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Postdischarge Pediatric Mortality in Nigeria for Children Under 5 Years of Age

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This is to certify that the doctoral dissertation by

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Abstract

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MPH, Walden University, 2015

BS, Michael Okpara University, 2009

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Child mortality has remained a public health issue that is prevalent among families living in Nigeria and low- and middle-income countries. Factors associated with post-discharge pediatric mortality among children under 5 have not been explored. The study involved examining associations between timely individual follow-up visits, availability of healthcare facilities for follow-up care, and likelihood of post-discharge mortality among children under 5 while adjusting for household income, geographical location, mothers' age, and mothers' education. The theoretical framework was the social ecological model. Data were generated from the 2018 Demographic and Health Survey. A sample size of N=21,671 was used to determine associations between independent, dependent, and covariant variables. Findings from this study indicate children with timely follow-up visit were 45% less likely to die posthospital discharge (*AOR* = 0.550, 95% *CI*: 0.467–0.646, $p < .001$) and those from richer homes (*AOR* = 0.687, 95% *CI*: 0.581–0.813, $p = .001$) or better educated mothers had 24-31% lower odds, showing a significant effect. Availability of healthcare facilities and urban or rural residence did not have a significant effect. Findings from this study have the potential for positive social change via public health interventions which target follow-up care for children from low-income households whose families often lack education, resources, or support systems that are necessary to ensure continued care after discharge in Nigeria.

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Dedication

To God Almighty for His constant love, faithfulness, and provisions. Especially for keeping me in sound health, mind, and body to pursue and complete my PhD. I am forever grateful to Him.

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Chapter 1: Introduction to the Study

Postdischarge pediatric mortality (PPM) refers to the death of children under 5 that typically happens after these children are discharged from hospitals. PPM among children in low-income countries like Nigeria is significantly underreported, with a vast majority of underreporting occurring among this age group (Knappett et al., 2024; Wiens et al., 2024). Deaths occur mostly at home or on the way to hospitals, usually within a few months following treatment for acute illnesses like severe anemia, malnutrition, malaria, or sepsis (Chaudhry et al., 2023; Knappett et al., 2024; Umuhoza et al., 2024). Despite efforts to improve child health outcomes, children under 5 in Nigeria make up a large proportion of those who die. They are at high risk due to inadequate followup care, limited healthcare infrastructure, and socioeconomic disparities (Chaudhry et al., 2023; Knappett et al., 2024). In the last two decades, the Ministry of Health (MoH), including international nongovernmental organizations such as the World Health Organization (WHO) have diligently worked to address this issue globally. PPM remains an underexplored area in pediatric healthcare, particularly in low-income countries like Nigeria.

PPM represents a critical period where children are at a heightened risk of death, yet mechanisms and interventions to reduce risks are often lacking in healthcare. There is still limited research that focuses primarily on PPM among children under 5 because these rates can be as high as or higher than in-hospital mortality rates, especially in poor countries. Most children die at home following discharge, with 1-2% deaths from anemia and malaria and 3-20% from malnutrition and respiratory infections (Nemetchek et al.,

2018). Despite the high burden of PPM, this issue and challenge continue to receive insufficient national and international recognition. In fact, lack of research and data on deaths after hospital discharge reduces the importance of care following discharge, making it a low priority to policymakers, even though better awareness could lead both researchers and policymakers to take action. This study has the potential to lead to positive social change via strong awareness and policy interventions which significantly reduce child mortality and improve wellbeing of families in poor countries such as Nigeria.

This chapter includes research questions and hypotheses, the background of the study, problem statement, purpose of the study, definitions, theoretical framework, nature of the study, assumptions, scope and delimitations, limitations, and significance of the study. Finally, a summary concludes the chapter.

Background

Child mortality is an indicator of the future of any society globally. Causes and prevention of child deaths are still challenging issues for child mortality researchers. Child survival rates have improved recently, dropping from 9.6 million estimated deaths in 2000 to 7.6 million in 2010; deaths per 1,000 live births dropped from 93 in 1990 to 38 in 2021 (O'Hare et al., 2013; UNICEF, n.d.). These improvements mean children have gained from effective implementation of public health interventions, which are linked with micro and macroeconomic growth, better female education, lower fertility rates, and stronger global, regional, and national public health programs (Yaya et al., 2018). Even though child health has improved, child mortality is still a significant problem in low-

income countries. For instance, in 2021, about 13,800 children between 0 and 5 died every day, and around 5 million died in 2020 (WHO, 2020). Moreover, in 2020, more than 80% of 5 million under 5 deaths happened in Sub-Saharan Africa, which includes resource-poor countries, and Nigeria, Ethiopia, and the Democratic Republic of the Congo (DRC) were responsible for half of all child deaths in 2020, with Nigeria alone accounting for nearly a third of all deaths (WHO, 2020).

These high child mortality rates are attributed to causes that can be prevented or treated. However, the majority of these deaths occur mainly at home after these children are discharged due to poor hygiene, inadequate followup care, suboptimal healthcare-seeking behavior, insufficient nutrition, and socioeconomic inequalities among communities, households, and individuals (Chaudhry et al., 2023; Midtgaard et al., 2021; Nemetchek et al., 2018; WHO, 2023). Overall, the most underreported child mortality deaths occur outside hospital settings and mostly at home or on the way to the hospital, particularly with children under 5, because over 80% of these deaths occur without families seeking further medical help in rural areas (Rus & Cruz, 2019). Knappett et al. (2024) showed existing research studies have primarily focused on high rates of in-hospital child mortality due to factors like malaria, anemia, and malnutrition. There remains a major and critical gap in understanding other causes of pediatric mortality following hospital discharge, especially in low-income regions like Nigeria . There is still a need to shift from inpatient to postdischarge care as these postdischarge deaths are highly predictable but currently not addressed in terms of existing guidelines (Diallo et al., 2021).

The number of postdischarge deaths continues to increase and even exceed in-hospital mortality rates, with most postdischarge deaths occurring at home. Also, leaving hospitals against medical advice, young age, pneumonia, malnutrition, hypoxia, anemia, and previous hospitalization all lead to a higher likelihood of death after discharge (Chaudhry et al., 2023; Midtgaard et al., 2021; Nemetchek et al., 2018). At six months postdischarge, the mortality rate was 4.4% (Knappett et al., 2024).

In addition, Wiens et al. (2016) stated a significant proportion of child deaths occur outside of health facilities. Four out of five children who died after discharge were outside of the health system, indicating a critical need to address postdischarge care, especially improved community-level care during the vulnerable postdischarge period (Wiens et al., 2016). Most children are admitted to hospitals for illnesses such as anemia, severe malnutrition, and malaria, where they get treated and discharged, but later die at home. Specific illnesses such as pneumonia, diarrhea, and malaria are often challenging to differentiate clinically and often coexist, especially among children in poor-income households (Nemetchek et al., 2018). Also, Kwambai et al. (2023) stated death rates were highest in children with severe acute malnutrition (21.6%), followed by those with severe anemia (15.5%), severe pneumonia and other conditions (5.6%), and severe malaria (0.7%). As a result, Kwambai et al. reported death rates after leaving the hospital totaled 4.9% by 3 months, 6.2% by 6 months, and 9.3% by 12 months. Children who had severe anemia were more likely to die after they left the hospital than while they were in the hospital. Moreover, Kwambai et al. found for children under 5 with other health problems, odds of dying after leaving the hospital were even higher (MHOR = 2.67).

Therefore, the prevalence of child mortality indicates children are more than two and a half times as likely to die after discharge compared to during their hospital stay.

Socioeconomic disparities, poor health-seeking behaviors, lack of followup care, and inadequate healthcare infrastructure affect all children, and these are associated with PPM (Midtgaard et al., 2021; Nemetchek et al., 2018). Also, mothers and caregivers often misinterpret their children's discharge from health facilities as a sign of complete recovery, leading to delays in terms of seeking further medical attention when symptoms of diseases continue or persist (English et al., 2016; Wiens et al., 2021). Major factors contributing to the burden of postdischarge pediatric mortality in low-income countries are inability to afford transportation fees to go for followup visits after discharge, delays in seeking care, limited awareness of risks during the postdischarge period, and low levels of education among mothers (English et al., 2016). In addition, low levels of maternal education are associated with a higher probability of death outside of health facilities and increase in community deaths (Agunbiade et al., 2023; Wammanda et al., 2022; Wiens et al., 2021). Educated mothers and caregivers are more likely to seek healthcare after hospital discharge and adopt better child-rearing practices that will reduce PPM.

Children from the poorest households are at a higher risk of dying due to limited or no access to healthcare and nutritious food caused by poverty and lack of wealth (Bamigbala & Ojetunde, 2023; Wammanda et al., 2022). Also, geographical disparities can be a key contributing factor. Regions in NE and NW Nigeria have higher mortality rates, usually connected with poorer socioeconomic conditions and limited healthcare

infrastructure (Adesuyi et al., 2021; Bamigbala & Ojetunde, 2023). Egbon et al. (2022) reported the likelihood of PPM among children under 5 is severe in specific states and provinces in Nigeria such as Kebbi, Jigawa, Kwara, and Kaduna, and targeted interventions, especially during the first 6 weeks after childbirth improved child survival rates. Often, healthcare centers are not close to homes of mothers of these children, leading to barriers to followup visits after hospital discharge. Major barriers that prevent timely access to healthcare include costs of transportation, distance to healthcare facilities, and need to travel at night, which exacerbate postdischarge mortality risks (Wammanda et al., 2022). Significant risk factors for postdischarge mortality include young age, malnutrition, pneumonia and HIV infection (Knappett et al., 2024; Nemetchek et al., 2018). Solutions to these problems require coordinated approaches from public health institutions that includes improving mothers' education, awareness regarding early child marriages, planning and implementing better policies to reduce poverty, and improving healthcare infrastructure. Public and private hospitals, including public health centers, need to pay more attention to how they care for children after they leave hospitals, making sure they continue to get care that is needed even after they go home to support them in staying healthy and reduce the risk of dying through community intervention or followupvisits from healthcare workers. Therefore, when children are discharged from hospitals, it is paramount they continue to receive good postdischarge care, and this might mean followup visits with doctors, getting right medicines, or having someone check on them regularly.

It is generally hard to get accurate data regarding child deaths after hospital discharge, which makes it challenging to understand causes of these deaths fully. Policymakers do not focus enough on the issue because of insufficient available data on PPM, leading to not enough specific interventions that are targeted to prevent these deaths among these populations. Conditions like malnutrition, anemia, and malaria are leading causes of death postdischarge, and there is still insufficient research on how factors such as household income, maternal education, age, and geographic location impact survival outcomes. Additionally, while studies have shown the role of community-based health interventions in terms of improving child survival rates, there is limited or no understanding of how to effectively implement and scale such programs in resource-poor communities in Nigeria.

Most PPM remain unreported, leading to an absence of national policies and healthcare strategies that specifically address postdischarge care for at-risk children. Also, many health systems in LMICs lack structured monitoring mechanisms or followup care practices for children after discharge, leaving them at heightened risk of mortality (Nemetchek et al., 2018; Wiens et al., 2013). This has contributed to insufficient investment in followup care programs and postdischarge monitoring, leading to continued high mortality rates (Nemetchek et al., 2018; Wiens et al., 2013). Moreover, gaining a better understanding of this topic may help promote greater institutional awareness, structured interventions, and aid for educating healthcare workers, helping professionals, and experts to develop new tools and tailored specific treatment

approaches that can contribute to lessening systemic and structural barriers which prevent children from receiving adequate care after hospital discharge.

Problem Statement

PPM among children under 5 has been underreported. There is insufficient information regarding children who are discharged from hospitals in the poorest areas who often fall ill and die months later due to lack of postdischarge care and treatment for conditions like malaria, anemia, and malnutrition. Currently, researchers who study child mortality or pediatric healthcare focus primarily on high rates of in-hospital child mortality due to these factors. This approach marginalizes proper care after hospital discharge and leads to poor health facilities and absence of community health interventions postdischarge that are faced by families in these communities. Also, absence of research among children under 5 who died after hospital discharge can be linked with underreporting of PPM due to inadequate followup mechanisms, mothers with low levels of education, and financial barriers (Umuhoza et al., 2024; Wiens et al., 2023).

In many cases, children under 5 from resource-poor nations like Nigeria are discharged without proper documentation or followup plans, making it challenging to track their individual health outcomes as they go back to their homes. This is particularly true in underserved and rural areas with limited or no access to public healthcare facilities or hospitals. A The likelihood of PPM rates was highest among children under 5 with severe acute malnutrition (SAM) and severe anemia in western Kenya (Kwambai et al., 2023). Nonetheless, these cases were often not documented in national health databases

or registers due to poor followup visits (Kwambai et al., 2023). Inadequate followup care, poor hygiene, insufficient nutrition, suboptimal healthcare-seeking behavior, and socioeconomic disparities contribute heavily to these deaths (Midtgaard et al., 2021; Nemetchek et al., 2018).

Policymakers and healthcare providers have historically placed greater emphasis on reducing in-hospital mortality, often neglecting the critical postdischarge period (Nemetchek et al., 2018). Limited or no targeted interventions, guidelines, and policies addressing postdischarge pediatric healthcare have resulted in high mortality rates that could otherwise be prevented with structured followup care and community-based interventions. Further research is necessary to gain a deeper understanding of factors contributing to this issue. In addition, understanding mothers' levels of education, age, and financial barriers, especially in poor households in rural areas of the country is important.

Purpose of the Study

The purpose of this quantitative research study is to examine factors contributing to PPM in Nigeria among children under 5 by investigating roles of healthcare infrastructure, followup care, and community health interventions, including socioeconomic factors, and propose strategies for improving survival rates of these children.

Research Questions and Hypotheses

In this study, I used the following research questions:

RQ1: Is there an association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education?

$H_0$1: There is no association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education.

H_a1: There is an association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education.

RQ2: Is there an association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels?

$H_0$2: There is no association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels.

H_a2: There is an association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels.

Theoretical Framework

The theoretical framework for this study is Urie Bronfenbrenner's socioecological model (SEM). This framework helps researchers understand how the complex interplay of different levels between individual, interpersonal, organizational, community, and

societal factors shapes an individual's behavior, including their experiences in society (Bronfenbrenner, 1979). Bronfenbrenner (1979) provided a practical and theoretical tool for understanding how different environmental factors influence human development and well-being, especially for children. Also, this theory originated from the wider theory of social ecology, that posits that human behavior and health are shaped by multiple factors at different levels of the environment, including that children's development is influenced by the environment in which they live, their family, school, and community (Bronfenbrenner, 1979; Mosley & Chen, 1984). According to this concept, there are five levels of environmental systems: the microsystem, the mesosystem, the ecosystem, the macrosystem, and the chronosystem, and each level affects children's health and survival, depending on their interactions and contexts (Bronfenbrenner, 1979). Implementing the socioecological model approach to children who die after being discharged from the hospital will provide a framework that helps identify the different factors that may contribute to their deaths. In addition, this model examines influences at various levels, including the child's health, family support, hospital care, community resources, and broader social conditions (Bronfenbrenner, 1979).

Urie Bronfenbrenner's ecological theoretical framework, which proposes that human development is influenced or affected by multiple different levels of environmental factors, from individual to societal, has been applied in public health research to understand how different contexts affect health outcomes and behaviors (Xiang et al., 2021). Furthermore, the study will use the SEM to identify the factors and interventions that can promote or hinder this relationship at different levels of influence

on children under 5 years old (Golden & Earp, 2012). Therefore, the primary function of the theoretical frameworks for this study is to help develop a thorough understanding of the research problem, design ways to investigate it, and plan to analyze the resulting data to make the research findings more meaningful in real-world experiences.

In a search to determine the appropriate methods to illuminate the study of PPM and their association between timely individual followupvisits and the availability of healthcare facilities, SEM was found to be an appropriate approach for this study to gain a deeper understanding of why children die after hospital discharge at home. For example, a child's chances of survival after leaving the hospital are often shaped by family income, caregiver knowledge of health practices, and how easy it is to access medical care in their community (Benova et al., 2018).

Nature of the Study

A quantitative cross-sectional design will be used in this research. A quantitative approach, such as cross-sectional designs in a study, means that the researcher will be focused on gathering, collecting, collating, and statistically analyzing data and information using SPSS at the same time, which will help researchers find factors and common patterns prevalent within a certain population or specific group of children. Szklo and Nieto (2019) noted that cross-sectional studies will support researchers in looking at the link between outcome (effect) and exposure (possible cause) at a single point in time or at the same time, instead of over a long period. The cross-sectional design will be used to analyze data and information from the Demographic and Health Survey (DHS) at a single point in time to assess the association between postdischarge

mortality and followup care practice, to explore how many children died after discharge and what factors, such as household income, healthcare availability, geographical location, mother's education, and mother's age were associated with those deaths. According to Creswell and Creswell (2018), a quantitative research approach systematically examines relationships between variables using numerical data and statistical analysis. This approach will offer a meaningful outlook, provide a real-world meaning, and seek to adopt a deeper understanding of the factors influencing postdischarge mortality among children under 5 years old in low-income areas of Nigeria.

The National Population Commission (NPC) of Nigeria originally collected the data using computer-assisted personal interviewing (CAPI) and standardized questionnaires. Additionally, this study will use a quantitative, cross-sectional design to analyze secondary data from the 2018 Nigeria Demographic and Health Survey (NDHS). The research explored the association between timely followup visits, healthcare facility availability, and postdischarge mortality among children under 5 years old when adjusting for household income, geographical location, mothers' age, and mothers' education. Also, in this research, the target population comprised of children under 5 years old in Nigeria, particularly those who reside in low-income communities across the country, using a weighted sample of 34,193 children. The stratified two-stage cluster sampling approach will be the sampling method used to ensure national representation across rural and urban areas (Lawal et al., 2023; NPC & ICF, 2019). Since the study is based on secondary data, there will be no direct recruitment of participants.

For data analysis, the study will employ multivariable logistic regression to assess associations between followup care, healthcare availability, and postdischarge mortality. Nonetheless, statistical controls for covariate variables such as mothers' highest level of education, household income (wealth index), geographical location, and mother's age will be applied to isolate the effects of the main variables and ensure accurate inferences in the study. Moreso, sampling weights will be used to adjust and control for selection probabilities and response rates, enhancing the generalizability of findings. After data collection and coding, Statistical Package for the Social Sciences software (SPSS) will be employed for statistical tests, including descriptive statistics for measures of central tendency and multivariable logistic regression to examine and investigate the association between the dependent variable, postdischarge mortality, and the independent variable, timely followup visits, and healthcare facility availability among children under 5 years old. Confounding variables such as the mother's age, household income, and the mother's education will be controlled to ensure accurate results. This approach, utilized in this study, allows for an objective and systematic assessment of relationships between variables, ensuring the findings are reliable, valid, and generalizable (Creswell & Creswell, 2018).

Definitions

Geographical Location: This refers to the setting of a household that is typically categorized as a place or an area that involves whether the child resides in an urban or rural community (Adeoti & Cavallaro, 2022). Rural children usually experience increased challenges and barriers that are related to healthcare access, including longer distances to

medical facilities, fewer healthcare providers, and limited transportation (Okoli et al., 2022). Children living more than 10 km from a healthcare facility have a 26.6% higher risk of postdischarge mortality compared to those living within 1 km (Karra et al., 2017).

