacted on the validity and reliability of the study findings. However, this limitation was mitigated because the 2016 UDHS had a 5-year reference period and provided enough cases for the study since death is a rare event.

The 2016 UDHS did not document some of the limitations in the sampling process and no consideration was given to the refugee populations despite the high influx of refugees into the country. This limitation was resolved because generalization of estimates to Uganda took care of any special populations like refugees.

A potential challenge of this study was inability to provide estimates at the district level, a limitation also highlighted by Roberts (2015). Some regions like Kampala accounted for less than 5% of the cases included in the study resulting in smaller sample sizes not adequate for logistic regression analysis. To solve this, cases were merged for Kampala region with the central region to ensure an adequate sample for analysis. Each geographical region had enough observations because all cell frequencies had at least 10 cases for analysis as highlighted by Warner (2013).

In the binary logistic regression, the assumption of the absence of outliers was not satisfied. While 250 cases in RQ2 had standardized residuals of more than 2 SDs and 345 cases in RQ2, no exclusions were made which could have influenced the results. This study used actual data from the 2016 UDHS and as such no transformations were made.

For ANCOVA the assumption of homogeneity of linearity and normality were violated presenting a potential limitation to the results. However, since according to Laerd Statistics (2017) the non-conformity to normality test to a large extent may not impact on the occurrence of Type I error, I still considered ANCOVA robust for this analysis.

Recommendations

This study showed that while attending at least 4 ANC visits reduced the odds of neonatal deaths by 1.57 times and not taking antimalarial drugs during pregnancy increased the odds of neonatal deaths 1.67 times; taking 4 or more TT vaccine doses before pregnancy had an insignificant effect on neonatal mortality. Further research to determine the effect of receiving 4 or more TT vaccine doses during pregnancy has on the deaths of newborns is recommended to support ACIP recommendations and findings by Shafique Sani et al. (2017).

This study also showed that the combined effect of distance to a health facility and assistance during childbirth by a health professional on neonatal mortality was not significant. In this research the indicator on distance to a health facility was based on perceptions and not actual distance. Overall, the non-significance of distance to a health facility on neonatal deaths contradicted the verbal autopsy results by Koffi et al. (2017) in Nigeria. Possibly there exist other community factors explaining the neonatal deaths in Uganda. I recommend further studies on the effect that other community factors including actual distance to health facility have on neonatal deaths.

The results of ANCOVA showed no statistically significant differences in deaths of neonates across regions while controlling for age of mother at first birth, number of ANC visits and number of TT vaccine doses received before pregnancy. Statistically significant differences in neonatal deaths existed in regions while controlling for only the number of ANC visits. I recommend future studies to consider inclusion of other covariates to explain the differences in deaths of newborn babies across all regions.

Undertaking a verbal autopsy could provide other reasons for neonatal mortality in Uganda.

Implications

This study on neonatal mortality highlighted essential findings on access to health services and impact on neonatal deaths in Uganda. This study with a nationally representative sample was the first of its kind in Uganda and analyzed data at the national level. A positive social change is that this study adds knowledge to the measurement of neonatal deaths applying the Mosley and Chen's model in Uganda. The application of ANCOVA was a unique dimension to the analysis of the differences of newborn deaths, an area for further research.

This study underscored the importance that attending ANC at least 4 times during pregnancy had on reducing the odds of neonatal mortality by 1.57 times. In this regard, policies and programs at the national and subnational level for pregnant women on the need to embrace ANC could be a significant contribution. At the individual level the likely positive social change could be awareness creation especially among pregnant women on the importance of ANC and subsequent attitude-change on the need to attend at least 4 ANC visits. Also, improving the continuum of care through awareness creation could reduce neonatal deaths. A likely contribution may be the reduction of the deaths of neonates possibly resulting in saving of would be lost lives of babies and allowing them to benefit from their full potential when alive.

