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Master's Thesis of Public Health

Effects of Maternal Empowerment on Childhood Vaccination Completion in Nigeria

모성 임파워먼트가 나이지리아 아동 백신 접종에 미치는 영향

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Effects of Maternal Empowerment on Childhood Vaccination Completion in Nigeria

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Submitting a master's thesis of
Public Health

August 2023

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Abstract

Introduction: The Expanded Program on Immunization (EPI) has been implemented globally to safeguard the population from vaccine-preventable diseases. However, the percentage of children completing the recommended vaccination schedule remains low, particularly in Low and Middle Income Countries (LMICs) such as Nigeria. Nigeria stands as one of the five countries responsible for two-thirds of the global population of unvaccinated children. Moreover, the country's under-5 mortality rate remains alarmingly high, with a rate of 132 per 1,000 children. Given these circumstances, it becomes crucial to enhance immunization rates in Nigeria in order to improve the overall health outcomes for its children. In the context of Nigeria, maternal empowerment assumes significant importance regarding child immunization. Maternal empowerment refers to the process of augmenting women's decision-making power and autonomy in matters pertaining to their reproductive health (Kabeer, 1999). Nigeria, being a patriarchal society, often imposes societal norms that limit women's decision-making authority and restrict their access to vital resources (Oni et al., 2018). Consequently, addressing maternal empowerment becomes integral to improving child immunization rates in Nigeria. This study aims to examine the relationship between maternal empowerment and child vaccination coverage in Nigeria. The findings can offer insight into effective health interventions to improve child vaccination coverage in Nigeria and contribute to global health policy implications for other African countries.

Methods: This study aims to explore the effect of maternal empowerment on childhood vaccination in Nigeria by analyzing data from the 2018 Nigerian Demographic and Health Survey (NDHS), specifically focusing on children aged 13 to 59 months who are expected to receive all nine doses of the EPI-recommended vaccination in their first year of life in Nigeria. The study initiated

with correlation analysis among subdomains of the Survey-based Women's emPowERment (SWPER) index and several control variables. Ordinal variables, including age of mother, maternal education, paternal education, wealth index, and age of child, were assessed via Spearman's correlation test. Meanwhile, categorical variables like place of residence and place of delivery were scrutinized using Cramer's V correlation test. Subsequent to the correlation analysis, the Wald Chi-square test was employed to evaluate differences in children's vaccination completion statuses. Finally, the study used logistic binomial regression analysis to assess the impact of Nigerian maternal empowerment on childhood vaccination completion, while controlling for key influencing factors. This comprehensive methodological approach was designed to illuminate the factors affecting childhood vaccination, especially the role of women's empowerment. The dependent variable is a binomial variable indicating completion of all nine doses of the EPI-recommended vaccination in Nigeria in the first year of life, with a score of 1 indicating completion of all nine doses and 0 indicating otherwise. The explanatory variables are three subdomains of SWPER, an indicator designed to calculate maternal empowerment using Demographic and Health Survey (DHS) data from low-income countries, developed by Ewerling. Each domain of SWPER (attitude to violence, social independence and decision-making) is divided into 3 categories representing 'Low,' 'Medium,' and 'High' levels of maternal empowerment. This model also controls for variables that may affect children's vaccination administration, based on previous studies and Nigerian DHS data. Descriptive analysis was performed via categorical classification of all explanatory variables and control variables. The statistical analysis was conducted using Stata version 17.0, with national weights provided by DHS assigned prior to significance level analysis. The 0.05 criterion was used in this study.

Results: Correlation analysis revealed significant associations among the SWPER subdomains ($p<0.05$), while relationships between SWPER subdomains and control variables varied, with some showing significant correlations. Two control variables, maternal education and wealth index, were notably distinct in their strong correlations with the SWPER subdomains. Following this, the Chi-square test confirmed that the significant associations between all variables, including the three SWPER domains and control variables. Lastly, logistic analysis indicated that the decision-making domain demonstrated significant results at 'High' maternal empowerment. Positive associations with childhood vaccination coverage were observed at 'Medium' and 'High' levels across all three SWPER subdomains (attitude to violence, social independence and decision-making). A positive trend and direction from 'Low' to 'High' levels further supported these findings.