Household Income: This is defined as the economic status of a child's family, categorized based on the DHS wealth index, which classifies households into Poorest, Poor, Middle, Rich, and Richest (NPC & ICF, 2019). In addition, household income can also be measured by calculating the total earnings of all members of a household over a specified period, such as monthly or annually income. According to Kwambai et al. (2023), children from the poorest households (Hhs) are twice as likely to die postdischarge compared to those from wealthier households.

Maternal Age: This is the age of the child's mother at the time of the child's birth, which can influence caregiving abilities, health-seeking behavior, the ability to manage followup care, and the overall and child health outcomes (Wiens et al., 202; Adeoti & Cavallaro, 2022; Finlay et al., 2011; Budu et al., 2021). It is operationalized as a continuous variable (in years) and categorized into groups (e.g., <20 years, 20–34 years, ≥35 years) for analysis.

Maternal Education: Maternal education is the highest level of formal schooling attained by the child's mother (Makinde et al., 2021).

Socioecological Model (SEM): The theory describes how different factors affect people's health and, for this study, children's health. It shows that health is influenced by many levels that examine how multiple levels of influence, like individual, interpersonal, organizational, community, and societal levels, interact to shape health outcomes and

behaviors (Bronfenbrenner, 1979; Golden & Earp, 2012; Mosley & Chen, 1984). This model emphasizes that health behaviors and risks are not solely determined by individual choices but are influenced by broader social, economic, and environmental factors (McLeroy et al., 1988). For example, in this study, SEM is used to examine how factors like maternal education, healthcare facility availability, household income, and community resources influence the likelihood of PPM among children under 5 years old in the country (Xiang et al., 2021).

Assumptions

I assumed all participants answered survey questions honestly and accurately. Next, I assumed secondary data sources had contain accurate and comprehensive information on PPM without inaccurate or incomplete data. Also, I assumed findings from the selected sample were generalizable to children under 5 in Nigeria, so study conclusions and recommendations can be applied to improve pediatric healthcare, reduce mortality rates, and pediatric care research. Lastly, I assumed followup care was provided within 7 and 14 days after discharge to aid the study evaluation.

Scope and Delimitations

The primary focus of this study is to investigate the factors contributing to PPM among children under 5 years old in Nigeria, and particularly exploring the association between timely individual followup visits, healthcare facility availability, and the likelihood of PPM when adjusting for socioeconomic factors like household income, mothers' age, geographical location, and mothers' education. The study was chosen due to the high prevalence of PPM (many children under 5 years old died after hospital

discharge) in poor-income areas, where followup care is often inadequate, leading to increased mortality risks. The delimitation that may restrict this study is that the study will not include children over 5 years old, as the focus is specifically on the most vulnerable age group for PPM. Children who have not been hospitalized and discharged will be excluded. Lastly, all participants in the survey must be from government-owned hospitals before being included in the study because DHS primarily captures data from public healthcare facilities and excludes those who received private-sector healthcare. Nonetheless, the study's large-scale DHS data increases its generalizability within Nigeria, particularly for public-sector healthcare users in rural and low-income communities.

Limitations

A possible limitation of the study may be the inability to include households with children treated and discharged from privately owned hospitals, those who did not seek formal medical care, or those who fell sick and died at home, as the likelihood of postdischarge death may be high in their region. Effectively focusing on public healthcare settings, which serve the majority of Nigeria's low-income population, may mitigate this limitation. Moreover, since the study will rely on secondary data and the data were not collected explicitly for this study, there may be measurement errors or inconsistencies in how variables such as followup visits and availability of healthcare facilities were recorded, which limits control over data collection methods, variable selection, and potential missing data. Using the most reliable and recent Nigeria Demographic and Health Survey (NDHS) 2018 and making sure that the data is cleaned

and validated will minimize errors and ensure trust, accuracy, and credibility of the information used

Significance of the Study

The likelihood of postdischarge pediatric mortality (PPM) among children under 5 years old has created a grave challenge for children who were discharged from the hospital due to severe illness. Roles of followup care practice, barriers to healthcare infrastructure, and community health interventions, including mothers' age, educational level, household income, and geographical location, sometimes contribute to postdischarge pediatric mortality (PPM). These factors sometimes promote adverse implications that may also create concern for society, Nigeria's public health organizations, pediatric care institutions, and practitioners. The findings from this study will be deemed important as it will explore the gap in the research related to timely individual followup visits, availability of healthcare infrastructure for followup care, and the likelihood of PPM among children under 5 years old, controlling for household income, geographical location, mothers' age, and mothers' education.

The findings will also provide vital insights to Nigerians as to the challenges children under 5 years old face during the critical period following hospital discharge due to diseases and propose strategies to improve survival rates (Wiens et al., 2023). Although there is significant research surrounding child mortality, most of it is primarily conducted on deaths of children that occur during hospital admissions. Although data show that the significant risk of mortality among children in resource-poor countries during the period following hospital discharge is often comparable to or exceeding in-

hospital mortality rates (Knappett et al., 2024; Nemetchek et al., 2018), the bulk of research is based on in-hospital deaths.

Implications for Positive Social Change

Social change occurs or happens when people's actions influence others to adopt new behaviors, attitudes, or perspectives, leading to a better environment or positive outcomes for society and community (O'Cass & Griffin, 2015). However, the knowledge gained from this study will also be pivotal in the quest to promote positive social change as it relates to children under 5 years old from low-income households in Nigeria who die as a result of inadequate postdischarge pediatric followup care. Positive social change will occur in this study as the provision of relevant data, interventions, and recommendations may provoke the Institute of Child Health, Ministry of Health (MoH), and National Primary Health Care Development Agency (NPHCDA), to advocate and develop new policies to help reduce the barriers to postdischarge pediatric care, so that child survival rates will increase in Nigeria and to lobby for healthcare professionals' training, especially for those who work with this population.

Furthermore, this study would promote significant change within the ranks, both upper and lower cadre, in the public health profession, which can also play a major role in proposing strategies to improve survival rates among this population. It will help uncover and provide an understanding of the factors and implications associated with it, like timely individual followup visits to require in-depth medical care to address chronic childhood disease management, by translating the information into action through home visits, like community interventions. Social change may also occur if the public health

leaders use the key information provided in this research for decision-making, inform healthcare providers about the importance of postdischarge followup care in reducing child mortality rates, and empower communities.

Summary

Postdischarge pediatric mortality (PPM) has been occurring in Nigeria for decades, but research has focused primarily on in-hospital deaths among children under 5 years old. However, the increased number of reports and findings being made from systematic reviews and meta-analyses of studies conducted in resource-poor countries is promoting awareness and bringing the prevalence of this often-neglected area of postdischarge pediatric healthcare (inadequate followup care) to the surface. It will also highlight the fact that inadequate healthcare infrastructure for followup care, mothers' age, educational level, household income, and geographical location may be associated with high after-hospital discharge deaths.

The goal of this quantitative cross-sectional study is to explore mortality (PPM) in Nigeria, focusing on children under 5 years of age. The findings from his study will also provide the Ministry of Health, Nigeria National Primary Health Care Development Agency, the Institute of Child Health, and other public health or governmental institutions a greater understanding of the approaches and interventions required for a sustained, comprehensive care that addresses the complex challenges faced by families in these communities to improve child survival rates posthospital discharge. In Chapter 1, PPM, the burden of child mortality and prevalence of child mortality occurring in-

hospital vs. postdischarge, the contributing risk factors, and the increased rate of underreporting among children under 5 years old in Nigeria.

The theoretical framework was also discussed to understand the factors influencing PPM. Also, the assumptions, scope, limitations, and delimitations of the study were also discussed. The significance of the study was formed to identify why there is so little research on PPM among children under 5. Chapter 2 will highlight the literature that identifies the reason for pediatric mortality following hospital discharge, especially in low-income regions like Nigeria, along with how the absence of proper care after hospital discharge, poor health facilities, and the absence of community health interventions postdischarge contribute to many children under 5 years old dying in Nigeria. The literature review will also provide an understanding into the key concepts related specifically to the likelihood of postdischarge mortality among children under 5 years who have died at home or outside the health facility (HF) due to the absence of proper care after hospital discharge, poor HFs, and the absence of community health interventions postdischarge, including the challenges faced by their families in these communities to improve child survival.

Chapter 2: Literature Review

Children under 5 remain at high risk of death both during and after hospital discharge, particularly in Nigeria and other LIMCs (Ekholuenetale et al., 2020). There is a gap related to PPM research among this population. Each day, 13,800 children under 5 died in 2021, with 5 million child deaths occurring in 2020, predominantly in low-income countries like Nigeria (WHO, 2023). Children who were discharged from hospitals in the poorest regions in Nigeria often became ill and died weeks and months later, mainly due to a lack of postdischarge care and treatment for conditions like malaria, anemia, diarrhea, HIV, and malnutrition, indicating a significant gap in pediatric healthcare. For this specific reason, there is a critical need to identify reason for other causes of pediatric mortality following hospital discharge, especially in low-income regions like Nigeria, along with how absence of proper care after hospital discharge, poor health facilities, and absence of community health interventions postdischarge contribute to many children under 5 dying in this country.

In addition, there is great concern regarding PPM in low-income countries, as it significantly contributes to child mortality, with 4.4% of children who are treated for general acute illnesses dying within 6 months postdischarge; half of these deaths occur within the first 30 days and the remainder within 90 days of discharge (Knappett et al., 2024; Madrid et al., 2019). It is imperative healthcare professionals, public health professionals, and providers understand the importance of improved followup care, educating mothers, and management strategies for children under 5, as well as the urgent need for targeted postdischarge care guidelines and discharge planning. The study

involved understanding factors contributing to postdischarge mortality among children under 5 in Nigeria, specifically investigating roles of followup care, healthcare infrastructure, and community health interventions, and propose strategies for improving survival rates of this population. Participants were between 0 and 5 years in Nigeria who faced the likelihood of PPM linked to conditions like household income, mothers' age, geographical location, and mothers' education. There was a clear gap in literature, as this topic remains largely understudied, particularly in terms of understanding survival challenges children face after leaving structured care of hospitals, where malaria, anemia, diarrhea, and malnutrition continue to pose significant risks.

This chapter begins with a discussion of the search strategy and literature review on the SEM, PPM, and healthcare access among children under 5 in Nigeria. This includes a brief background on Nigeria's healthcare system and the country's socioeconomic disparities. Issues caregivers face when seeking postdischarge care, including individual followup visits for their children, are discussed. Finally, factors that significantly influence patients' likelihood of dying at home after hospital discharge are addressed.

Literature Search Strategy

In this study, I used the following databases: the Walden University Library, Google Scholar, Thoreau Multi-Database Search, MEDLINE, EBSCOHost, Academic Search Complete, APA PsycArticles, APA PsycInfo, ProQuest, CINAHL Plus, SAGE Journals, Social Science Direct, Nursing and Allied Health, PUBMED, , ProQuest Central, SocINDEX with full text, and Dissertation and Theses Library. I used the

following key words: c*hild mortality*, *postdischarge*, *acute illnesses*, *socioeconomic disparities*, *healthcare*, *pediatric*, *mortality*, *children under 5 years*, *Nigeria and the Nigerian Demographic and Health Survey (DHS)*, *following discharge*, *after discharge*, *socioecological model*, *barriers to care*, *health-seeking behavior during postdischarge followup visits*, *pediatric mortality risk factors*, *healthcare infrastructure/resources*, *quality of life*, *survival rate*, *community health interventions*, *access to care*, and *geographical location.*

I searched for peer-reviewed articles and journals, periodicals, and reports that were published between 1979 and 2024...

Theoretical Framework

The theoretical framework for this study was the SEM. This was appropriate for this study in order to provide an understanding of how different environmental factors impact human development and wellbeing, especially for children.

The SEM is a model that emerged from Bronfenbrenner's ecology theory, which he introduced in the 1970s. It is used to guide and explain sociodemographic factors and health outcomes or behaviors as well as interpersonal, intrapersonal, and environmental factors. In this study, the SEM was used to explain associations between as timely individual followup visits, household income, mothers' age, mothers' education, availability of HFs for followup care, geographical location, and postdischarge mortality among children under 5 in Nigeria.

The SEM has been widely applied in research for evaluation of health outcome behaviors, risk factors, and complex health challenges. For instance, the SEM has been

used in research to explain the influence on behaviors such as tobacco control, smoking cessation, and exercise. It has also been used to explain community-based health interventions and promotion measures that impact child development.

In the context of this study, caregiving roles and socioeconomic challenges within households are key factors shaping decisions regarding postdischarge care for children under 5 years old. Support systems, including community-based groups or extended family networks, may facilitate or become a barrier to followup care plans among mothers and caregivers. Similarly, financial constraints and caregiving dynamics within families can affect a caregiver's ability to recognize and respond to danger signs in children. Such limitations could affect children's health and survival. SEM constructs, such as intrapersonal, interpersonal, and community factors, are represented in this study to evaluate their association with postdischarge pediatric mortality. In other words, individual caregiver characteristics, including knowledge, income, and education levels, are explained using intrapersonal constructs. Interpersonal constructs consists of caregiving roles, family support, and the influence of socioeconomic pressures on health-seeking behavior. At the community level, cultural norms and the accessibility of healthcare services will explain how external environments influence caregiver decisions and actions related to followup care visits.

Nigerian Healthcare System

Background

The Nigerian healthcare system is structured across three (3) levels of care: they include primary, secondary, and tertiary, with approximately 34,140 healthcare facilities

distributed among them, which collectively aim to serve the needs of the growing population, including children under five years of age. Each level of care has a distinct responsibility, which aligns with the different government levels (Federal, State, and Local). The Federal Ministry of Health oversees the entire healthcare infrastructure, while Local Government Areas (LGAs) play a role in delivering primary healthcare services (PHC), which is pivotal for followup care after pediatric discharge (Federal Ministry of Health, 2024).

Primary healthcare is managed at the granular level, with approximately 29,854 facilities under LGAs. These healthcare facilities focus on providing grassroots and granular health services through dispensaries, health posts, and clinics. These facilities provide services such as followup visits and routine immunizations, which are critical for reducing postdischarge mortality among children under 5 years old. However, barriers such as insufficient healthcare facilities, limited accessibility in low-income areas, and a shortage of healthcare providers hinder timely followup care (Oladimeji et al., 2022). Timely postdischarge visits are paramount for disease identification and detection of complications early and preventing mortality, making the accessibility and availability of primary healthcare services particularly significant for children recently discharged from hospitals (Abubakar et al., 2021).

At the tertiary level, which falls under the federal government, there are about 47 facilities, primarily teaching hospitals and federal medical centers. These institutions provide specialized healthcare services, and the federal government formulates health policies, guidelines, and strategic plans for the overall healthcare system, including

immunization programs. The federal government also supports state and local governments in providing health services (WHO, 2024). Nigeria is divided into six geopolitical zones: Northwest, North-East, North-Central, South-West, South-East, and South-South. It comprises 36 states, a Federal Capital Territory (FCT), and 774 LGAs. Also, the diversity in geographical, cultural, and socio-political aspects of these zones significantly influences the availability and access to healthcare services, with notable disparities observed in healthcare facility distribution and quality throughout the country (Abubakar et al., 2021).

Challenges

Across the country, the healthcare infrastructure or system faces major challenges, that include outdated equipment, insufficient funding, and inadequate facilities, especially in low-income areas where timely followup visits remain inadequate. While tertiary hospitals, which are usually called the general hospitals or teaching hospitals, are relatively few, most healthcare facilities are primary care centers managed at the local government level, often facing resource constraints (Oladimeji et al., 2022). Also, this infrastructure unavailability and gap in a broader range contribute to uneven access to healthcare across different regions, with rural communities and their populations being particularly underserved (Afolabi & Oke, 2023). In addition, secondary data from the Demographic Health Survey (DHS) shows that household income and the geographical distribution of healthcare services are critical factors affecting access to followup care. This means that children living in low-income households are less likely to receive timely

followup visits after hospital discharge, which is associated with a higher risk of mortality (Afolabi & Oke, 2023).

Furthermore, Nigeria has a high burden of infectious diseases, including measles, cholera, and yellow fever. In the country, heavy disease burdens like the measles, yellow fever, polio, and cholera outbreaks among children under 5 years old are particularly prevalent during the dry season (February to April), with the country reporting about 19,470 suspected cases and 11,433 confirmed cases in early 2024 (WHO, 2024). The prevalence of these diseases highlights weakness in the routine immunization systems and a lack of public health awareness about the dangers and spread of this infectious disease, and resources to combat outbreaks effectively (Abubakar et al., 2021). Nigeria's healthcare workforce is another critical challenge. The Nigerian healthcare sector suffers due to a small number of trained healthcare professionals and practitioners working, leading to a heavy workload for existing staff, decreased quality of care provided, and a high burnout rate.

Additionally, this shortage directly impacts caregivers' ability to attend followup appointments or visits and adhere to treatment plans for their children. Additionally, household factors such as caregivers' education level attainment and age influence adherence to treatment and access to healthcare services (Oladimeji et al., 2022). Similarly, Abubakar et al. (2021) noted that mothers and caregivers with higher educational levels attained are more likely to seek timely followup care and follow strictly to prescribed treatment regimens, which decreases the likelihood of PPM. Nigeria's healthcare system faces significant challenges that affect PPM, particularly

among children under 5 years of age. Nonetheless, the major challenges include timely postdischarge visits, the availability of healthcare facilities for followup care, and socioeconomic factors like household income and caregivers' education levels (Wiens et al., 2021; Nemetchek et al., 2018; Ojewumi, 2023).

Literature Review Related to Key Variables and Concepts

Defining PPM

PPM and child mortality may be used interchangeably; however, the actions associated and related with both terms are the same for children under 5 years old, which is the focus of this research. PPM refers to the deaths of children that occur after they have been discharged from a hospital following an acute illness (Chaudhry et al., 2023); it also includes deaths that occur at home or on the way to the hospital as an additional concern.

According to Wiens et al. (2023) and Diallo et al. (2021), PPM refers to a period that encompasses a timeframe where approximately half of all deaths among children under 5 years old admitted to health facilities in low- and middle-income countries (LMICs) happen within 6 months of discharge. During this critical yet neglected period, the risk of mortality can be as high as during the initial admission, especially in resource-poor countries due to numerous risk factors that include severe anemia, severe malnutrition, malaria, HIV seropositivity, risky home environments, poor health-seeking behaviors, weak health systems, and early discharge from hospital following treatment (Knappett et al., 2024; Chaudhry et al., 2023; Kwambai et al., 2023). Moreover, PPM constantly impacts and burdens Nigeria's public health system, ranging from 5.4% to

18%, with the highest risks observed in children who were hospitalized for severe conditions such as severe acute malnutrition (SAM) and severe anemia (Kwambai et al., 2023). Also, almost half of the mortality among acutely ill young children in sub-Saharan Africa and South Asia occurs postdischarge, with 48% of deaths happening within 180 days after discharge from the hospital (Diallo et al., 2021). For example, in Mozambique, where more than 80% of postdischarge deaths in children were reported to have occurred outside the hospital, and in another study among children admitted with infectious conditions in Uganda, where 67% of postdischarge deaths occurred in the community - these numbers are very high, which means that many children are not getting the help they need after they leave the hospital (Kwambai et al., 2023). The researchers in this study suggests that there might be problems with how children are cared for after they go home (Kwambai et al., 2023) because when children are discharged from the hospital, it is important that they continue to get good care. This might mean having followup visits with doctors, getting the right medicines, or having someone check on them regularly will reduce PPM. Most research conducted on after-hospital discharge deaths of children under 5 years of age found that out of 1,242 children discharged from the hospital, 61 died within six months, with 66% of these deaths occurring outside of a hospital setting (English et al., 2016), while more than 80% of postdischarge deaths in children have occurred outside the hospital, and notably 67% of postdischarge deaths occurred in the community.