Another positive social change from this study is the likely initiation of community adult learning classes on maternal health during pregnancy which may

translate to increased community awareness on importance of attending at least 4 ANC visits during pregnancy. Further, this could lead to improved household livelihoods because the reduction in neonatal deaths may make the community contribute to economic development. The awareness on antimalarial drugs for malaria prevention during pregnancy could lead to reduction of malaria incidence in the community, thus a positive social change.

At a national level the likely positive social change from this study could be renewed policy direction on malaria prevention and increased advocacy for ANC attendance at least 4 times during pregnancy that may translate to a reduction in the health budget, a saving to government. Specific policies may be developed on prevention of malaria during pregnancy like indoor/outdoor spraying, sleeping under ITNs, and closing shutters that may benefit the population and reduce neonatal deaths. This study showed no significant differences in neonatal deaths in all regions implying that the government must do more work throughout the country to create awareness on the need to reduce the high neonatal mortality. Policies and advocacy messages involving all stakeholders could be formulated to create awareness on the importance of attending at least 4 ANC visits during pregnancy. A joint effort among stakeholders (public sector, private sector, international agencies like UNICEF, and the general public) may be critical in awareness creation on ANC which may result in a positive social change. Globally, the likely positive social change maybe contribution to realization of SDG target 3.2 of lowering the neonatal mortality rate to a maximum of 12 deaths per 1,000

live births and a saving of 116 million lives of newborns as highlighted by Lawn et al. (2014).

Conclusion

Reducing the stagnating neonatal deaths standing at 27 deaths for every 1,000 babies born alive since the 2006 UDHS is a problem in Uganda. The government of Uganda has put in measures to improve the health of the population like increasing the budget allocations to the health sector. While this led to the declining levels of infant mortality to 43 deaths per 1,000 live, under-five mortality to 64 deaths per 1,000 live births, over the same period neonatal mortality remained stagnant at 27 deaths per 1,000 live births. The primary purpose of this retrospective cross-sectional study was to determine proximate and socioeconomic factors affecting access to health services and their effect on neonatal mortality rates in Uganda applying the Mosley and Chen's framework. The findings showed that attending ANC less than 4 times during pregnancy increases the odds of neonatal deaths 1.57 times while failing to take any antimalarial drugs during pregnancy increased odds of neonatal deaths by 1.67 times. While previous researchers underscored the critical value of receiving TT vaccine doses during pregnancy, this study showed that receiving 4 or more TT vaccine doses before pregnancy did not contribute to any significant reduction to neonatal mortality. Also, this research showed that distance to a health facility was not significant whether or not the women considered it a challenge in accessing health services. Supervised childbirth by a medical professional had no effect on neonatal death a possible indication of other community factors contributing to neonatal deaths.

The findings from this study also showed no statistically significant differences in deaths of newborn babies in regions in Uganda while controlling for mothers' age at first birth, number of ANC visits, and number of TT vaccine doses received before pregnancy. While further studies could be undertaken to explain neonatal deaths like a verbal autopsy, a key finding from this research was that attending at least 4 ANC visits and taking medicine for malaria prevention during pregnancy contribute significantly to the reduction of neonatal deaths. As the global attention focuses on reducing neonatal deaths to 12 deaths per 1,000 live births under SDG goal 3, a concerted effort in promoting community initiatives and adult learning on the importance of ANC attendance and malaria prevention during pregnancy is critical. Such efforts may lead to a healthy population, reduction in neonatal deaths not only in Uganda but globally giving Uganda opportunity to reap from benefits of economic development and inclusive development as in Agenda 2040.

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Appendix: Data Use Agreement

This Data Use Agreement ("Agreement"), effective as of January 5th, 2019 ("Effective Date"), is entered into by and between Imelda Magdalene Atai Musana ("Data Recipient") and Uganda Bureau of Statistics ("Data Provider"). The purpose of this Agreement is to provide Data Recipient with access to a Limited Data Set ("LDS") for use in research in accord with the HIPAA and FERPA Regulations.