Discussion: This study illuminates the substantial role of maternal empowerment, particularly decision-making, in childhood vaccination in Nigeria. There was an interconnectedness among various aspects of maternal empowerment. Notably, improvements in decision-making are associated with advancements in other areas. Despite these interconnections, decision-making prowess emerged as a particularly strong predictor of vaccination completion, supporting previous research findings. The study also uncovers the complexity of women's empowerment within a broad socioeconomic context, as evidenced by the diverse interactions between SWPER subdomains and control variables. Therefore, interventions aimed at enhancing vaccination coverage should prioritize bolstering women's decision-making capabilities through education, income-generating initiatives, and resource provision. Addressing gender-based violence and enhancing healthcare access through strengthened health systems are equally important. However, the study carries certain limitations. It is based on 2018 Nigeria DHS data and employs the SWPER index, which may lean more towards perceptions than actual behaviors. The study also relies on self-

reported data, introducing potential recall bias. While comprehensive, other unexplored factors could influence childhood vaccination in Nigeria. Moreover, the study's focus on vaccination completion limits its broader implications for child health improvement. Future research should seek to address these limitations and further explore the impact of maternal empowerment on child health.

Conclusion: This study examines the relationship between maternal empowerment and childhood vaccination coverage in Nigeria, emphasizing the importance of decision-making. Proposed interventions, including training sessions for women and workshops on violence prevention, show promise for improving maternal empowerment and child health outcomes. Further research is needed to determine applicability in other LMICs. These findings contribute to the field of global health, highlighting the significance of maternal empowerment in addressing childhood vaccination challenges. Policymakers and healthcare providers can use these insights to design targeted interventions for better maternal and child health outcomes.

Keyword: Maternal Empowerment, Childhood Vaccination, Childhood Health, NDHS, Nigeria, Logistic Regression
Student Number: 2021-24645

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Chapter 1. Introduction

1.1. Background

1.1.1. Childhood Vaccination

Childhood vaccination is a globally recognized strategy for reducing disease morbidity and mortality in children and has been saving 2 to 3 million lives annually (Cui et al., 2007). In 1974, the World Health Organization (WHO) launched the Expanded Program on Immunization (EPI) to protect humans from diseases such as Tuberculosis, Tetanus, Pertussis, Measles, and Polio (WHO, 2016). This initiative aimed to make vaccines accessible to all children, regardless of their socioeconomic status or geographic location (WHO, 2016).

Childhood vaccination plays a vital role in reducing the burden of infectious diseases and improving the overall health of communities. By protecting children from vaccine-preventable diseases, immunization programs can prevent the spread of the diseases and reduce the risk of outbreaks (Andre et al., 2008). Furthermore, vaccination helps to reduce the overall economic burden on healthcare systems by preventing expensive treatments and hospitalizations (Ozawa et al., 2016).

The Global Alliance for Vaccines and Immunization (GAVI) was established in 2000, with significant contributions by the Bill & Melinda Gates Foundation (BMGF), to accelerate access to vaccines in low-income countries and improve immunization coverage (GAVI, 2019). As a result of these efforts, the coverage of vaccinations increased from 45% in the 1990s to 62% in 2018 (WHO, 2018). Vaccination with the EPI is considered a mandatory and cost-effective way to maintain morbidity and progression from early childhood worldwide and is part of the World Health Organization's strategy to achieve health for all by the year 2000 (WHO, 2016).