Even though the MoH, health organizations, and agencies are making continuous and constant efforts to increase preventive measures to address PPM, underreporting and

prevalence continue, especially among children under five years old in poor-income countries, highlighting a major oversight in global health efforts aimed at reducing child mortality (Chaudhry et al., 2023). Albeit most research conducted on pediatric mortality essentially focuses on the high rates of in-hospital child mortality, even though more children die at home or in the community following hospital discharge (Knappett et al., 2024). However, it may seem that children are more likely to die in the hospital from these illnesses, there is a greater population of children who die at home after hospital discharge (Knappett et al., 2024), who may not report or be documented due to the lack of timely followup visits and medical attention following discharge. In other words, the prevalence of postdischarge pediatric mortality in poor-income countries is greatly underreported, and altogether, children dying after hospital discharge is considered one of the most underreported deaths, with children under 5 years old being at a particularly higher rate (Knappett et al., 2024).

PPM Among Children Under 5

PPM is a global challenge that constantly and continues to permeate throughout poor-income countries, particularly in Nigeria, where it contributes substantially to deaths among under 5-year-old children (Chaudhry et al., 2023). Moreover, Diallo et al. (2021) and Nemetchek et al. (2018) deduced that PPM is still widely underreported, with postdischarge deaths highest within the first month after discharge and the majority from preventable complications. In other words, nearly 30% of pediatric deaths occurred within the first 28 days after discharge (Diallo et al., 2021). Rus and Cruz (2019) conducted a study and found that 3.6% of children died within the first 90 days after

being discharged from the hospital. Also, half of the postdischarge deaths happened within 30 days, and over 80% of these deaths occurred without families seeking further medical help in this rural area (Rus & Cruz, 2019). This low reporting rate related to postdischarge deaths can be attributed or linked to the lack of documentation, followup visits, and data on children's deaths, as many of these deaths occur at home without any official records. Also, studies have found that common causes of postdischarge mortality among children under 5 years old are untreated infections, pneumonia, and malnutrition, with children from low-income households facing a higher number of deaths due to delayed or missed followup care. (Wiens et al. 2016; Yaya et al.,2017). According to Knappett et al. (2024), a recent systematic review and meta-analysis of twenty four (24) studies found that approximately one in 20 children under 5 with general acute illness risk dying within weeks and six months after leaving the hospital, and this proportion rises to one in 10 for children admitted with severe anemia, severe malnutrition, or HIV. Approximately half of all deaths among children under 5 years old admitted to hospitals in low-income countries and rural areas occur within 6 months of discharge. In fact, that half of these postdischarge deaths occur at home is of additional concern. More research findings indicate that children who are discharged from the hospital remain highly vulnerable in the immediate postdischarge period (Akech et al., 2023). The reasons for this vulnerability are undeniably difficult and they could be linked to multiple interacting factors such as risky home environments, premature discharge, residual underlying conditions, poor health-seeking behaviors, weak health systems, poor household income, and poor socioeconomic conditions faced by parents of these children (Akech et al.,

2023). The increase in the prevalence of PPM also harbors the increase of severe malaria, diarrhea, and a need for more care and followup for children under 5 years old once they go home.

Furthermore, these health conditions may be associated with a markedly increased mortality risk after hospital discharge. Also, Kwambai et al. (2023) suggested the overall 6-month PPM rate for children under 5 years of age in western Kenya was 6.2%, with significantly higher rates seen in children with severe anemia (15.5%) and, severe acute malnutrition (21.6%). Similarly, the researchers deduced that the risk of dying within 6 months after discharge was significantly higher for children with severe anemia (hazard ratio [HR] = 2.55) and severe acute malnutrition (HR = 3.95) compared to those without these conditions, while children with severe malaria had a lower risk of mortality (HR = 0.33) than those without severe malaria, suggesting a complex relationship between these health conditions and postdischarge outcomes (Kwambai et al., 2023).

Timely Followup Visits

Timely followup visits to provide care to children under 5 years old who were initially hospitalized are a largely overlooked, less researched, and understudied component of healthcare. As such, children who missed follow-ups were significantly more likely to experience a greater risk of complications leading to death (Kwambai et al., 2023). In addition, adherence to followup schedules is a critical factor in reducing mortality among children under 5 with severe illnesses, such as pneumonia or malnutrition (Kwambai et al., 2023). For example, Ashraf et al. (2014) conducted a study on the importance of followup visits after hospital discharge and observed that common

morbidities during the followup included cough (28%), fever (20%), and rapid breathing (13%), showing that 4.4% of the children required re-hospitalization and 1.6% had died, emphasizing the importance of followup visits for early detection and treatment of medical issues to reduce postdischarge pediatric mortality risk among children under 5 years old (Ashraf et al., 2014). However, in Nigeria, a developing country, there is the ideology that children cannot become sick or die after they leave the hospital because it is believed they are in the recovery process. As a result, few caregivers of children under 5 years old return for postdischarge care, creating a barrier to reporting the deaths of the child that happened at home, especially in poor-income households in rural areas of the country (Nemetchek et al., 2018).

The early detection and management of complications from individual timely followupvisits may result in reduced PPM among children under 5 years old. Wiens et al. (2016) conducted a study related to PPM in poor-income countries in sub-Saharan Africa and found that scheduled followup visits and simple prevention kits, including counseling among children under 5 years old, improved postdischarge outcomes, with 85% of children completing at least one followup visit and a reduction in mortality rates to 2.5% within 60 days postdischarge. Likewise, recent studies conducted deduced that children receiving followup care and visits within the first two (2) weeks of discharge were significantly less likely to die than those without followup (Wiens et al., 2021). Moreover, these visits allow healthcare providers to monitor the child's recovery, manage complications, provide preventive care, and reduce postdischarge pediatric mortality in the community. Nonetheless, if caregivers can recognize the signs and symptoms of the

diseases early or if there is an improved way or modality of reaching care, timely and proactive health-seeking behavior would improve among these caregivers. Therefore, together with timely followup visits, adherence to these visits leads to improved health outcomes and increased childhood survival, particularly in rural and underserved communities in Nigeria (English et al., 2016; Kwambai et al., 2023).

Availability of Healthcare Facilities for Followup Care

Postdischarge pediatric mortality (PPM) is likely to reduce among children under 5 years old in a community when there are established quality and resource-filled healthcare centers for followup care. Parents of children under 5 years old discharged from the hospital following an acute illness will still have their children alive if quality healthcare facilities are available for followup care, alongside addressing socioeconomic gaps and geographic inequalities (Adeoti & Cavallaro, 2022). It can be highly challenging for mothers with children in Nigeria when they are unable to access healthcare facilities for followup visits because they are inadequate and are not within 5 km from their home, especially when they live in rural areas and have low household income (Fagbamigbe & Nnanatu, 2022). For instance, Getzzg (2022) stated that in Bangladesh, a country in South Asia, increased availability and readiness of healthcare facilities were linked to a 15%-24% reduction in neonatal and infant mortality, suggesting similar potential benefits in Nigeria. As such, an inadequate number of healthcare facilities or hospitals situated within a 5 km radius of the caregiver's and mother's house can be described as systematic barriers that contribute and increase to high under-five mortality rates in Nigeria, with geographical location playing a critical

role in determining access to care. Therefore, the density of healthcare resources, such as physicians and health centers, has been shown to have negative spatial spillover effects on PPM among children under 5 years old, showing that improved and adequate healthcare infrastructure can benefit not only local but also neighboring regions surrounding Nigeria (Zeng & Niu, 2023).

Health-Seeking Barriers Associated with Children Under 5 Seeking Postdischarge Care

Transportation and Economic Barriers

Research studies have found that limited transportation options and high costs hinder caregivers' ability to access followup care for children under 5 years old before they die (Nemetchek et al., 2018). However, seeking timely care for persistent illnesses among children under 5 years old after hospital discharge may be a difficult feat for the caregivers due to the barriers they face in arriving at the healthcare facilities for treatment, especially if they live in rural areas. The mothers face transportation barriers, usually from financial constraints or hardship, and limited transportation options that often limit the caregiver's access to timely medical interventions (English et al., 2016; Nemetchek et al., 2018).

The financial hardship faced by the mothers whose children died after discharge is reported to be barriers that impede seeking care before their child's death, including limited access to health facilities and services, poor health-seeking behavior, and difficulty recognizing symptoms (Nemetchek et al., 2018). The researchers deduced that the caregivers complained that limited transportation and poverty delayed care seeking

for their children before they died (Nemetchek et al., 2018). Another barrier that may impede mothers of children who died after discharge decision to refrain from seeking help is that they perceive their children as recovering despite signs of ongoing illness (Wiens et al., 2021). Given such, strategies and creative methods, such as proper coordination between community and healthcare facilities, must be created to enhance postdischarge support to address the critical period following hospital discharge, to improve care for diseases like malaria, pneumonia, and malnutrition, where postdischarge support can be crucial for long-term health outcomes.

Health-Seeking Barrier

While trying to secure care for their vulnerable children, especially children under 5 years old, mothers frequently face challenges at multiple levels, such as individual, household, and facility (Wiens et al., 2021). Nonetheless, seeking care for a recurring illness is often hindered by financial barriers and complicated pathways to care due to poor coordination between the community and health facilities. Fagbamigbe and Nnanatu (2022) presented their study findings that explain a constant systemic health-seeking behavior barrier, such as inadequate access to healthcare facilities, contributes to high under-five mortality rates in Nigeria, with geographical location critical in determining access to care. In fact, recent research has indicated that parents of children under 5 years old residing in rural and underserved communities significantly plays a role in determining access to care, further worsening the delays in health-seeking behavior among caregivers, who often face challenges in recognizing the urgency of their children's symptoms and navigating the barriers to timely medical intervention

(Ojewumi, 2023). More so, studies conducted by Adeoti and Cavallaro (2022) found that a significant proportion of caregivers in Nigeria did not seek appropriate care for childhood illnesses, with at least 25% not seeking any care for children with fever or acute respiratory infection (ARI), and over one-third not seeking care for diarrhea. Only 15% of caregivers sought appropriate care for fever, 13% for ARI, and 27% for diarrhea from formal health providers (Adeoti & Cavallaro, 2022).

Socioeconomic Challenges

The risk of postdischarge pediatric mortality in children under five has been shown to increase due to socioeconomic challenges and difficult living conditions that the families of these children face (English et al., 2016). These poor socioeconomic conditions are a significant factor that contributes to PPM in a poor-income country like Nigeria. For example, maternal education, poor sanitation, inadequate birth spacing, and living in a rural area were directly associated with a higher likelihood of postdischarge mortality among children under 5 years old in these poor-income countries (English et al., 2016). Also, children in families with middle, richer, and richest economic statuses have 11.1%, 37.5%, and 49%, respectively, lower childhood mortality compared to the poorest families (Yaya et al., 2017). Similarly, fathers in the middle to richer to richest economic brackets see reductions in childhood mortality rates by 3.3%, 20.2%, and 28.7%, respectively (Yaya et al., 2017). Moreover, other socioeconomic risk factors cause children under 5 years old to die after hospital discharge. The risk factors include limited awareness of risks during the postdischarge period because of low maternal education and challenging environmental conditions, as they place children and families

at a further disadvantage (Nemetchek et al., 2018; English et al., 2016). Kwambai et al. (2023) conducted a retrospective cohort study about the postdischarge risk of mortality in children under 5 years of age living in western Kenya and found that in the poorest group (called the poorest tercile), the mortality rate was 10.1%. While the population present in the wealthiest group (called the highest tercile), the death rate was 5.4%, showing a clear trend: richer families had healthier children under 5 years old who survived more often (Kwambai et al., 2023). In other words, the study found that as SES increased, the death rate decreased notably in the population sampled during the study. This finding means that children from wealthier families had a lower chance of dying after leaving the hospital. Nonetheless, often, children born to poor mothers in rural areas are delivered at home, leading to an increase in PPM among children under 5 years old (Okoli et al., 2022). However, children from low socioeconomic backgrounds, like poor-income households, are often served by under-resourced health sectors that cannot manage high patient volumes and illness, making returning to the hospital after discharge nearly impossible for mothers of children who had died at home.

Mother's Age

Mothers' age may be associated with caregiving abilities, health-seeking behavior, and the ability to manage followup care among children under 5 to reduce PPM. Younger mothers may lack experience or resources, while older mothers might face health-related caregiving challenges related to controlling PPM. Some factors, such as younger maternal age at first birth, a higher rate of home births, childbirth complications, and lower use of modern healthcare facilities compared to the southern regions of Nigeria, are

associated with postdischarge deaths (Okoli et al., 2022). Around the Northern regions of Nigeria, there is this ideology that the age for marriage is 13 years and above, leading to a high rate of PPM, as these young mothers do not perceive the need to return or go back to the hospital for followup care due to their young age. For example, PPM was found to increase with each additional year in the age of both fathers and mothers (Yaya et al., 2017). However, the opposite was true for the mother's age at first birth: older age at first birth was associated with lower childhood mortality, and this link was statistically significant (Yaya et al., 2017). Studies by Knappett et al. (2024) and Ojewumi (2023) indicate that the variable mothers' age is paramount in health-seeking behavior, with adolescent mothers facing often greater socioeconomic problems, usually due to their young age following their first childbirth. Nonetheless, younger mothers, usually below 20 years old, are less likely to adopt, utilize, or adhere to followup schedules. Mothers' age is likely to interact with other factors like education and income to shape caregiving decisions about timely followup care to reduce PPM among children under 5 years old (Diallo et al., 2021).

Mother's Education

The education level of caregivers significantly influences health-seeking behavior and timely followup care for children after they are discharged from the health facility, including reducing the risk of PPM. Recent studies indicate that mothers with secondary or higher education were more likely to recognize childhood illnesses and their symptoms, seek timely care for their children, and positively influence adherence to medical recommendations like followup care. (Fagbamigbe & Nnanatu, 2022;). This

timely individual followup visit often keeps the children alive and protects them from acute illness postdischarge until adulthood. More so, to mitigate the risk of PPM among children under 5 years of age, maternal education is a stronger predictor of survival than household income, particularly in some resource-constrained countries such as Nigeria (Adeoti & Cavallaro, 2022).

Furthermore, children whose mothers had secondary education had a lower likelihood of PPM (5.3%) than those whose mothers had only lower primary education (Kwambai et al., 2023). Also, this study suggests that more educated mothers may have better knowledge or resources to care for their children, especially in the context of PPM research among children under 5 years old. Many studies have often shown that a mother's education is a major factor in explaining the risk of PPM among children under 5years old in Nigeria (Yaya et al., 2027). Similarly, findings by Yaya et al. (2027) show that children of mothers with complete academic attainments, such as primary, secondary, or tertiary educational levels, have a 26.7%, 39.7%, and 45.9% lower odds or risk of dying, respectively, than children of mothers without formal education. Studies revealed that educated mothers are better equipped to learn healthy safe practices, improve feeding and childcare habits, and recognize health issues and challenges on time so that they seek for help for their children. Moreso, this study further confirms that education plays an important role to strengthen a mother's position in the family, helping her make quick, effective health decisions and use modern healthcare services more efficiently (Yaya et al., 2027). For example, in Nigeria, it is a common belief that mothers in northern Nigeria have a higher proportion of no education or primary

education due to early marriage (before age 16 years), even though mothers' education has a relatively higher impact on child mortality than fathers' education and many other socioeconomic factors (Okoli et al., 2022), causing higher PPM among children in Nigeria. However, a recent study by Kwambai et al. (2023) revealed that lower maternal education is related to increased PPM. In other words, when mothers have little or no education, their children are more likely to die after hospital discharge. Therefore, an intervention that includes maternal/caregiver education at discharge on identifying the danger signs and seeking prompt care may help reduce the burden (Kwambai et al., 2023).

Geographical Location

Often, children born to poor mothers in rural areas are delivered at home. These deaths are not surprising, as modern healthcare, healthcare resources, and infrastructure are not as easily available in rural areas as in urban areas. Hence, urban areas are reported to have lower under-5 mortality rates than rural areas (Okoli et al., 2022). For example, mothers and fathers in rural areas experience a higher rate of childhood mortality of 28.3% and 33.5% higher, respectively, than those in urban areas. This difference may be because urban areas generally have better access to employment opportunities, healthcare, and education, which helps reduce childhood deaths (Yaya et al., 2017). Additionally, Okoli et al. (2022) conducted a study where they found that among Nigeria's six (6) geopolitical zones, children in the northern zones, particularly the North West, North East, and North Central, face the highest risk of death before age 5 due to lack offollowup care after hospital discharge. In Nigeria, about 61.4% of deaths among

children less than 5 years old happen in rural areas, with the remaining 38.6% occurring in urban arears (Okoli et al., 2022). Across the country's six geopolitical zones, 68.3% of these deaths are concentrated in the three northern zones: North West (36.5%), North East (18.3%), and North Central (13.5%) (Okoli et al., 2022). In contrast, only 31.7% occur in the southern zones (Okoli et al., 2022). Overall, the majority of U5M cases, about 73.5%, are among families and mothers living in rural regions in the country.

Recent studies indicated that there is a relationship between the proximity of a child's home from the district hospital and postdischarge survival, with a three-fold higher chance of dying amongst children who lived at least 3 times away compared to those in the immediate locality of the district hospital (Mukasa et al., 2021). Many studies have reported the importance of child survival by living close to healthcare facilities for children's health after hospital discharge. However, Mukasa et al. (2021) suggested that improving access to healthcare for those living far away could help reduce the risk of death after discharge among children under 5 years old. According to Egbon et al. (2022), PPM among under 5 risk is particularly severe in specific states in Nigeria, such as Kebbi, Kaduna, and Jigawa, and emphasized the need for targeted interventions for followup visits, especially during the first two months after childbirth, to improve child survival rates. Likewise, the distance to healthcare facilities is a critical factor, as children living farther from these facilities have higher odds of mortality (Karra et al., 2017). For instance, children living more than 10 km away from a healthcare facility have a 26.6% higher risk of PPM compared to those living within 1 km (Karra et al., 2017). The study found that children living farther from health facilities have significantly higher odds of

PPM, especially for children living within 2 km, 3 km, and 5 km of a health facility have 7.7%, 16.3%, and 25% higher odds of neonatal mortality, respectively, compared to those living within 1 km (Karra et al., 2017). Moreover, children living more than 10 km from a facility have 26.6% higher odds of PPM. Even small increases in distance to health facilities are associated with substantial declines in health service utilization and increases in PPM, highlighting the importance of improving access to healthcare services by making healthcare facility in closer locations to mothers and their children (Karra et al., 2017).