1. Definitions. Unless otherwise specified in this Agreement, all capitalized terms used in this Agreement not otherwise defined have the meaning established for purposes of the "HIPAA Regulations" codified at Title 45 parts 160 through 164 of the United States Code of Federal Regulations, as amended from time to time.
2. Preparation of the LDS. Data Provider shall prepare and furnish to Data Recipient an LDS in accord with any applicable HIPAA or FERPA Regulations

Data Fields in the LDS. **No direct identifiers such as names may be included in the Limited Data Set (LDS).** The researcher will also not name the organization in the doctoral project report that is published in Proquest. In preparing the LDS, Data Provider or designee shall include the **data fields specified as follows**, which are the minimum necessary to accomplish the research: 2016 UDHS data for both households and individuals.

Responsibilities of Data Recipient. Data Recipient agrees to:

a. Use or disclose the LDS only as permitted by this Agreement or as required by law;

b. Use appropriate safeguards to prevent use or disclosure of the LDS other than as permitted by this Agreement or required by law;

c. Report to Data Provider any use or disclosure of the LDS of which it becomes aware that is not permitted by this Agreement or required by law;

d. Require any of its subcontractors or agents that receive or have access to the LDS to agree to the same restrictions and conditions on the use and/or disclosure of the LDS that apply to Data Recipient under this Agreement; and

e. Not use the information in the LDS to identify or contact the individuals who are data subjects.

3. Permitted Uses and Disclosures of the LDS. Data Recipient may use and/or disclose the LDS for its research activities only.

4. Term and Termination.

a. Term. The term of this Agreement shall commence as of the Effective Date and shall continue for so long as Data Recipient retains the LDS, unless sooner terminated as set forth in this Agreement.

b. Termination by Data Recipient. Data Recipient may terminate this agreement at any time by notifying the Data Provider and returning or destroying the LDS.

c. Termination by Data Provider. Data Provider may terminate this agreement at any time by providing thirty (30) days prior written notice to Data Recipient.

d. For Breach. Data Provider shall provie written notice to Data Recipient within ten (10) days of any determination that Data Recipient has breached a material term of this Agreement. Data Provider shall afford Data Recipient an opportunity to cure said alleged material breach upon mutually agreeable terms. Failure to agree on mutually agreeable terms for cure within thirty (30) days shall be grounds for the immediate termination of this Agreement by Data Provider.

e. Effect of Termination. Sections 1, 4, 5, 6(e) and 7 of this Agreement shall survive any termination of this Agreement under subsections c or d.

5. Miscellaneous.

a. Change in Law. The parties agree to negotiate in good faith to amend this Agreement to comport with changes in federal law that materially alter either or both parties' obligations under this Agreement. Provided however, that if the parties are unable to agree to mutually acceptable amendment(s) by the compliance date of the change in applicable law or regulations, either Party may terminate this Agreement as provided in section 6.

b. Construction of Terms. The terms of this Agreement shall be construed to give effect to applicable federal interpretative guidance regarding the HIPAA Regulations.

c. No Third-Party Beneficiaries. Nothing in this Agreement shall confer upon any person other than the parties and their respective successors or assigns, any rights, remedies, obligations, or liabilities whatsoever.

d. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

e. Headings. The headings and other captions in this Agreement are for convenience and reference only and shall not be used in interpreting, construing or enforcing any of the provisions of this Agreement.

IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly executed in its name and on its behalf.

DATA PROVIDER

Signed: 

Print Name: VITUS MULINDWA KATO

Print Title: DEPUTY EXECUTIVE DIRECTOR CORPORATE SERVICES

Institution: UGANDA BUREAU OF STATISTICS

DATA RECIPIENT

Signed: 

Print Name: IMELDA MAGDALENE ATAI MUSANA

Print Title: DEPUTY EXECUTIVE DIRECTOR STATISTICAL PRODUCTION & DEVELOPMENT

Institution: UGANDA BUREAU OF STATISTICS

Training Institution: WALDEN UNIVERSITY, USA