Despite the progress made, around 19.4 million infants and young children around the world still miss out on the recommended

primary vaccinations, leading to preventable deaths in newborns and children under 5 years of age (WHO & UNICEF, 2017). Sub-Saharan African countries, despite having the highest childhood vaccination rate, continue to have a significant number of children affected by preventable diseases (WHO, 2020). Factors contributing to the low vaccination rates include inadequate healthcare infrastructure, lack of access to healthcare services, and vaccine hesitancy among parents and communities (Larson et al., 2014).

Zero-dose children, who have not received a single dose of any vaccine including Celiac, Diphtheria, Tetanus and Pertussis, are a major concern for GAVI, and reducing the number of unvaccinated children by 25% by 2020 and by 50% by 2030 is a significant goal in GAVI's 2021-2025 strategy document (GAVI, 2021). Given that most of the actual causes of childhood diseases can be prevented through childhood vaccination (WHO, 2016), timely vaccination is crucial for protecting children, and anti-vaccination activities are a growing concern for major international institutions.

Childhood vaccination remains a critical component of global health strategies aimed at reducing morbidity and mortality among children. The collaborative efforts of organizations like WHO and GAVI have led to substantial progress in increasing vaccination coverage. However, there are still millions of children worldwide who remain unprotected from vaccine-preventable diseases. Ensuring universal access to vaccines and addressing the challenges associated with vaccine hesitancy are vital to achieving the goal of a healthier global community.

1.1.2. Immunization Status of Nigeria

Nigeria is a sub-Saharan African country with a land area of approximately 923,768 square kilometers, making it the 32nd largest country in the world. It is also the most populous country in Africa, with an estimated population of approximately 211 million in 2021, making it the seventh most populous country in the world.

Nigeria is classified as a low-middle-income country by the World Bank, with a gross domestic product (GDP) of $504.57 billion in 2020. The country's economy heavily relies on oil exports, accounting for about 90% of its export earnings (UN, 2021).

According to a report by the World Poverty Clock, Nigeria has 86.9 million people living in extreme poverty as of 2020, surpassing India to become the country with the world's highest number of extremely impoverished individuals (WPC, 2021). Additionally, Nigeria has a high poverty rate of 40%, income inequality, and unemployment, with significant regional disparities (NDHS, 2018). These challenges affect access to healthcare, education, and other essential services for women and children in Nigeria.

Nigeria faces several other challenges, including difficulties in accessing healthcare (CIA, 2021), and high rates of violence, including terrorism, banditry, and kidnapping, which exacerbate the country's socio-economic situation (CFR, 2021). Despite these challenges, the government of Nigeria has made considerable efforts to improve maternal and child health outcomes. vaccination coverage for children aged 12-23 months in Nigeria increased from 42% in 2013 to 50% in 2018 (NDHS, 2018). However, the country still lags behind the global goal of achieving at least 90% coverage for all vaccines (WHO, 2020). This highlights the need for further research to understand the factors affecting childhood vaccination in Nigeria, particularly maternal empowerment.

Figure 1.1. DTP3 Coverage in Nigeria (GAVI, 2022)

Nigeria, along with India, the Democratic Republic of the Congo, Pakistan, and Ethiopia, is one of the five countries that account for two-thirds of the world's unvaccinated children. In addition, the mortality rate for children under the age of 5 in Nigeria remains alarmingly high at 132 per 1,000. This rate far exceeds the SDG 3.2.1 target of 25 per 1,000 and highlights the urgent need to address this issue. In fact, Nigeria recorded the highest number of deaths among children under the age of 5 in the world in 2019.

Since the introduction of the Vaccination Expansion Program (EPI) in Nigeria in 1979, the Diphtheria-tetanus-pertussis (DTP) 3 vaccination rate has been successful, reaching 81.5% between 1988 and 1990. However, the rate has declined since the late 1990s. To combat this decline, the National Primary Health Care Development Agency (NPHCDA) has established and implemented strategies to continuously strengthen EPI vaccination through partnerships with various international organizations.