The likelihood of PPM among children under 5 years old was found to decline by 15% for every unit increase in the score or number of the basic management and administrative system of the mothers' or caregivers' homes nearest healthcare facility where child health care services are readily available for followup care (Getzzg, 2022). Similarly, the degree of readiness and availability of the mothers' or caregivers' homes nearest primary health care (PHC) to provide child health care services was linked with an 18%-24% reduction in pediatric mortality (Getzzg, 2022). On the other hand, for every kilometer increase in distance between mothers' homes and the nearest PHC was found to be associated with a 15%-20% increase in the likelihood of PPM among children under 5 years old (Getzzg, 2022). Nonetheless, the location of health facilities providing postdischarge care services close to mothers' homes will play a major role in reducing the likelihood of PPM among children under 5 years old in Nigeria. Therefore, public health programs, guidelines, and policies should be taken to increase the accessibility and

availability of health facilities that provide individual followup care services close to mothers' residences, especially in rural areas (Getzzg, 2022; Egbon et al., 2022).

Community Intervention

Most PPM is known to occur primarily at home, especially in rural areas that have limited healthcare centers, and families of these children are usually under-resourced to pay for transportation to get postdischarge care. Previous research has shown that a large proportion of child deaths occur or happen outside of health facilities (Wiens et al., 2016). The researchers found that 4 out of 5 children who died after discharge were outside of the health system, reflecting similar findings during the observational study (Wiens et al., 2016). Critical to addressing postdischarge care, therefore, is improved community-level care during the vulnerable postdischarge period (Wiens et al., 2016), which is an important focus of my dissertation. For high-risk children under 5 years old, assigning a community health worker, training families to spot danger signs, maintaining contact with health professionals, and easing emergency room access without extra costs can reduce postdischarge deaths at home and increase reporting of PPM in most poor income countries such as Nigeria (Diallo et al., 2021). Also, since most PPM happen at home rather than through readmissions, enhancing illness recognition and encouraging prompt health-seeking behavior within the community must become essential components of any broad strategy aimed to improve outcomes and child survival, including community followup among children under 5 years old who are at most risk, to increase the likelihood of having an important impact (Knappett et al., 2024).

Strategies for Improving the Survival Rates

The significant issue of PPM in children under 5 years old living in low- and middle-income countries (LMICs) is that many child deaths occur after hospital discharge, which is often overlooked in healthcare strategies (Akech et al., 2023). Most research has suggested a myriad of strategies for improving the survival rates of children under 5 years old related to PPM. One strategy that can improve delayed health-seeking behavior among mothers is by educating them about the disease's early warning signs or by establishing routine postdischarge care and utilizing available outpatient health resources or health infrastructure like postdischarge followup visits at nearby health centers (English et al., 2016). Nemetchek et al. (2018) suggested developing strong prediction models for designing interventions to improve postdischarge outcomes among children under 5 years old, such as education and routine postdischarge followup care visits that could significantly improve pediatric health-seeking behavior and health outcomes after discharge. Since most researchers found that lower maternal education is associated with increased postdischarge mortality, this means that when mothers have less education, their children are more likely to die after leaving the hospital. Therefore, an intervention that includes maternal or caregiver education at discharge on identifying the danger signs and seeking prompt care may help reduce the PPM burden (Kwambai et al., 2023).

In addition, the risk of PPM is the highest among people with low incomes and in poor-income countries. Okoli et al. (2022) suggested that interventions targeted at low-income people are important to close the gap. The researchers found out in their study

that increased formal education, particularly in northern Nigeria, is paramount for PPM reduction among children under 5 in the country, given that education is a fundamental and important factor to consider in terms of child survival, irrespective of region and geographical location (Okoli et al., 2022). Moreso, since that majority of deaths occur within four (4) to eight (8) weeks following discharge, approaches to improve outcomes must incorporate not merely discharge care but also changes to how children are managed and monitored during this extended period of risk in their community or households (Knappett et al., 2024). Most importantly, efforts to reduce out-of-hospital deaths must empower caregivers, typically mothers, to navigate the health system effectively, specifically targeting maternal well-being, agency, and financial independence (Wiens et al., 2021; Diallo et al., 2021) while also ensuring the health system becomes more responsive to the needs of the families it serves specifically those from rural and underserved areas. Therefore, these targeted interventions, strategies, and followup care are paramount in reducing postdischarge pediatric mortality (PPM) among children under 5 years old in such regions. Most importantly, Akech et al. (2023) advocated for improved healthcare systems that ensure continuous support for children after they leave the hospital and followup visits to reduce PPM, increase survival among children under 5 years old, and ensure every child is given the care he/she need.

Many studies have already shown that timely followup visits (making sure kids see a doctor or nurse after leaving the hospital), availability of healthcare facilities facilities (having enough hospitals or clinics nearby for families to go to), and socioeconomic challenges (problems like poverty, lack of education, or living in rural

communities where healthcare services are difficult to access), can lead to PPM(Chaudhry et al., 2023; Knappett et al., 2024). Nonetheless, knowing these factors are important, there is still a big problem. There is insufficient detailed, nationwide data that looks at how all these factors contribute to PPM in Nigeria. Most studies are either small or focus on just one specific area, so there is no complete picture of how these issues affect children nationwide. In other words, these factors matter, but how these factors interact with each other in Nigeria, especially when looking at the whole country, cannot yet be fully understood. However, this study attempts to address this gap using a large national dataset known as the 2018 NDHS to provide the reader a clearer understanding of how these factors work together to affect child survival after hospital discharge.

In addition, by addressing these gaps, this study contributes to the existing body of knowledge in numerous ways. First, it makes available to the field of public health a national-level analysis of PPM in Nigeria, offering insights into regional and socioeconomic disparities that have not been fully explored in previous research. Secondly, this study examines the interaction, relationship and association between socioeconomic factors and the availability of healthcare infrastructure, providing more insights into how these variables work together to influence child survival after hospital discharge. Finally, this study proposes evidence-based strategies for improving postdischarge care and reducing mortality among children under 5 years old, particularly in underserved and rural areas.

Summary

The public concern of PPM is nothing new, nor is the heightened risk faced by children under 5 years old a new trend within low-income countries like Nigeria. Yet, the occurrence of children dying after hospital discharge remains a regrettably understudied phenomenon. A large proportion of children have been dying at home or outside the hospital for a few weeks or months after hospital discharge for many years, especially in resource-poor countries, but the prevalence of high rates of in-hospital pediatric mortality due to conditions like anemia, malaria, HIV, diarrhea, and malnutrition has always been highlighted. Also, there are systemic and structural issues and challenges, such as inadequate healthcare infrastructure, absence of timely followup visits, and limited community health interventions, that increase PPM. However, these factors contribute to the challenge of reducing pediatric mortality rates, particularly in rural areas where geographic, economic, and social barriers often constrain or limit access to followup care and visits. Nevertheless, the disparity in access to care between urban, semi-urban, and rural areas, compounded by insufficient maternal education, poor household income, young mothers, and limited healthcare resources, further causes the inequities children and their families face in these poor-income countries and underserved regions.

However, the lack of sufficient postdischarge care and followup systems in public health in the country creates barriers that prevent treatment of disease complications and timely identification. Caregivers and mothers of these children, often constrained by limited or no education, poor household income, poverty, and young age at childbirth, are unable to recognize early warning signs or seek care promptly, resulting in preventable

deaths among children under 5 years old. Despite global health efforts to reduce child mortality, the gap in addressing postdischarge pediatric deaths highlights a significant oversight in healthcare policy and practice.

Therefore, examining the factors contributing to PPM among children under 5 years old in Nigeria will help to showcase the systemic, interpersonal, and individual challenges that families face. This study proposes strategies for creating a sustainable and effective healthcare system that addresses these barriers, ensuring children's survival beyond hospital discharge.

In Chapter 3, the methods and methodology used to examine the factors contributing to PPM among children under 5 years old, along with the data analysis, findings, and recommendations, will be discussed. There will also be an explanation about how quantitative methods will be applied to address the research problem, and how the study's design fills the identified gap in the literature. Issues related to validity, reliability, and trustworthiness will also be addressed.

Chapter 3: Research Method

Underreporting of PPM among children under 5 and understanding factors that contribute to children dying following hospital discharge is of primary importance, but little research has been devoted to understanding this topic among children under 5. Most research on pediatric mortality has been primarily focused on high rates of in-hospital child mortality due to malaria, anemia, malnutrition, poor parental education, low social class and lack of skilled jobs among parents, high patronage of chemists and prayer houses, and poor recognition of pallor or paleness among mothers.

In this quantitative case study, the 2018 NDHS was used to examine associations between timely individual followup visits, availability of healthcare facilities for followup care, and likelihood of postdischarge mortality among children under 5 in Nigeria. The NDHS is a national survey that is conducted every 5 years using a globally-validated and locally-adapted methodology, and the Nigerian National Population Commission implements the survey in collaboration with the ICF and other development partners. These surveys are carried out to provide up-to-date and nationally representative essential health and demographic indicator estimates for the country. The NDHS 2018 is the sixth edition in the series, and it used a sampling frame from the 2006 census. There is a need to carry out another census since the last sampling was conducted 19 years earlier.

The goal of this cross-sectional study is to address the relationship between timely followup visits after hospital discharge, availability of healthcare facilities for followup care, and possibility of still dying after every individual visit. This chapter

includes information about the quantitative case study approach that was used to gain insights regarding this topic. The research design and rationale, approach to answer research questions, study population, sampling and sampling procedures, recruitment of participants, participation in the study, data analysis, data collection, instrumentation, operationalization of concepts, threats to validity, and ethical procedures are also described.

Research Design and Rationale

A quantitative cross-sectional study design with secondary data from the 2018 NDHS was conducted to explore associations between timely individual followup visits, availability of healthcare facilities, and likelihood of postdischarge mortality among children under five with the following covariates: household income, geographical location, mothers' age, and mothers' education. According to Szklo and Nieto (2019), a cross-sectional study is a type of observational study that involves measuring exposure and outcomes of interest in populations at a single point or over a short period of time and helps describe prevalence and distribution of health conditions, behaviors, and risk factors in populations, as well as associations between them. A quantitative approach was ideal for understanding and exploring the topic under study.

Quantitative study involves objective measurement of associations between specific variables and outcomes. This ensures minimizing bias, improving reliability and validity of results, and analysis of large sample sizes, providing statistical power that is needed to generalize findings to broader populations. I used the cross-sectional design as it was ideal given time and resource constraints. I collected data at a single point in time,

reducing duration and costs associated with longitudinal studies, especially in resource-limited countries like Nigeria.

Methodology

Population

The target population for this study was children under 5 (0 to 59 months) born to women between 15 and 49 in Nigeria, particularly from low-income areas. A total weighted sample of 33,924 children was included in analyses. Initially, there were records for 33,924 children. However, to avoid duplication and ensure independence of observations for this study, the analytic sample was limited to the most recent births per woman using the birth index variable (MIDX = 1), resulting in a final weighted sample of 21,671 children. This specific age group was selected because they are at risk of PPM due to inadequate followup care, poor healthcare infrastructure, and socioeconomic disparities. 2018 NDHS data, being the latest in Nigeria, were used to explain underlying factors associated with PPM. 21,671 children under 5 were added during study analysis, leading to a representative sample of the broader national population. In this study, data were collected between August and December 2018 from 40,427 households nationally, and this group represents millions of children, given Nigeria's high birth rate and significant U5 population size.

Sampling and Sampling Procedures

Using the 2018 NDHS, I applied a stratified two stage cluster sampling technique. This approach ensures the sample is a representative of the national, state, and local populations. This makes the strategy appropriate for my study. This method is

particularly useful in large-scale surveys like the NDHS 2018, where the population is diverse and spread across different geographical regions, and it reduces the financial burden of data collection while maintaining precision.

In this study, samples were drawn from the population by dividing it into strata based on location (rural and urban areas), where each state and the Federal Capital Territory are considered separate strata. Also, the samples would be drawn by selecting enumeration areas (EAs) within urban and rural strata using probability proportional to size (PPS) (Lawal et al., 2023). Furthermore, this study methodology ensures an increase in the probability of selecting larger EAs with more households. Consequently, Lawal et al. (2023) stated that a total of 1,400 EAs are chosen, thereby ensuring that the number of EAs is distributed across each strata, which is proportional to the population size of that strata. However, this is the first stage and procedure for drawing the sample, which is known as cluster sampling.

The second stage is called systematic sampling, which involves a systematic selection of 30 households from each sampled EA. For this stage, Daniel and Cross (2019) stated that when using systematic sampling methodology, a researcher calculates the total number of records needed for the study or experiment at hand, where a random number is then chosen to use as a starting point for initiating sampling. The record located at this starting point is called record x. A second number, determined by the number of records desired, is selected to define the sampling interval (call this interval k). Consequently, the dataset would consist of records x, x + k, x + 2k, x + 3k, and so on until the necessary number of records is obtained (Daniel & Cross, 2019). As a result,

within each selected EA, a household listing is conducted, that identified participants, children under 5 years old, and their mothers as eligible within these households for data collection. Moreso, from each EA, 30 households were systematically selected, resulting in a total of 42,000 households. Also, sampling weights will be applied to adjust for differential response rates and selection probabilities, and ensuring the results are nationally representative (NPC & ICF, 2019). Nonetheless, the dataset contains detailed information on child mortality rates, healthcare utilization, and sociodemographic variables.

The sampling frame for this study includes all households within the selected EAs of the NDHS 2018. The inclusion criteria are women aged 15–49 years old who had given birth within the five years before the survey, households within the selected EAs, children born in the past five years (U5) before the survey, data on live births of children aged 0–59 months, complete responses to variables of interest, including PPM and sociodemographic factors. Additionally, inclusion criteria will involve children under 5 years of age who had been discharged from a healthcare facility, and these criteria require that the children have complete records of followup care, household income, and mother's age and education. On the other hand, exclusion criteria included children with missing data on key variables, cases involving severe data inconsistencies, women who did not give birth within the five years preceding the survey, households outside the selected EAs, children older than 5 years old at the time of the survey, households without children under 5 years old, and incomplete or missing data on critical variables such as child survival status or maternal health indicators. However, cases of multiple

births, such as twins, will be treated as a one birth event to avoid statistical bias (Avoka et al., 2022).

After determining the sampling frame, this study requires a power analysis (PA) to determine the sample size. Buckley (2024) explained that new researchers could conduct a power analysis at the planning stage to determine a minimum sample size (SS) for the study, and the researcher would need to make decisions on the significance criterion (α), a desired level of power (1 – β) and an estimate of a population-level effect size. The author went on to describe power analysis as a calculation that helps researchers determine the minimum sample size required for robust statistical inference that is performed before the study or dissertation begins and helps the researcher ensure that the study is not too small or too large (Buckley, 2024). For example, the following parameters will be used to conduct power analysis for this study: effect size (Cohen's d 0.3, representing a moderate effect or medium effect size), Alpha Level (α) 0.05 (to ensure a 95% confidence level and 5% significance level) and Power Level (1-β): 0.80 (80% power which is standard for detecting meaningful differences) (Szklo & Nieto, 2019).

Assuming these parameters are applied and then use the G*Power software for the logistic regression, a minimum sample size of 1,084 children was estimated. To account for potential data loss where a 25% oversampling was implemented, this results in an adjusted required sample size of 2,159 (Faul et al., 2007). This study's sample size is adequate and it offers a statistical power to show statistically significant associations between followup care practices, healthcare facilities' availability for followup care, and

PPM, while controlling for confounding variables such as geographical location, mothers' age, household income, and mothers' education (Faul et al., 2007; Akeju et al., 2022). Also, the total weighted sample from the NDHS datasets, consisting of 21,671 children, exceeds this requirement or threshold. Thereby, ensuring adequate power for subgroup analyses and multivariable regression. The sampling strategy is robust, representative, and scientifically justified, providing a solid foundation for this dissertation.

Procedures for Recruitment, Participation, and Data Collection

Procedure for Recruitment and Participation

Since this study will use secondary data from the 2018 NDHS, there will be no direct recruitment of participants. The NDHS data were collected by the National Population Commission (NPC) of Nigeria with support from Opinion Research Corporation Macro International (ORC) Macro/Inner City Fund International (ICF). The survey included women and men aged 15–49 years, and data collection was conducted using a stratified two-stage cluster sampling design. This stratified, two-stage cluster design was used to select the study participants. After the first and second stages of EA selection, a fixed number of thirty (30) households were selected from each cluster through equal probability systematic sampling (PSS), which gave rise to a sample size of approximately 42,000 households (Anyasodor et al., 2023). Also, out of the total of 41,668 households selected, 40,666 were fully occupied, and 40,427 were interviewed during the survey. Of the 42,121 eligible women of childbearing age added in the study, 41,821 responded to the survey (99.3%). This study included data for 21,671 children, 0–59 months of age and born to the responding mothers. The NDHS dataset includes

detailed health and sociodemographic data on child mortality and healthcare practices, making it an ideal source for studying PPM factors. Nonetheless, the data collection procedures and methods for the original study were carried out by DHS Program experts in collaboration with Nigeria's NPC, adhering to strict protocols to ensure data quality and ethical standards (NPC & ICF, 2019).

Data Collection

The data collected for this study was done using information from the NDHS. The data from the NDHS, and the data archived in the NDHS was collected using stratified two-stage cluster sampling, computer-assisted personal interviewing (CAPI), and questionnaires. The stratified two-stage cluster sampling involved a survey that was stratified by location (rural and urban), divided into two stages: in the first stage, enumeration areas (EAs) were selected during the survey with probability proportional (pp) to size, and in the second stage, households within each EA were systematically selected. The CAPI was conducted by highly trained enumerators who used CAPI to collect data from 40,427 households between August and December 2018. Additionally, data were collected for the survey using standardized questionnaires on various topics, including family planning, maternal and child health, childhood mortality, malaria, and more. For this study, data will be collected and analyzed on children born in the past 5 years to women aged 15–49 years.

Procedure and Necessary Permissions for Gaining Access to the Dataset

Access to the 2018 NDHS requires a formal application through the DHS Program's data access system. A formal application to access the NDHS data through the

DHS Program website (www.measuredhs.com) has been made by submitting a brief description of the research project, its objectives, and the intention to use the data for research. This request was approved, and datasets were available for download through a secure portal.

The DHS Program provides data free of charge upon approval of data usage requests (NPC & ICF, 2019). Also, the dataset is fully anonymous and adheres to stringent ethical and confidentiality standards, thus ensuring compliance with institutional review board (IRB) requirements (NPC & ICF, 2019). Nevertheless, the 2018 NDHS data will be used to utilize high-quality, comprehensive, and nationally representative data to investigate the factors contributing to PPM among children under 5 years old in Nigeria and produce findings that are robust, reliable, and relevant for informing public health interventions and policies.

Instrumentation and Operationalization of Constructs

The United States Agency for International Development (USAID), in collaboration with ICF International, created the NDHS. with the latest survey published in 2018. The NDHS 2018 was implemented by the NPC with technical support from ORC Macro/ICF International through Monitoring and Evaluation to Assess and Use Results Demographic and Health Surveys (MEASURE DHS) (National Population Commission [NPC] & ICF Macro, 2018). This survey is important for this study because it provides numerous data on PPM in Nigeria. Adeyemi et al. (2021) described the 2018 NDHS as a highly appropriate survey for the study because it provides detailed, nationally representative data on children under 5 years old, including PPM,

sociodemographic factors such as mothers' age, mothers' education, and mothers' healthcare practices. Also, to utilize the datasets, written permission to the developers were provided to gain access to the DHS program website. On July 10, 2023, the developers granted access after submitting the request.

The NDHS dataset's reliability and validity values have been widely published and recognized for their rigorous methodology, standardization of survey instruments, and data collection procedures. Fabric and Choi (2013) conducted a systematic review explaining that the DHS program utilized proven, standardized tools and methodologies adapted from international protocols, ensuring high-quality data collection across various countries. This describes the validity values of the DHS relevant to their use in this study. Additionally, the NDHS 2018 ensures and upholds reliability through rigorous training of field enumerators for pre-testing, data collection, using standardized questionnaires tailored to the local context (Quintão & Andrade, 2020). Specifically, the creators of the NDHS 2018, like the NPC of Nigeria, including the ICF, ensure the survey's reliability by employing comprehensive sampling methods, training field staff intensively, and conducting pre-tests. Similarly, validity was created and established by applying rigorous questionnaire design, that is consistent with international standards and verified with other data sources made for the Nigerian context (Cobern & Adams, 2020; Ahmed et al., 2024). Moreover, further evidence is provided through the survey's consistent use and citation in peer-reviewed research, proving its reliability and validity over time, and measures like test-retest reliability, ensuring consistent results over time.

The NDHS is part of a global DHS Program previously used in various studies in multiple countries and across Nigeria, ensuring validity and reliability. The 2018 NDHS specifically expands on past surveys with a larger sample size and additional health indicators like malaria and sickle cell anemia prevalence. In Nigeria, the NDHS is typically used in research to establish its validity through extensive sampling methods, to analyze health and demographic trends, and statistical analyses that confirm its representativeness at national, state, and residential levels. For example, the NDHS was used across various populations in Nigeria, providing data from urban to rural areas. Findings from the NDHS have been published and distributed to many health, medical, and scientific journals, contributing significantly to the understanding of health trends in Nigeria. Uthman and Aremu (2021) carried out a study that used data from the 2018 NDHS to explore the factors affecting U5 mortality in different regions of Nigeria. Since 2018, NDHS has used a carefully planned sampling method to ensure that the data is both representative and high quality. Findings from the study identified ongoing factors contributing to U5 mortality. As a result, the findings are reliable and accurate and were used in public health interventions across the various states in Nigeria.

Data Analysis Plan

Data analysis is a process used to determine the different ways to interpret the data used in research and convert the data into meaningful findings for the study (Creswell & Creswell, 2018). Also, data analysis in quantitative research is about exploring numerical data to enable researchers to make sense of the information by identifying relationships or associations between variables through mathematical

calculations and statistical tests within the data (Ali, 2021). All statistical analysis in the study were applied using SPSS version 28.0 software, and the data for this study came from the 2018 NDHS.

In this study, data cleaning and screening procedures will be applied to ensure the accuracy, generalizability, and reliability of the dataset before analysis. Sheard (2018) and Osborne (2013) described data cleaning as a process of identifying and correcting errors or inconsistencies in the data, like missing values, outliers, or incorrect entries, usually from the dataset the researchers plan to use for their study. The researchers also described screening as the process of reviewing the data to assess its quality and suitability for analysis, which includes checking for normality, linearity, and homoscedasticity (Sheard, 2018). For example, descriptive statistics describes the means and standard deviations (SD), or frequencies and percentage, as appropriate, and they were computed for all variables in the study. These data were reviewed to check for missing data, outliers, and "cells" with low frequencies that might prevent stable and appropriate statistical analysis in the study. Simple/unadjusted associations were the next subject checked using Chi-square test analysis for the simple logistic regression models, 61 categorical predictor variables and for the age variable for women in the RQs. Multivariable logistic regression analysis models were built for each variable category – postdischarge child mortality, followup care practices, availability of healthcare facilities, and socioeconomic factors to explore the relative importance of factors within each category. Given that the outcome variable (mortality rate) is binary (death yes/no), logistic regression will be used. This approach or methodology will allow for the

assessment of the association between followup care practices, health infrastructure, and PPM while controlling for confounding variables like household income, mothers' age, and mothers' education. The regression model will provide odds ratios and confidence intervals (CI) to measure the reliability and strength of the significant association between followup care, infrastructure, and the likelihood of PPM among children under 5 years old. The DHS dataset is presented in different groups of recode files, and this study concentrates on the children recode file on mothers with births in the past 5 years, which provides information on children within the age of 0–59 months born in the 5 years prior to the surveys (Akeju et al., 2022). Also, the DHS data used in this study are the children's file data. The model is given by a linear probability model (LPM) measure of a household experiencing child mortality. If the household has lost a child before or at the 59th month, child mortality Y = 1; otherwise, Y = 0. If the household has lost a child before or at the 12th month, infant Y = 1; otherwise, Y = 0. This study utilized 2018 NDHS pooled data. NDHS selected participants for the study through probability sampling procedures. Pooling data from different surveys requires that we account for the differences in survey years and regions. This is achieved by creating a strata identification using year and region as the stratification factor. NDHS selected participants for the study through probability sampling procedures. It separated urban and rural strata to provide appropriate samples of urban and rural populations at the national level for the study (Anyamele, et al 2015). All statistically significant predictors of the dependent variable, the likelihood of PPM, from the univariate analyses, were subsequently inputted into a multiple logistic regression model in SPSS. A backward

stepwise process was then used to remove or delete non-significant variables until a parsimonious model was gotten. Backward stepwise model building starts with all potential predictor variables in the analysis and tests the statistical effect of dropping each one. When no more variables can be removed without a decrease in the quality of fit, the remaining model is usually known as parsimonious. However, most statistically non-significant predictor variables were added in the final regression model (non-parsimonious) based on their scientific importance as recommended by other published studies.

Research Questions and Hypotheses

The following questions and hypotheses were used to guide this study:

RQ1: Is there an association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education?

$H_0$1: There is no association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education.

H_a1: There is an association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education.

RQ2: Is there an association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels?

$H_0$2: There is no association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels.

H_a2: There is an association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels.

The multivariable logistic regression (MLR) model will be used to test the hypotheses for the study. Since the dependent variable (postdischarge mortality) is binary (death: yes/no), which is obtained from the birth recode of the 2018 Nigeria DHS data. The outcome variable (PPM) was the risk of dying for those under the age of 5 years old, defined as the probability of a live-born child death before their fifth-year birthday. Similarly, this is measured as the duration of survival since birth in months; logistic regression will be used to evaluate or calculate the association between independent variables (timely followup visits, healthcare facility availability) and postdischarge mortality, controlling for household income, mothers' age and mothers' education. Moreover, considering the binary nature of the outcome variable, multivariable logistic regression is the appropriate statistical method for this study while controlling for potential confounders. In the DHS women's data, women were asked whether a range of factors would be a big problem for them in followup care practice. These factors included 1) distance to a healthcare facility, 2) timely postdischarge visits, 3) adherence to treatment plans, 4) access to healthcare professionals, and 5) availability of healthcare facilities. Responses to these questions in the NDHS were categorized as a big problem

coded as' 1' and not a big problem coded as '0' (Adedini et al., 2014). The Hosmer-Lemeshow test will be used to calculate the goodness of fit for the model logistic regression, and for multicollinearity assessment, the variance inflation factor (VIF) will be checked to ensure that independent variables do not exhibit high collinearity.

Moreover, this study will account for multiple statistical tests and reduce the risk of Type I errors by applying the Bonferroni correction, and adjusted p-values will be reported to account for the potential inflation of false positives. This method adjusts the significance level by dividing the desired alpha level (e.g., 0.05) by the number of comparisons being made. This ensures that the overall Type I error rate is controlled. Additionally, the reason for the inclusion of potential confounding variables is that economic status or economic disparities affect healthcare access, resources, postdischarge care adherence, and overall child health outcomes, while maternal age affects child health, mortality, knowledge of healthcare-seeking behavior, and care quality. Also, regarding mothers' education, higher education levels are often associated with improved health-seeking behaviors, adherence to medical recommendations, and access to healthcare. However, key explanatory variables focus on child health at birth, measured by child weight/size at birth, whether child health was checked after discharge, baby postnatal check within 2 days of delivery, and hospital discharge. Other control variables comprising maternal and household characteristics were adopted for the statistical analysis: mother's age (<20, 20–29, 30–39 or ≥40 years); mother's educational level (illiterate, completed primary, or secondary and higher); paternal education (illiterate, completed primary, or secondary and higher); household wealth status of the family

(poor, middle or rich). This study recorded the wealth index into 3 categories ('poor' comprising the poorest and poorer, 'middle' comprising the middle, and 'rich' comprising the richer and richest), maternal age at first birth (12–17, 18–30 or ≥30 years); number of living children (no living child or one or more living children); place of residence (urban or rural); distance to health facility (refers to how much of a problem is 'the distance to the health facility' in getting medical help for oneself, a big problem, not a big problem) and place of delivery (home or hospital) (Olubodun et al., 2023). Mother's age is considered a quantitative variable in the NDHS dataset. The wealth status was derived from the wealth index. The lower category (poor) was generated by merging the poorest and poorer, whereas the rich was created by combining the richest and richer groups of study participants (Ashis Talukder et al., 2021). Additionally, in 2013, the WHO updated its guidelines on PNC or followup care with the recommendation that women and children should receive postnatal care at a health facility for at least twenty four (24) hours after birth, on day three (48–72 hours), between days 7–14 after childbirth and six (6) weeks after birth, regardless of the place of delivery (WHO, 2014). Nonetheless, there will be coding PNC as followup care or followup visits for the purpose of this study. Therefore, non-use of health facilities for delivery (coded as 1 if the child was delivered at home and 0 if the child was delivered at a health facility) and non-use of PNC or followup care (coded as 1 if the women did not receive a health check within 2 months after delivery and 0 if women received a health check within two (2) months after delivery). The variable for PNC or followup visits was derived from the following

question: How long and how often after delivery did the respondent receive health checks? (Bolaji, & Samina, 2019).

The following factors were considered at the community level: community-level poverty, community-level women's education, community distance to health facilities, place of residence (urban or rural), and region. The region was used as provided in the NDHS dataset, which included North Central, North East, North West, South East, South-South, and South West. Other community-level variables were computed by aggregating individual characteristics at the cluster level (CL), dividing the measure into tertiles, and categorizing them as low, medium, and high. A similar procedure has been widely applied to derive community variables in DHS datasets. Community-level poverty was described as the proportion of women who are from the poorest communities. Community women's education was defined as the proportion of women from a community with at least secondary education. Community distance to health facilities was defined as the proportion of women for whom distance to a health facility is a big problem, aggregated at the cluster level. The variables such as religion, respondent's employment status, respondent's education status, companionship to health facility, place of residence, partner's education, and region or geographical location were used for analysis as they were originally in the NDHS. All other variables were recorded from existing variables (Olubodun et al., 2024).

The results of this study were presented using key statistical metrics like the odds ratios (ORs), 95% confidence intervals (CIs), p-values, model fit statistics, and effect size. Also, to determine the factors associated with the likelihood of postdischarge

mortality among children under 5 years old, the 2018 NDHS datasets were pooled, and logistic regression analysis (LRA) was applied using 3 models to calculate the odds of mortality at a 95% CI with a p-value for statistical significance set at 0.05. In addition, in Model 1, univariate (unadjusted) analysis was done by entering each independent variable separately in a model with the dependent variable (PPM) to provide a crude estimate of their association with children under 5 mortality. In Model 2, a multivariate analysis was done to control for the confounding effect of other factors at the same level as the Mosley and Chen framework and determine the effect's direction and magnitude. Therefore, all socioeconomic determinants and survival status of the children were entered into Model 2a in the SPSS, and all proximate factors and survival status were entered into Model 2b. Likewise, Model 3 was used to compute the fully adjusted odds ratio for each determinant of children under 5 mortality after accounting for confounding due to proximate and socioeconomic variables (Airemen, I., & Danat, I. M. 2024). Just like in the literature, the odds ratio to quantify the likelihood of PPM associated with each predictor variable was used; 95% Confidence Intervals (CIs) provided a range within which the true association is likely to fall, aiding in the interpretation of statistical and practical significance level of $p < 0.05$. Also, the effect size was calculated to evaluate the practical impact of findings beyond mere statistical significance, and the Hosmer-Lemeshow goodness-of-fit tests and other diagnostics will be reported to assess the quality of logistic regression models. However, the attention was focused on the survival status of the index or first child, the most recent delivery the women had in the past 5 years before the start of the study. The dependent variable was (PPM), which was

assessed with the question on the survival status of the most recent childbirth coded (dead =1 or alive= 0) in the last 5 years before the survey.

In addition, the data analysis process allowed the identification of key themes for this study, including codes and patterns, from the collected data, which was used to formulate a relationship between the data and the research question and describe an unanswered question (Ravitch & Carl, 2016). Creswell and Creswell (2018) state that data analysis consists of a five-step process categorized as: firstly, to organize and prepare data for analysis (compiling), read or look at all the data, including beginning coding of all the data (reassembling). Others are to generate themes and descriptions (interpreting/transcribing), representing the description and themes (concluding). However, multivariable logistic regression analysis was used to analyze the DHS data, and the coding process was done using the codebook to identify variables.

Threats to Validity

External validity refers to how applicable findings from a study are in real life beyond the sampled population. As the researcher, this study was conducted with a high level of external validity and produced tangible findings that can be utilized as an intervention in individual or population settings. One of the threats to external validity is the interaction effects of selection and experimental variables, which is the tendency for the study results to be different because certain types of people were selected, and their unique characteristics interacted with the treatment in a way that would not happen with a different group and when the sample is not a representative of a population, this introduces threats to external validity (Bhandari, 2022; Burkholder, 2020). For this

research, the study sample comprises children under five years old who were discharged from hospitals in Nigeria. Due to this selection criterion, findings may not apply to other pediatric populations, like neonates or older children. As a result, to reduce this problem, the results of this study were interpreted with caution and made recommendations that were only tailored to populations with similar characteristics (Burkholder, 2020). The DHS was used and the data collected had already been obtained by random sampling, so the sample was representative of the population.

Internal validity in quantitative research is the extent to which a study or research can establish that one variable (the independent variable) causes a difference in the other variable internally (the dependent variable) without being influenced by one or more predictor variables. Internal validity assesses whether observed relationships between variables truly reflect the findings of the outcome variable rather than being influenced by confounding factors (Creswell, 2009). Internal validity is the determination of how accurately a study is conducted and how these results reflect the studied participants in question. This study examined whether the independent variables resulted to an outcome (dependent) rather than other variables in the study (Burkholder, 2020). Moreso, this study's potential threats to internal validity consist of testing and history. External events, like seasonal disease outbreaks (malaria or flu season), particularly during the rainy season, may influence PPM independently of the examined factors. To reduce this, the DHS dataset, with its collection spanning multiple years, and with seasonal trends considered in the analysis, was used. Since the study relies on secondary data, repeated exposure to the same test or assessment instrument was not a concern. However,

variations in caregiver responses over time introduced inconsistencies, and this is proof that the problem was resolved. The study's findings made meaning because the independent variables were the reason for the difference in outcome between the two concepts studied while controlling for confounders (Burkholder, 2020).

Quantitative researchers must be aware of the extent to which the conclusions drawn from their study should be accurate and reliable and that the study's statistical tests correctly support the conclusions (Burkholder, 2020). Problems or threats to this validity can arise if the study does not have enough data or if the sample size is too small to detect real effects and significant association (low statistical power), if the chosen statistical methods do not fit the data properly (violations of assumptions), or if the data itself is not reliable. These issues can lead to incorrect or misleading results. To combat this potential hindrance to the study, a power analysis was conducted to ensure a sufficient sample size for my study to detect meaningful effects. Logistic regression models were used for this study, and this model assumes linearity in log odds, independence of errors, and absence of multicollinearity, so checks on assumptions were being performed, like VIF for multicollinearity, before conducting the analysis.

Ethical Procedures

This study involves secondary data analysis from the 2018 NDHS. To obtain access to the data, an official authorization was requested from the data custodians, ORC Macro and ICF International, headquartered in Calverton, Maryland, USA. When approval was received, the dataset was retrieved and securely stored it for analysis. The 2018 NDHS dataset is managed under the MEASURE DHS+ system, a domain

supported by USAID together with the National Malaria Elimination Program (NMEP) under Nigeria's Federal Ministry of Health. The Institutional Review Board (IRB) of the United States approved the study's protocol, and Nigeria's National Health Research Ethics Committee (NNHREC) also conducted an independent review and granted approval (NPC & ICF Macro, 2018).

In addition, doctoral research utilizing secondary data analysis does not involve direct interaction or intervention with human subjects but still requires IRB review, as outlined in 45 CFR 46.102(f) (University of Connecticut, 2020). According to 45 CFR 46.102(e)(1), human subjects used in research are defined as living individuals about whom a researcher (whether a professional or student) conducts studies (United States Department of Health and Human Services: Office of Human Research Protection [HHS-OHRP], 2020). Moreso, when secondary data is de-identified and publicly available, IRB review is not mandated, provided the research meets the stated criteria. In this case, while IRB approval was technically unnecessary since this study utilizes secondary data, there is no direct recruitment of participants, intervention, or interaction with human subjects. Nonetheless, ethical considerations about the use of previously collected data were assessed during the data analysis. The data custodians ensured de-identification, meaning that no personally identifiable information (PII) was included in the dataset, and all dataset was securely stored on a password-protected computer, with only the researcher having access to the dataset, ensuring confidentiality.

Summary

This quantitative cross-sectional design was the chosen approach for this study since the focus was to examine the association between timely individual followup visits, the availability of healthcare facilities for followup care, and the likelihood of PPM among children under 5 years old in Nigeria. Also, the use of a cross-sectional design was suitable for this research as it allows for the collection and analysis of data at a single point in time, allowing the identification of patterns and associations between major key variables. In addition, the study utilizes secondary data obtained from the NDHS 2018, a representative dataset of the nation implemented by the Nigerian NPC in collaboration with ICF and other development partners. The NDHS follows globally validated and locally adapted methodologies to provide essential demographic and health estimates. All attributes of the research approach were presented to include research design and rationale, methodology, population, sampling and sampling procedures, instrumentation, procedures for recruitment and participation, data analysis plan, data collection, and threats to validity, along with ethical considerations to aid in the decisions and selection process made in the study. The target population (TP) for this capstone study were made up of children under 5 years old (U5), usually from low-income regions in Nigeria. Nonetheless, this database consisted of 34,193 children's records, ensuring a comprehensive and representative sample for the country. Also, the study used a stratified two-stage cluster sampling strategy that ensured the data were representative at national, state, and residential levels. Where the first stage involved selecting enumeration areas (EAs) using probability proportional to size (PPS), while the second stage involved the

systematic selection of 30 households from each EA. In addition, sampling weights were applied to adjust for differential probabilities of selection and participants' response rates.

The overall goal in conducting this cross-sectional study was to provide information that was uncovered in the research on PPM in Nigeria, specifically focusing on children under 5 years of age. In Chapter 3, the analytical approach, data collection procedure, and process used to achieve my research goals will be discussed. In Chapter 4, research findings from the data collected related to the research question will be presented.

Chapter 4: Results

This chapter contains data involving presence of associations between timely followup visits, availability of healthcare facilities, household income, and likelihood of PPM among children. The data gathered was based on a secondary dataset from the 2018 NDHS, a nationally representative study that contains data from all 37 states of the country. The study used a cross-sectional design to analyze data and information from DHS at a single point in time. Primary research questions were used to understand the association of these factors with the death of the children after hospital discharge, along with two hypotheses. The questions were as follows:

RQ1: Is there an association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education?

$H_0$1: There is no association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education.

H_a1: There is an association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education.

RQ2: Is there an association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels?

$H_0$2: There is no association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels.

H_a2: There is an association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels.

The study was conducted using 2018 NDHS data. The database included women between 15 and 49 from 42,000 households, and a fixed sample of 45 households was selected in each cluster. The study sample included 18,516 women of this age who had given birth in the past 5 years before the survey, with 21,671 children between 0 and 59 months whose records were analyzed. Priority was given to women in terms of most recent delivery (using MIDX = 1) they had in the past 5 years prior to the study to avoid duplicate observations and ensure independence of observations. Methods for collecting data in analysis are discussed in this chapter.

This chapter also includes descriptive statistics, Chi-square, simple logistic regression, and multivariable logistic regression ($\alpha = 0.05$). A three-stage stratified cluster design consisting of 904 clusters (372 in city areas and 532 in rural areas) was used for sample selection. Chi-square was used to determine whether statistically significant associations were found between availability of followup care, access to healthcare facilities, community health interventions, and postdischarge mortality status. Logistic regression was used. The regression model was used to provide CIs and ORs to quantify

strengths of associations. There were no changes in the initial research design, and all participants' records for this cross-sectional study were analyzed.

Data Collection

An official email to the NDHS website requesting access to the 2018 NDHS database was sent and approved after 14 days. Upon approval of the request form which was filled out online, children's recode datasets and files that were relevant to this study were downloaded. These datasets were essential for addressing research questions related to the topic under study.

NDHS data, which were collected between August 14 and December 29, 2018, involved using a stratified two-stage cluster sampling design to ensure national representativeness, with a high household and individual response rate among women between 15 and 49 of 99%, ensuring data completeness and reliability. No primary recruitment was conducted. Also, selection was limited to the most recent birth in the last 5 years, prioritizing records where children's survival status was available. There were no discrepancies from the data collection plan as presented in Chapter 3.

Demographics/Sample

In this study, categorical variables such as mothers' education level, timely followup care, and health facility availability were recoded into binary or dummy variables to enable inclusion in logistic regression models. This allowed for clearer interpretations of associations and ensured all variables met statistical requirements for inclusion in analysis (see Table 1).

Socioeconomic Characteristics of Respondents

The NDHS collected data on distribution of respondents by age group among children under 5. Mothers' age ranged from 15 to 49, with a mean age of 29.73 (SD = 7.19). In the sample, the variance for mothers' age was 51.73, showing a moderately wide age distribution among mothers of children between 0 and 59 months. Respondents in the 25 to 29 age group constituted 25.8%, followed by mothers between 30 and 34 (21.4%) and 20 and 24 (19.3%). There was a major drop in number of respondents as age of mothers of children under 5 increases beyond 34, with the lowest representation in the 45 to 49 age group (3.3%).

Household income identified as wealth index combined in the NDHS dataset was evenly distributed across quintiles, with the largest proportion, 5025 (23.1%), classified as poorest and the smallest population, 3251(14.9%), categorized as the richest. Mothers' education showed that a high population of mothers, 9527 (43.7%), had no formal education, 32.4% had secondary education, 15.6% had primary education, and only 8.2% had higher education. A significant proportion of the children lived in rural communities, and many were born to mothers with limited formal education, as shown in Tables 1 and 5.

Table 1

Socioeconomic and Demographic Characteristics of Children Under 5

Variable	Frequency	Percent
Household income		
Poorest	5025	23.1
Poorer	4905	22.5
Middle	4586	21.0
Richer	4025	18.5

Richest	3251	14.9
Mothers' education levels		
No education	9527	43.7
Primary	3410	15.6
Secondary	7064	32.4
Higher	1791	8.2

Table 2

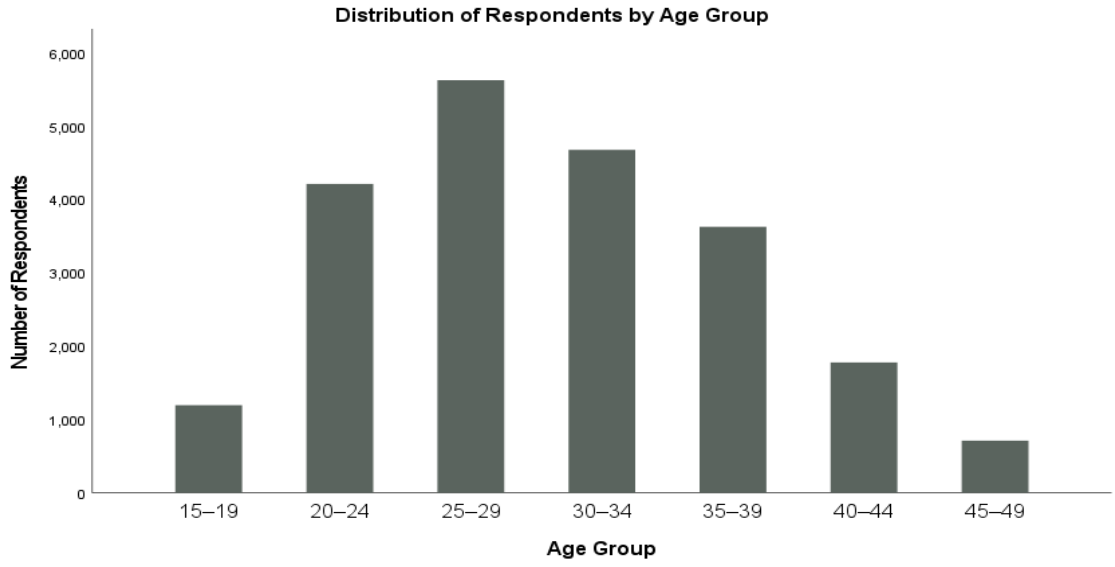
Mothers' Age of Children Under 5

Variable	*N*	Minimum	Maximum	*M*	Variance	*SD*
Mothers 'age	21792	15	49	29.73	51.726	7.192

Note. *SD* refers to standard deviation, and *M* = Mean

Figure 1

Age Distribution of Respondents



Biological Characteristics of Respondents' Children

The likelihood of PPM of the respondents' children is shown in Table 3 below. Among the sampled children, the proportion of children who were alive was 93.8% (n = 20,433), which was higher than the proportion of children who were deceased, 6.2% (n = 1,359), at the time of the survey. Nonetheless, this PPM outcome shows a significant public health concern, pointing out the importance of care following hospital discharge and investigating factors that may influence survival outcomes (Midtgaard et al., 2021; Nemetchek et al., 2018).

Table 3

Biological Characteristics of Respondents' Children

Variable	Frequency	Percent
Likelihood of PPM		
Child is alive	20433	93.8
Child is dead	1359	6.2

Behavioral Health-Seeking Characteristics of Respondents

The respondents differ in their decisions on individual care practices they take at different times, which affects their child's health outcomes. The results in Table 4 below indicate that among children under 5 years old sampled, only 4531 (20.8%) received a timely individual followup visit after hospital discharge (within 7 days), while a large proportion of respondents, 17,140 (78.7%), did not, a gap that may contribute to the risk of mortality. One hundred twenty-one (0.6%) had missing data for this variable. This missing data was coded separately and excluded from the analysis of the association between timely followup and PPM. For the independent variable, availability of

healthcare facilities for followup care, the majority of mothers, 15338 (70.4%), indicated that accessing a facility for followup care was "not a big problem," whereas 6454 (29.6%) indicated that it was a very big problem. This factor is a major barrier faced by nearly one-third of respondents and could have implications for postdischarge care-seeking, health systems, and child survival.

Table 4

Behavioral Health-Seeking Characteristics of Respondents' Children

Variable	Frequency	Percent
Timely individual followup visits		
Yes	4531	20.8
No	17140	78.7
Availability of healthcare facilities for followup care		
Not a big problem	15338	70.4
A big problem	6454	29.6

Geographic and Environmental Characteristics of Respondents

The place of residence of mothers often leads to urban-rural disparities, which are an important factor in postdischarge paediatric care in Nigeria. Table 5 below presents the geographical distribution of the sample, where many of the children (64.6%) resided in rural areas, while 35.4% of them lived in urban areas. Rural areas are often linked with reduced healthcare access, longer travel times to facilities, and big difficulty in receiving timely followup care.

Table 5

Place of Residence of Respondents' Children

Variable	Frequency	Percent
Geographical location		
Urban	7710	35.4
Rural	14082	64.6

Chi-Square Analysis of Covariates Associated with PPM in Children Under 5

Using the children's recode dataset, a univariate analysis was conducted using SPSS (indicate version) that justifies the inclusion of the covariates into the multivariable logistic regression models. The chi–square test results, as presented in Table 6 below, were conducted to examine the association between each of the covariates (mothers' age, household income, geographical location, and mothers' education) and the likelihood of PPM among Nigerian children under 5 years old.

Nonetheless, results and findings from chi-square tests in the SPSS output showed statistically significant associations for mothers' education ($\chi2(3, N = 21671) = 88.309$, $p <0.001$), household income ($\chi2(4, N = 21671) = 83.286$, $p < .001$), geographical location ($\chi2(1, N = 21671) = 16.254$, $p <0.001$). Also, the variable mothers' age was grouped into categories ($\chi2(6, N = 21671) = 110.041$, $p <0.001$), all presented in Table 6 below. Therefore, these variables were maintained as covariates used in the multivariable logistic regression (MLR) models for the study.

Table 6

Frequencies and Chi-Square Results for Associations Between Independent Variables and PPM

Independent variable	Category	Alive		Dead		$\chi^2(2)$	df	P
		n	%	n	%			
Mothers' education	No education	8794	43.0%	733	53.9%	88.309	3	<0.001
	Primary	3175	15.5%	235	17.3%			
	Secondary	6743	33.0%	321	23.6 %			
	Higher	1721	8.4%	70	5.2%			
Household income	Poorest	4637	22.7%	388	28.6%	83.286	4	<0.001
	Poorer	4533	22.2%	372	27.4%			
	Middle	4301	21.0%	285	21.0%			
	Richer	3833	18.8%	192	14.1%			
	Richest	3129	15.3%	122	9.0%			
Geographical location	Urban	7298	35.7%	412	30.3%	16.254	1	<0.001
	Rural	13135	64.3%	947	69.7%			
Timely followup visit	Yes	4355	21.4%	176	13.0%	53.937	1	<0.001
	No	15966	78.6 %	1174	87.0%			
Health facility availability	Not a big problem	14420	70.6%	918	67.5%	5.584	1	<0.018
	A big problem	6013	29.4%	441	32.5%			
Mothers' age	15 - 19	1099	5.4%	94	6.9%	110.041	6	<0.001
	20 - 24	3961	19.4%	245	18.0%			
	25 - 29	5342	26.1%	275	20.2%			
	30 - 34	4419	21.6%	251	18.5%			
	35 - 39	3366	16.5%	256	18.8%			
	40 - 44	1633	8.0%	141	10.4%			
	45 - 49	613	3.0%	97	7.1%			

Assessment of Statistical Assumptions

The Hosmer–Lemeshow goodness-of-fit test was evaluated, and the result is $\chi^2(8) = 9.89$, $p = .273$. This result shows that the Hosmer–Lemeshow was not significant, the logistic regression model is a good fit, and the model explains 2.4% of the variance in PPM (Nagelkerke $R^2 = 0.024$). Variance Inflation Factors (VIFs) were also evaluated to assess potential collinearity among predictors, and all variables demonstrated VIF = (range: 1.052–2.048), and tolerances are all > 0.2, indicating that multicollinearity was not violated in the logistic regression model.

In addition, to reduce the risk of Type I error due to multiple comparisons that include six independent tests ($\alpha = .05/6 = .0083$), a Bonferroni correction was applied. As such, only p-values below this threshold ($p = 0.0083$) were considered statistically significant. Results of the Bonferroni correction test showed that five out of six variables (mothers' education level, household income, geographical location, timely followup visit, and mothers' age remained statistically significant ($p < .001$) with the likelihood of PPM among children under 5 years old. Although the univariate association between availability of health facility infrastructure and the likelihood of PPM did not meet the Bonferroni-adjusted significance level ($p = .018$), this variable was retained in the multivariable logistic regression model. Nemetchek et al. (2018) and Chaudhry et al. (2023) stated that previous research studies have explored the impact of healthcare accessibility on postdischarge child survival in low-income countries. Therefore, these results determined what covariates are appropriate to include in the logistic regression model for the study.

Hypothesis Testing

The Chi-Square test was used to determine the associations between the independent (IV) and dependent variables (DV), while multiple logistic regression analysis and simple logistic models were conducted to test the hypotheses for these associations, controlling for covariates.

RQ1

The Chi-Square test in Table 7 below indicates that there is a statistically significant association between timely followup visits and PPM among children under 5 years old, [(c2 (1, N = 21671)] = 59.8935, Cramer's V = .050, p = < .001)]. The descriptive statistics for the likelihood of PPM were significantly lower among children who received a timely followup visit (176 or 3.9%) compared to those who did not (1174 or 6.8%). This result means that the higher a child receives a timely followup visit after hospital discharge, the lower the likelihood of the child dying. Moreso, even though the association was statistically significant, the effect size (Cramer's V = .050) indicates a small effect.

Table 7

Chi-Square of Associations Between Timely Individual Followup Visits and Likelihood of PPM

	Likelihood of PPM						
Variable	No Timely Follow-up	Yes Timely Follow-up	Total	*df*	$\chi^2(2)$	Cramer's V	p
PPM				1	59.894	0.05	<0.001
Alive	15966(93.2%)	4355(96.1%)	20321				
Dead	1174(6.8%)	176 (3.9%)	1350				
Total	17140	4531	21671				

A simple binary logistic regression using SPSS was performed to determine the effect of timely individual followup visits on children under 5 years old who survived or died after discharge from the hospital. The analysis used dichotomous options of "Alive" = 0 and Dead" = 1. The simple logistic regression model in Table 8 presents results that shows only one independent variable (Timely Followup Visit) is statistically significant [(χ2 (1, N = 21671) = 59.835, p = .001)], showing that timely followup visits are a significant predictor of postdischarge outcomes and that the predictors reliably distinguished between children who survived and those who died postdischarge. Also, Table 8 results below show β (Beta) = -0.599 for timely followup visits, which indicates that timely followup visits reduce the likelihood of postdischarge pediatric mortality. Also, the result shows that between 0.3% Cox and Snell R square (0.003× 100) and 0.7% Nagelkerke R square (0.007 × 100) of the variance in postdischarge mortality (Alive or Dead) was explained by the timely followup visits variable, and correctly classified 100% of cases. These values suggest that the predictor variables in the model collectively account for a small but statistically significant proportion of the variance in PPM. The odds ratio for timely followup visits equaled Exp (B) = 0.550, p = .009 (95% CI: = [0.467, 0.646]). This means that the respondents' children who had a timely followup visit were 45% less likely to die after discharge compared to those who did not have a timely followup visit (since 1 - 0.550 = 0.45 or 45% reduction). Likewise, the 95% CI does not include 1, indicating that the result is statistically significant. Therefore, this analysis indicates that children who were taken for a timely health check-up either to the

health facility or visited by a community healthcare provider after their child leaves the hospital were about 45% less likely to die than those who did not get any followup visit.

Table 8

Simple Regression Predicting Likelihood of PPM from Timely Followup Visit

Variable	Beta	95% CI for OR			*OR Exp(B)*	*P*	*Chi-square (p)*	R^2	ΔR2
		SE	*LL*	*UL*					
Step 1							0.001	0.007	0.003
Timely followupvisit (Yes)	- .599	.083	.467	.646	.550	.001			
Constant	-2.610	.030			.074	0.00			

a. Variable(s) entered on step 1: Timely followup visit

Table 9 shows an adjusted association between timely followup visits and child mortality. After controlling for the covariate in the model, the full model was statistically significant [(χ2 (1, N = 21671) = 193.499, p = <.001)] as presented in Table 9. The result of the model summary revealed that between 0.9% Cox and Snell R square (0.009 × 100) and 2.4 % Nagelkerke R squared (0.024 × 100) of the variance in the likelihood of postdischarge mortality among children under five years of age was explained by socioeconomic factors, and correctly classified 100% of cases. The result for the adjusted odds ratio (AOR) indicated that timely followup visits significantly reduced the odds of PPM (AOR = 0.621, 95% CI [0.526, 0.732], $p < .001$), thus, rejecting the null hypothesis.

Additionally, household income indicated a significant effect ($p < .001$):[rich household AOR = 0.687, p = .001 (95% CI: 0.581, 0.813); (Middle income household AOR = 0.895, p = 0.143 (95% CI: 0.771, 1.038)] on the likelihood of PPM. This result means that children under 5 years old from wealthy homes had significantly lower odds

of mortality after hospital discharge compared to those from poor homes, while the difference between middle-income and poor homes was not statistically significant.

Furthermore, as shown in Table 9, the result for the adjusted odds ratio indicated a significant association of mothers' education (p =.002) with mortality, where primary education (AOR = 0.997, p = 0.970 [95% CI: 0.851, 1.168], secondary education (AOR = 0.764, p = 0.001 [95% CI: 0.651, 0.896], and higher education (AOR = 0.699, p = 0.014 [95% CI: 0.525, 0.929]) on postdischarge deaths of children under 5 years old. Also, this result means that, although a mothers' education level is key in reducing the risk of a child dying after hospital discharge, having only primary education did not make a difference in reducing the child's risk of dying compared to mothers with no education. The odds were almost the same as for mothers with no education**.** Also, the children under 5 years old of mothers who graduated from secondary school and have higher education were 24% and 30% less likely to die after hospital discharge, respectively, compared to children of mothers with no education. Therefore, the higher a mother's level of education, the greater the child's chances of surviving after hospital discharge.

Nonetheless, the results as presented in Table 9 below showed that mothers' age has a significant relationship with mortality ($p < .001$). However, children of older mothers (aged 35–49) had 36% higher odds of PPM (AOR = 1.363, 95% CI [1.18, 1.58], $p < .001$) compared to younger mothers aged 15–24, while the age group 25–34 years old was not significantly different.

Table 9

Results of Regression Predicting Individual Timely Followup Visit

Variable	Beta	SE	95% CI for OR						
			LL	*UL*	*OR Exp(B)*	*P*	*Chi-square (p)*	R^2	ΔR2
Step 1							0.001	0.024	0.009
Timely followup visit (Yes)	- 0.477	0.084	0.526	0.732	0.621	.001			
Household income category (Ref = Poor)						.001			
Middle income	-0.111	0.076	0.771	1.038	0.895	.143			
Rich	-0.375	0.085	0.581	0.813	0.687	.001			
Mothers' education level (Ref = No educ.)						.002			
Primary	-0.003	0.081	0.851	1.168	0.997	.970			
Secondary	-0.269	0.081	0.651	0.896	0.764	< .001			
Higher	-0.359	0.145	0.525	0.929	0.699	.014			
Mothers' age group (Ref = Age 15–24)						< .001			
Age 25–34	-0.140	0.073	0.754	1.003	0.870	.055			
Age 35–49	0.310	0.075	1.177	1.578	1.363	< .001			
Constant	-2.679	0.073			0.069	0.01			

b. Variable(s) entered on step 1: Timely followup visit

RQ2

Table 10 illustrates a Pearson Chi-Square analysis of an availability of healthcare facility for followup care and the likelihood of PPM among children under 5 years old with the analysis revealing that there is a statistically significant association between the independent variable and dependent variables, [(c2 (1, N = 21671) = 5.58, Cramer's V = .02, p = .018)].χ^2(1, N = 21671) = 5.58, p = .018, with a very small effect size . The descriptive analysis of the likelihood of PPM was slightly higher among children whose mothers reported that reaching a healthcare facility was a big problem (6.8%, n = 441) compared to those who reported that access to a healthcare facility for followup care was not a problem (6.0%, n = 918). In other words, the result was statistically significant but a very small difference, suggesting that it is unlikely to be due to chance. Maybe other factors are likely more important in explaining why some children die after discharge, since only about 7 out of 100 children under 5 years old died when their mothers said getting to a healthcare facility was a big problem, compared to 6 out of 100 children whose mothers verified that reaching the healthcare facility for followup visits was not a problem.

Table 10

Chi-Square of Association Between Availability of Healthcare Facility for Followup Care and Likelihood of PPM

	Likelihood of postdischarge mortality						
Variable	Availability of Healthcare	Availability of Healthcare	Total	***df***	**χ^2(2)**	Cramer's V	p

	Facility (Big Problem)	Facility (Not a Problem)					
PPM				1	5.584	0.016	<0.018
Alive	6013 (93.2%)	14420(94.0%)	20433				
Dead	441(6.8%)	918 (6.0%)	1359				
Total	6454	15338	21792				

In this study, simple logistic regression analysis was used to examine the effect of the availability of healthcare facilities for ollowup care on the likelihood of PPM among children under 5 years old. The findings in Table 11 below shows that the model was statistically significant, $\chi^2(1, N = 21,671) = 5.58$, $p = .018$, indicating that the predictor contributed to explaining the variance in PPM, but with a very small effect size of 0.1% (Cox & Snell $R^2 = .001$; Nagelkerke $R^2 = .000$) and correctly classified 93.8% of overall cases. Respondents who identified the availability of healthcare facilities as "a big problem" was significantly associated with the likelihood of PPM ($B = 0.142$, $SE = 0.060$, $p = .018$) as shown in Table 11 below. Also, the odds of PPM were 15.2% or 1.15 times higher (OR = 1.152, 95% CI [1.024, 1.296]) among children whose mothers reported that the availability of healthcare facility was a big problem compared to those who reported it was not a big problem. Although the effect was very small overall, the result of this analysis means that families who said getting to a healthcare facility was a big problem were more likely to die after being discharged from care compared to those whose families did not report access as a problem (about 15% higher). Their difference is unlikely due to chance, which also means that difficulties in using the health services or

reaching these centers may be putting children at greater risk after they leave the hospital back to their homes.

Table 11

Sample Regression Predicting Likelihood of PPM from Availability of Healthcare Facilities for Followup Care

Variable	Beta	95% CI for OR							
		SE	*LL*	*UL*	*OR Exp(B)*	*P*	*Chi-square (p)*	R^2	ΔR2
Step 1							0.019	0.001	0.000
Availability of Health Facility (Big Problem)	0.142	.060	1.024	1.296	1.152	.018			
Constant	-2.754	.034			.064	0.001			

c. Variable(s) entered on step 1: Availability of healthcare facilities for followup care

In Table 12, a multivariable logistic regression analysis was conducted in SPSS to test the hypothesis of whether there is an association between the availability of healthcare facilities for followup care and the likelihood of PPM among children under 5 years old when controlling for household income, geographical location, and caregiver education. The result of the analysis in Table 12 below indicates that although the full model was statistically significant, $\chi^2(7) = 112.71$, $p < .001$ with a small effect of variance in the outcome (Nagelkerke $R^2 = .014$), but when adjusted, the independent variable, availability of a healthcare facility for followup care was not associated with the likelihood of PPM (AOR = -0.007, 95% CI [0.891, 1.138], p = .915). Thus, we do not reject the null hypothesis.

Moreso, household income was statistically significant ($\chi^2(2) = 19.88$, $p < .001$) where poor household (B = −0.414, AOR = 0.661, p = .001 [95% CI: 0.551, 0.793]), middle-income household (B = -0.137, AOR = 0.872, p = 0.143 [95% CI: 0.748, 1.016]) on the likelihood of PPM. This result means that children from poor homes had 33.9% lower adjusted odds of survival after discharge than children from rich households, and this difference was statistically significant. While children from middle-income homes had a higher risk of dying (13% lower odds of survival) than those from rich homes. However, this finding was not statistically significant. Consequently, children from poorer homes were more likely to die after hospital discharge compared to those from wealthier families.

Mothers' education was also a significant predictor overall ($\chi^2(3) = 28.17$, $p < .001$). However, when compared across their different levels of education using higher education as reference, no formal education (B = −0.454, AOR = 0.635, p < .002%, CI [0.479, 0.842]) and secondary education (B = −0.392, AOR = 0.676, p = .001, 95% CI [0.578, 0.791]) were associated with 36.4% and 32.4% higher adjusted odds, respectively, of PPM compared to those whose mothers had higher education. In other words, children whose mothers had secondary or higher education were roughly one-third less likely to die after discharge than those whose mothers had no schooling or less education. This result suggests that simply having a facility within reach or perceiving followup care as "not a big problem" or a "big problem" may not be sufficient to reduce PPM, did not make a big difference in the child's risk of dying, once other factors were

considered, utilization or improved child health outcomes were not guaranteed (Kruk et al., 2018; Nemetchek et al., 2020).

Geographical location, a variable indicating whether the children lived in the city or rural communities, was not a significant predictor and did not make any difference (B = 0.091, AOR = 1.095, p = .206, 95% CI [0.951, 1.261]).

Table 12

Results of Regression Predicting Availability of Healthcare Facility for Followup Care

Variable	Beta	SE	95% CI for OR						
			LL	*UL*	*AOR Exp(B)*	*P*	*Chi-square (p)*	R^2	ΔR2
Step 1							0.001	0.014	0.005
Availability of Healthcare Facilities (Big problem)	- 0.007	0.062	0.879	1.123	0.993	0.915			
Household income category (Rich)						.001			
Middle income	-0.137	0.078	0.748	1.016	0.872	0.080			
Poor income	-0.414	0.093	0.551	0.793	0.661	.001			
Mothers' education level (Higher)						.001			
Primary		0.080	0.815	1.117	0.954				

	-0.047					.556
Secondary	-0.392	0.080	0.578	0.791	0.676	< .001
No formal education	-0.454	0.144	0.479	0.842	0.635	.002
Geographical Location Urban)	0.091	0.072	0.951	1.261	1.095	.206
Constant	-2.443	0.050			0.087	0.001

Assessing the Final Model

The six predictor variables influencing PPM among children under 5 years old in Nigeria were entered into a multivariate logistic regression model. They include availability of healthcare facilities for followup care, geographical location, mothers' age, timely followup visits, household income, and mothers' education. Moreso, the final multivariate logistic regression model that is made up of all six categorical predicting variable was statistically significant, [$\chi^2(6, N = 21,671) = 164.91, p < .001$], indicating that the combined predictors were able to distinguish between children who were "Alive = 0" and "Dead = 1" after hospital discharge.

The results of the MLR model in Table 13 showed that between 0.8% Cox & Snell R^2 (0.008 x 100) and 2.0% Nagelkerke R^2 (0.020x100) of the variance in PPM was explained by the six predictor variables in the model, and correctly classified 100% of overall cases. The Omnibus Tests of Model Coefficients confirms that the MLR model fits the data adequately (Hosmer and Lemeshow goodness-of-fit test = 15.258, df = 8, p = 0.054).

Table 13

Predictive Model on PPM for MLR

Model Fits Information					Pseudo R-squared		
Model	- 2 Log Likelihood	Chi-Square	*df*	*p*	Cox & Snell	Nagelkerke	Hosmer and Lemeshow Test
Final Model	9944.041	164.908	6	< .001	0.008	0.020	(χ^2 = 15.258, df = 8, p = 0.054)

The results from the analysis demonstrated that some independent variables were 8statistically significant on PPM among children under 5 years old, while others were revealed to be non-statistically significant. Specifically, the independent variables, such as household income, mothers' age, individual timely followup visits, and mothers' education, demonstrated significant associations with PPM, resulting in the rejection of their null hypotheses, respectively. On the other hand, the independent variables, including the availability of healthcare facilities for followup care and geographical location, showed no significant association with PPM among children under 5 years old, and thus their null hypotheses were not rejected.

Summary

In chapter 4, study results on whether there is a significant association or not between timely individual followup visits, the availability of healthcare facilities for followup care, household income, geographical location, mothers' education, mothers' age, and the likelihood of PPM among children under 5 years old will be discussed. Descriptive analysis, Chi-square test, along with the simple logistic analysis and MLR,

were used to answer the study's research questions/hypotheses. All results presented showed that four out of the six predictive variables (mothers' age, individual timely followup visits, household income, and mothers' education) have a significant association with the outcome variable (postdischarge mortality) at a p-value < 0.05.

In Chapter 5, the interpretation of the study's findings, including the study's limitations, recommendations, the implications of the findings for positive social change, and a conclusion in the community, along with areas for further studies, will be presented.

Chapter 5: Discussion, Conclusions, and Recommendations

The study was conducted to address a gap in literature on postdischarge pediatric research among children under 5 in Nigeria, and why this population remains at increased risk of death following hospital discharge. I explored timely followup care, healthcare infrastructure, socioeconomic conditions, and community health interventions to understand better contributions to PPM among this population. The theoretical framework underlying the study is Urie Bronfenbrenner's SEM. I analyzed the children's recode dataset from the 2018 NDHS survey using SPSS version 28, followed by univariate, bivariate, and MLR analyses. In this chapter, the purpose of this study, along with detailed interpretations of results during data analysis process are discussed. The chapter concludes with areas for future research, a discussion of limitations of this study to help determine answers to research questions, a summary, and implications for positive social change.

Nigerian children who are discharged from hospitals in the poorest areas often fall ill and die months later due to a lack of postdischarge care. In addition, malaria, anemia, and malnutrition are responsible for high rates of in-hospital child mortality in Nigeria and other low-resource countries (Chaudhry et al., 2023; Knappett et al., 2024; Midtgaard et al., 2021; Nemetchek et al., 2018;).

This chapter includes a discussion of two research questions:

RQ1: Is there an association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education?

$H_0$1: There is no association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education.

H_a1: There is an association between timely individual followup visits and likelihood of PPM when controlling for household income, mothers' age, and mothers' education.

RQ2: Is there an association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels?

$H_0$2: There is no association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels.

H_a2: There is an association between availability of healthcare facilities for followup care and likelihood of PPM in low-income areas of Nigeria when controlling for household income, geographical location, and caregivers' education levels.

Interpretation of the Findings

This section includes interpretations of data results and findings from Chapter 4. It is structured based on two research questions and hypotheses.

Based on data results, I found timely followup visits, mothers' age, mothers' education level, and family income all had strong effects on whether Nigerian children under 5 survived after leaving hospitals. Additionally, children who received timely

followup visits were 45.0% less likely to die after discharge than those who did not receive any visits either from healthcare providers or via visits to health centers. Children who come from wealthier households and those with mothers who had secondary or higher education experiences had lower odds of PPM. Geographical location and availability of healthcare facilities for followup care showed no significant associations with PPM. Overall, data revealed while healthcare access factors and their availability were important, it did not guarantee use. Socioeconomic factors and secondary or higher education among parents played a more important role in determining child survival after hospital discharge and improved pediatric healthcare.

Research Questions

Research questions were used to identify if timely individual followup visits and availability of healthcare facilities for followup care were associated with PPM and identify if confounding variables (household income, mothers' age, mothers' education, and geographical location) independently affected outcomes. Only 3.9% of children with timely followup visits died, compared to 6.8% of those without followup visits, revealing early postdischarge visits and care can significantly reduce risk of deaths among this population, even when accounting for confounding variables. Mothers of children who reported they had problems going to clinics because health facilities were not available for followup visits after being discharged were 15% more likely to die than those whose mothers did not report access problems. After controlling for mothers' education, household income, and geographical location (urban or rural), 6.8% of children in the big problem group died, compared to 6.0% in the not a big problem group, indicating

challenges involved with accessing care may not independently drive child deaths, but rather result from broader socioeconomic barriers, like poverty or caregivers' lack of education.

Timely Individual Followup Visits of Children

The study's findings showed that children whose parents reported a timely individual followup visit after the initial hospitalization had a significant effect on PPM. A timely followup visit among children under 5 years old after being discharged from the hospital within the recommended time (up to 6 weeks) had significantly lower odds of PPM. They were 45% less likely to die compared with those who did not receive such followup care. This finding agrees with the results from similar cohort and intervention studies that showed structured postdischarge followup reduces later illnesses and mortality in low-resource settings (Ashraf et al., 2014; English et al., 2016; Wiens et al., 2016a; Wiens et al., 2021b; Kwambai et al., 2023). The authors explained that when complications like fever, respiratory distress, or trouble breathing were detected early during followup visits, children were more likely to survive. In contrast, when there was no structured postdischarge care, especially for children with serious illnesses, the risk of dying within six months was much higher (Ashraf et al., 2014; Kwambai et al., 2023; Wiens et al., 2016a; Wiens et al., 2021b). In Uganda and Kenya, prior studies conducted confirm the findings that parents who have taken their children for followup visits within days and weeks soon after leaving the hospital were significantly associated with improved survival rates in low- and middle-income countries (Wiens et al., 2016a; Wiens et al., 2021b; Kwambai et al., 2023; Chaudhry et al., 2023).

Around the globe, this finding agrees with the WHO's guidelines and policies on PPM, which recommend that children be seen again by health workers within 48–72 hours, at 2 weeks, and again at 6 weeks after they leave the hospital (WHO, 2023). This study confirms that following these guidelines helps save lives, especially in low-income countries like Nigeria, where postdischarge deaths are common but often not reported. Moreso, these results also match findings from other studies that documented that many children die at home from preventable causes like malnutrition, infections, or anemia after being discharged from the hospital (Ashraf et al.,2014; Nemetchek et al.,2018). Therefore, this study adds new information by using national data to show that even after considering factors like mothers' age, mothers' education, and household income, followup visits still significantly reduce the chance of a child dying, especially from low- and middle-income countries (LMIC).

Availability of Healthcare Facilities for Followup Care

The availability of healthcare facilities suitable for followup care has no significant effect on PPM after considering sociodemographic factors like household income, mothers' educational level, and family residence. There were 0.7% higher odds of survival among children under 5 years old whose mothers reported that a health facility was available, compared to those without healthcare facilities suitable for follow-up care. However, this effect had no impact on the likelihood of a child dying after discharge from the hospital. This finding explains that even though most mothers reported a nearby health facility, this study shows that having a clinic or hospital nearby does not guarantee that children get the followup care they need. Since the data were

from the Nigeria Demographic Health Survey (NDHS), challenges like long wait times, poor service, lack of transport, or out-of-pocket costs may prevent families from returning for care (NPC & ICF Macro, 2018). This study's findings are not consistent with other studies conducted in different LMICs, which often report that access to healthcare services improves child health outcomes, including several studies reviewed in Chapter 2 that associated facility density, readiness, and proximity of place of residency to improved neonatal/child survival (Adeoti & Cavallaro, 2022; Fagbamigbe & Nnanatu, 2022; Getzzg, 2022; Karra et al., 2017; Zeng & Niu, 2023). For example, results from Bangladesh a country in South Asia and spatial analysis in sub-Saharan Africa suggested mortality declines when basic child health services are available within modest travel distance (Getzzg, 2022; Karra et al., 2017). Zeng and Niu (2023) found that children living near healthcare facilities were more likely to survive postdischarge in Bangladesh. Similarly, Adeoti and Cavallaro (2022) reported that proximity to health facilities was associated with lower child mortality in sub-Saharan Africa. Although the 2018 NDHS reported that health service availability varied across geopolitical zones, with some areas more underserved than others, this study's finding suggests that structural availability alone may be insufficient to improve outcomes (NPC & ICF, 2019). In this present study, controlling for other factors (like geographical location, family income, and mothers' education) disconfirms the expectation that structural availability alone predicts better postdischarge survival in Nigeria or significantly reduces the risk of death among recently discharged children.

Several factors may explain this difference from other studies, such as why the presence of a facility does not guarantee the availability of essential services or quality care. Fagbamigbe and Nnanatu (2022) documented that many health centers in Nigeria, especially in rural areas, are poorly equipped, understaffed, or operate intermittently. Also, factors like cost of transport, paying out of pocket, and low health-seeking behaviors may still prevent access, even if health facilities are available within range. These barriers are common in resource-limited settings, where families often face significant challenges in utilizing followup care (Kruk et al., 2018). Therefore, based on these study findings, the impact may rely more on strengthening referral systems and addressing socio-economic and cultural barriers to followup care after hospital discharge than on their physical infrastructure and presence.

Household Income of Parents/Caregivers

Household income status is another factor influencing the PPM. This study's findings showed that increasing household income was significantly associated with progressively lower odds of PPM relative to the poorest category among children under 5 years old. Children from the poorest homes recorded the highest proportion of those who are more likely to die after being discharged (34%) compared to children from wealthy households. The poorer the family, the higher the chance that the child may not survive after leaving the hospital. Families or households with the lowest income had the highest rates of child deaths after discharge, while families with the highest income had the lowest PPM. These findings are consistent with a similar one from a study in multicounty and in Nigeria, which showed evidence associating poverty to the likelihood of higher

child mortality and lower rates of seeking medical help after hospital discharge (Yaya et al., 2017; English et al., 2016; Okoli et al., 2022; Afolabi & Oke, 2023). Similarly, Kwambai et al. (2023) reported that children under 5 years old from the poorest one-third of households had the highest risk of dying within six months after being discharged from the hospital.

Earlier research has shown that poverty is a major reason why children in LMICs like Nigeria often do not survive past their fifth birthday. For example, in Nigeria, a study found that children in wealthier homes were more likely to live because they had better access to healthcare services and basic health resources (Yaya et al., 2017). Okoli et al. (2022) documented that poorer families lack money and are more likely to delay or skip important followup care for their children, which can make their children's fevers worse. These study findings strengthen these earlier results because they focus mainly on the time after hospital discharge, a critical period often overlooked in child health research. Additionally, Kwambai et al. (2023) conducted research across sub-Saharan Africa, and they reported that children from poor families are more likely to die after leaving the hospital. This researcher's findings are in alignment with what was found in this study, which showed that richer families are better able to purchase recommended medicines, maintain safer home environments (sanitation, food security), and have higher maternal literacy (English et al., 2016; Nemetchek et al., 2018; Kwambai et al., 2023).

Educational Level of Parents/Caregivers

This study revealed that a mother's educational level has a significant effect on the likelihood of postdischarge mortality among children under 5 years old. Mother's

education (secondary or higher) was significantly associated with reduced odds of PPM compared with no or low education. Children of mothers with secondary education were 24% less likely to die after hospital discharge compared to those of mothers with no formal education. Also, children whose mothers had higher education had 30% lower odds of PPM. Also, these results agree with a study conducted in Kenya, a country in East Africa, where researchers found that lower mothers' education was associated with increased postdischarge mortality (Kwambai et al.,2023). Yaya et al. (2017) also reported a graded reduction in child mortality risk as mothers' educational level increased in Nigeria. Adeoti and Cavallaro (2022) argued that a mother's education predicts child survival postdischarge more than household income in some LMICs. Additionally, Fagbamigbe and Nnanatu (2022) and Okoli et al. (2022) documented how maternal education enhances the likelihood of appropriate care-seeking behaviors, including timely followup visits, which is an important mediating pathway that agrees with the findings in the present study.

These results strongly confirm extensive evidence showing that mothers' education predicts care-seeking, preventive practice adoption, and child survival across LMICs and within Nigeria (Adeoti & Cavallaro, 2022; Fagbamigbe & Nnanatu, 2022; Kwambai et al., 2023; Okoli et al., 2022; Yaya et al., 2017). Several studies reported sizeable mortality reductions with increasing levels of mothers' education, even after accounting for income (Yaya et al., 2017; Kwambai et al., 2023). These present findings agreed with a study conducted globally, which revealed that educated mothers are more likely to notice warning signs, follow hospital instructions, ensure their children get

vaccinated, and know where to go if their child gets sick again (Wiens et al., 2021; Kwambai et al., 2023). Nevertheless, this study's results show that by focusing particularly on child mortality after hospital discharge, mothers' education continues to play a crucial role in keeping children alive. Research argued that higher education empowers mothers to talk confidently with healthcare providers when in the hospital, enables them to understand health literacy, and makes better decisions (Okoli et al., 2022). Therefore, these findings are helpful, especially in regions where early marriage and low female schooling reduce a mother's ability to take charge of her child's health.

Parents/Caregiver Age

There is a significant relationship between the age of caregivers/mothers and the likelihood of PPM. Children whose mothers were 35 to 49 years old were 36% more likely to die after hospital discharge compared to those whose mothers were 15 to 24 years old. Similarly, children of mothers aged 25 to 34 years had 13% lower odds of dying than those of the youngest mothers. However, the result showed that this difference was not statistically significant, suggesting that it could have happened by chance. This finding supports similar ones from other studies that documented younger mothers (adolescent motherhood) had weaker care-seeking attitudes for their child under 5 years old and had a higher likelihood of having their child die (Diallo et al., 2021; Ojewumi, 2023; Okoli et al., 2022). Yaya et al. (2017) reported that when older mothers gave birth to their first child, they usually did not die, but in some other parts of their study, they found that as parents got older in general, the risk of a child dying was higher. They noticed that this death was increasing among older parents because these mothers tend to

have more children or face more health and caregiving challenges over time (Yaya et al., 2017). At the same time, other studies have noticed a U-shaped association, where both very young and much older mothers are more likely to have children who die due to tiredness from many years of parenting or their health problems, which can affect their ability to provide followup care (Yaya et al., 2017; Knappett et al., 2024). So, both very young and older mothers can increase a child's risk of dying after discharge. Nonetheless, after controlling for the covariates, this research result found that very young mothers are disadvantaged, confirming concerns raised in the Nigerian context regarding early marriage and limited caregiving experience among adolescent females (Okoli et al., 2022; Ojewumi, 2023).

Rural and Urban Geographical Location

Geographical location has no statistically significant relationship with PPM among children under 5 years old when other confounding factors were taken into account. The descriptive analysis revealed that the children whose parents live in rural areas have a slightly higher postdischarge death rate. However, in this study, after adjusting for other important factors like household income, mothers' education, and timely followup visits, findings show that children living in urban areas had only 9.5% higher odds of PPM compared to those in rural areas, and this difference was not statistically significant. This study's findings, therefore, revealed that the location (rural vs. urban) no longer made a significant difference in whether a child lived or died after being discharged from the hospital. Prior studies have found that where a child lives, whether in a rural or urban area, usually affects their chances of surviving, especially in

Nigeria. For example, some studies suggested that children living in rural areas or the northern part of the country tend to have a higher risk of dying because they are farther from health centers, have fewer trained health workers nearby, or face transportation challenges when seeking care (Okoli et al., 2022; Yaya et al., 2017; Afolabi & Oke, 2023). The NDHS 2018 showed that child survival and healthcare utilization outcomes often vary across Nigeria's six geopolitical zones, with the northern zones generally experiencing poorer child health outcomes (NPC & ICF, 2019). This study disconfirms the usual assumption that rural children are automatically at higher risk. Instead, it extends our understanding by showing that it is not just about where people live, but more about what resources and support they have, like money, education, and followup care.

Interpretation of the Findings

I used the SEM to organize variables at individual, family, community, and policy levels, to explain how all these multi-layers work together to influence child survival after hospital discharge

The study's analysis supports earlier literature by revealing that caregivers' characteristics, such as mothers' age and mothers' education, significantly impacts whether some children, particularly children under 5 will be alive after they go home following hospital discharge (Adeoti & Cavallaro, 2022; Ojewumi, 2023; Kwambai et al., 2023). In line with SEM, education improves symptom recognition and care-seeking, and younger mothers face barriers to seeking followup care. Also, mothers' age functions across the intrapersonal level, where younger mothers may lack experiential knowledge

or confidence to detect postdischarge danger signs and navigate the healthcare system. They may also have limited education or exposure to health information. The secondary dataset analysis by various authors showed that at the interpersonal, community, and policy levels, older mothers may carry disproportionate caregiving burdens, have more children to care for, or experience reduced physical capacity, affecting followup behaviors. While in some regions of Nigeria, especially in the North, cultural norms around early marriage and adolescent motherhood (marriage by age 13 and above) further constrain maternal agency and health-seeking behaviors (Okoli et al., 2022). Both variables are significantly associated with mortality, confirming that caregiver knowledge and experience matter in the postdischarge period.

Within the context of improving child survival, all layers of a child's environment, ranging from individual caregivers to broader health system structures, do influence the survival or death of children under 5 years old in the postdischarge period. In line with the SEM, interpersonal and household-level factors such as family income and timely followup care practices had a significant association with the likelihood of PPM. This finding agrees with the studies conducted, where the researchers argued that timely caregiver seeking and initiated followupvisits reduced late morbidity and mortality in poor income areas (Wiens et al.,22016; Ashraf et al.,2014). Similarly, children from poor households face economic barriers, which remain a challenging factor for followup care and result in PPM (Yaya et al.,2017; English et al.,2016).

In addition, although previous studies have shown that residing very close to functioning healthcare facilities and urban residence are associated with better child

health survival outcomes in line with the community level, the present findings revealed no statistically significant association between these structural indicators and PPM (Karra et al., 2017; Getzgg, 2022). Also, this analysis simply means that having a health facility nearby does not guarantee utilization of health (access) or improved outcomes unless caregivers are empowered with the knowledge and resources to demand for those services. This study's findings further support the SEM's statements that interventions must connect multiple levels of influence to be effective and achieve the outcome. Although the societal or macrosystem level was not directly measured in this study, results show their indirect effect on systemic inequities, particularly in rural and economically disadvantaged areas. For example, children under 5 years old whose families reside in rural regions in the country face financial and economic hardship not only because of the distance to where they live but also due to broader and wider systemic issues like poorly funded health systems (Oladimeji et al., 2022; Afolabi & Oke, 2023).

Finally, the study showed that relationship-level factors, particularly mothers' education and household income, are strongly associated with PPM. This confirms the role of relationship-level SEM components in improving uptake of life-saving post-hospitalization behaviors. Strengthening household economic conditions and promoting mothers' education are likely to reduce child mortality, as shown in the multivariate model, where households with higher incomes had significantly better child survival outcomes. Nonetheless, improving intrapersonal and interpersonal factors such as mothers' knowledge, caregiver engagement, and financial capacity may be the most

effective strategy for reducing PPM in Nigeria. Therefore, after hospital discharge, a child's survival depends on a series of different connected steps which includes: the caregiver's ability to recognize danger signs and respond appropriately (intrapersonal), the support and resources available within the home (interpersonal/household), the ability to access and receive timely care from nearby health services (community/organizational), and the policies and systems that ensure those services are adequately funded and staffed (societal). In this study, the biggest gaps appeared in the first two steps, caregiver knowledge and household means, which were the strongest predictors of PPM even when health facilities were present. This highlights the SEM's guidance that efforts to reduce child deaths should begin by improving caregiver education and easing the economic barriers that limit action after discharge.

Limitations of the Study

The study sample population was limited to children treated and discharged from government public hospitals and was not representative of the Nigerian population. This study excluded children under 5 years old treated and discharged from private hospitals, those who never accessed formal care, who may have been due to poverty, and those who died at home without contact with health services. In addition, this study relied on secondary datasets from the NDHS, and the DHS studies are common globally because they are reliable and trusted by researchers. However, the use of secondary datasets usually has some limitations, such as missing key variables (illness severity at discharge, quality of care, and timeliness of follow-up) since they were not collected for any study, including challenges to control for confounders identified by prior literature (distance to

facility, caregiver health literacy, or discharge instructions, was not possible), for which was not originally designed to measure PPM.

During the original data collection process, known as the primary data collection stage, it is possible that important variables were not captured, especially if reporting biases (social desirability, recall bias) were present during this stage (Smith et al., 2011). In addition, these limitations may compromise the trustworthiness of the data, including the study's findings, and deaths that occurred after discharge may not have been accurately linked to hospital stays or illnesses, as cause-of-death data were not captured in the DHS. A prospective study using primary data could allow for causality rather than using a cross-sectional design. The cross-sectional design prevents establishing a causal relationship between thefollowup care, socio-demographic factors, and the likelihood of PPM among Nigerian children under 5 years old. One of the fundamental points to note in this study was the recognition that the independent variable (timely followup care and healthcare facility availability) was measured using available DHS variables that may not fully capture the actual postdischarge care quality or timing. Therefore, these limitations identified the need for further research using longitudinal, facility-linked data to build on the findings of this study.

Recommendations

The limitations highlighted in this study provide opportunities for future research, including exploring and including data omitted on some essential factors during the primary data collection process of the 2018 NDHS. Although researchers use the DHS globally and it is considered a nationally representative sample of the population, it may

not have captured all relevant variables influencing child outcomes after hospital discharge, such as cultural beliefs, caregiver perceptions, or the quality and timing of discharge instructions in Nigeria. So, in this case, the recommendation is to conduct a mixed-methods approach (quantitative and qualitative study) where the researchers are personally involved in collecting the data, exploring the lived experiences of caregivers, healthcare providers, and community health workers regarding barriers to postdischarge followup care. In addition, conducting a quantitative and qualitative study is usually expensive and time-consuming. On the other hand, the result is likely to yield better insights and clarify why some caregivers fail to return for followup or miss danger signs at home, thus complementing the quantitative associations observed in this study in Nigeria.

Furthermore, most recent research on PPM in Nigeria, including this study, derives its evidence from household surveys or hospital-based records. However, community-based longitudinal studies tracking recently discharged children over time, like 30 to 90 days postdischarge, are urgently needed in Nigeria. In this case, such research designs would allow researchers to pinpoint the exact causes, timing, and circumstances of postdischarge deaths that occur outside hospital settings, where most PPM events remain often neglected and undocumented. In this regard, policymakers, pediatric researchers, and stakeholders could use the findings to plan and implement community-based interventions to assess the impact of community health worker (CHW) programs, mobile health (mHealth) followup reminders, and caregiver education initiatives on reducing PPM in Nigeria. The government, especially at the district level

and ward level (local government areas), could find the study's result helpful to strengthen focus on hospital-to-home transition pathways, optimize healthcare infrastructure placement, improve emergency transport systems for rural communities including evaluations of discharge planning quality, referral systems, and the availability of postdischarge counseling, especially in primary healthcare centers in rural communities. The academic field could benefit from the findings because it focused specifically on postdischarge mortality among children under 5 years old in Nigeria, which consistently contributes to the high number of child mortality in Africa, from the 5 million who died in 2020 alone in poor-income countries (WHO, 2023). Since this study focused on children aged 0–59 months in Nigeria as a whole, if effectively implemented, the recommendations could help enhance access to healthcare services in high-burden areas particularly northern states and regions, where structural inequities, sociocultural norms, and access to healthcare differ considerably, including generating more tailored and actionable recommendations to reduce PPM in regions with persistently high child mortality rates. Policymakers, government officials, and other stakeholders could rely on the study's empirical evidence to make informed decisions that affect the vulnerable populations of children and women. Therefore, government officials, public health officials, policymakers, and other key decision-makers can rely on the study's findings to make better evidence-based decisions that help protect the well-being of vulnerable groups, such as children and women.

Implications for Social Change

The contributing factor to the continued risk of mortality following hospital discharge among Nigerian children under 5 years old has remained largely underexplored. The study could be described as the first to explore PPM in Nigeria, focusing on children under 5 years of age using a cross-sectional retrospective analysis of 2018 NDHS secondary datasets. The body of research will contribute to identifying major factors that may influence child mortality after hospital discharge in Nigeria, a subject underexplored in Nigeria's public health research, and transform postdischarge care from a neglected issue into a national health priority.

The findings of this study have strong potential to contribute to positive social change as they identify key barriers like inadequate followup care, poor maternal education, and poor use of available healthcare services associated with PPM among children under 5 years old in Nigeria, particularly in socioeconomically disadvantaged communities. Given that Nigeria is one of the leading contributors to global child mortality, the study's findings may help inform policies and programs aimed at strengthening followup care, reducing preventable child deaths after hospital discharge, including support for health system strengthening and community-based interventions to address the gaps in postdischarge pediatric care.

Furthermore, the efforts to use results to improve child survival outcomes at the individual and family levels must include increasing awareness through health talks and mass media among caregivers about the importance of followup care after hospital discharge, especially in recognizing danger signs post-hospital discharge and adhering to

care recommendations. In addition, the findings theoretically affirm the relevance of the Socioecological Model (SEM) in understanding how individual, interpersonal, community, and system-level factors interact to influence child health outcomes beyond the hospital setting. This study provides important evidence on the factors associated with PPM among children under 5 years old in Nigeria, particularly in socioeconomically disadvantaged communities. By identifying key barriers such as inadequate followup care, limited maternal education, and poor healthcare access, the findings have strong potential to contribute to positive social change at multiple levels—individual, family, organizational, and societal. This result must provide practical guidelines at the organizational level to healthcare providers in primary care and pediatric settings on clear, targeted interventions such as home-based followup programs, health worker training on discharge counseling, and strategies for community outreaches, especially in rural areas where children are at greater risk of dying after discharge. Partners in these efforts to improve postdischarge care and child survival at the societal and policy level should include State Primary Health Care Agencies (SPHCA), Nigeria‘s National Primary Health Care Development Agency (NPHCDA), the Federal Ministry of Health (moH), other government partners, civil society organizations (CSOs), local community leaders (traditional, religious, youths, women groups), and bilateral and multilateral partners in health in Nigeria. Also, at this societal level, efforts must provide a basis for public health practitioners and policymakers to design programs that address social determinants of health, such as maternal education and household income, that significantly affect children’s survival. However, assuming many Nigerian children in the

population under 5 years old continue to die after being discharged from healthcare facilities due to inadequatefollowup care, poor caregiver awareness, and limited access to services, the burden of preventable child mortality will continue to surge higher. The potential for positive social change lies in the need for policies and interventions aimed at public health interventions that prioritize followup care for children from low-income households, particularly those living in underserved rural communities, children from low-income households in underserved regions, whose families often lack the education, resources, or support systems necessary to ensure continued care after discharge, and enhance the quality of life for families in Nigeria and similar low-income countries.

Conclusion

Since the 20th century, child survival has consistently improved chiefly due to effective implementation of public health interventions, advances in medical care, which are linked to economic growth at micro- and macro-levels, better female education, lower fertility rates, and stronger public health programs at global, regional, and national levels (Yaya et al., 2018). Currently, children discharged after acute illness face significantly high mortality, often driven by factors such as malnutrition, anemia, socioeconomic, political, cultural, and lack of followup care factors (Vallejo-Torres & Gonzalez Lopez-Valcarcel, 2022). However, Nigeria and low-income countries continue to experience increasing child mortality. Nigeria is a country in West Africa that accounts for nearly one-third (5 million under-5 deaths) of all child deaths in sub-Saharan Africa. Moreso, in the 2018 NDHS, only children from low-income households, those with

uneducated mothers, and those who did not receive timely followup care were disproportionately more likely to die after discharge, highlighting a critical gap in PPM in Nigeria. While much attention and research have been frequently done on in-hospital deaths, factors associated with the likelihood of PPM among children under 5 years old in Nigeria that occur often at home and without further contact with the health system have never been explored. Also, the research study investigates the factors associated with PPM among Nigerian children under 5 years old, utilizing a retrospective cross-sectional analysis from the children recode dataset 2018 NDHS.

Furthermore, the study findings identified a significant association between PPM and timely followup care, mothers' education, mothers' age, household income, and rural residence in Nigeria. In addition, Up-to-date, comprehensive postdischarge pediatric care is recognized as a cost-effective, life-saving strategy for achieving child health equity in Nigeria. It is important to note that long-term child health care depends on what happens after the child leaves the healthcare facility, even though hospital-based care is essential for immediate survival. As most developed countries have invested in caregiver education, routine followup visits, and community health worker programs with some countries having individual family doctors who do followup visits at home, Nigerian citizens need to do same and step up their demands for the right political will, coordinated public health strategies, and community engagement, so many of these postdischarge deaths can be prevented in the country. It is critical that Nigeria cannot afford to continue losing children after treatment has already been initiated, especially in poor, rural areas. Therefore, there is an urgent need to strengthen postdischarge followup

systems in Nigeria's pediatric healthcare delivery, which is important in reducing under 5 mortality and improving the overall well-being of families.

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