In recent years, Nigeria has introduced initiatives to improve routine vaccination coverage, such as the 2017 National Immunization Transformation Plan (NITP), which aims to strengthen the country's immunization system and increase access

to vaccines. Despite these efforts, Nigeria still faces significant challenges in achieving universal vaccination coverage, particularly in hard-to-reach areas and among marginalized populations, according to the World Health Organization (WHO) in 2019.

The percentage of children who have completed the mandatory vaccination schedule recommended for vaccination in the first year of life in Nigeria is still very low, with DTP1 coverage rate at 70% and DTP3 coverage at 56% as reported by GAVI in 2021. Nigeria also has a high maternal mortality rate, with 512 maternal deaths per 100,000 live births in 2017, according to WHO in 2019. Furthermore, UNICEF reported 726,000 under-five deaths in Nigeria in 2019 alone, making it one of the countries with the highest mortality rates for children.

Given the high child mortality rates in Nigeria, early intervention is critical, and improving vaccination rates can help to improve the health outcomes of Nigerian children and beyond. Therefore, this study's importance is underscored as it aims to contribute to the improvement of children's health worldwide by examining the effect of maternal empowerment on childhood vaccination in Nigeria.

Table 1.1. Immunization Indicators in Nigeria (GAVI, 2021)

Indicator	Value
Number of zero dose children at national level (n)	2,247,212
National-Level Percentage Reduction in Zero Dose: 2019-2021	-3%
DTP1 coverage at the national level	70%
DTP3 coverage at the national level	56%
MCV1 coverage at the national level	59%
Drop out from DTP1 to DTP3 at national level	14%
Geographic equity: Drop out from DTP1 to last routine dose of MCV at national level	49%
DTP3 coverage in the 20% of districts with lowest coverage	45%

Low vaccination rates in Nigeria have been attributed to various factors, including socioeconomic status, cultural beliefs, access to medical care, and maternal empowerment levels (Ughasoro et al., 2020). Geographical location, socioeconomic status, and other factors affecting access to healthcare may impact childhood vaccination rates in multiple ways. For instance, if women lack access to healthcare during pregnancy, they may not have adequate information and support on the importance of childhood immunization. Additionally, immunization may be unavailable if women lack access to healthcare for themselves or their children, making it difficult to receive timely notifications and follow-up vaccinations. Reluctance to receive vaccinations due to safety and efficacy concerns may also affect childhood vaccination coverage in Nigeria (Olakunde, 2019).

In 2017, a major meningitis outbreak in Nigeria resulted in over 14,000 suspected cases and 1,166 deaths, which was attributed to low vaccination rates in the affected areas (CDC, 2017). These factors may interact with access to healthcare, reducing vaccination rates in specific populations. The vaccination of Nigerian children is crucial because vaccine-preventable diseases are one of the primary causes of child mortality in Nigeria, with an estimated 12% of deaths among children under the age of 5 attributed to vaccine-preventable diseases (WHO, 2021). In Nigeria, EPI vaccination is currently offered free of charge to all children under the age of 5 by the public health system and non-governmental organizations (FBA, 2005). Therefore, it is imperative to identify the supply factors that may hinder vaccine delivery, as well as the other influencing factors besides the general factors identified earlier.

1.1.3. Maternal Empowerment

Maternal empowerment is generally defined as the process of enhancing the decision-making power and autonomy of women in relation to their reproductive health, including pregnancy and childbirth, as well as improving their access to resources and

opportunities to improve their status and well-being (Kabeer, 1999). The United Nations' Sustainable Development Goals (SDGs) recognize the need to improve women's opportunities to narrow the gender gap and promote social development, setting women's empowerment as a key agenda (UN, 2015). Empowerment is not only a goal in itself but also has direct implications on children's health, particularly through the influence and motivation of empowered women.

Empowered women are more likely to make informed decisions regarding their children's health, education, and overall development (Upadhyay et al., 2014). Prior studies have shown a positive relationship between maternal empowerment and childhood vaccination rates (Nair et al., 2020; Abdulraheem et al., 2012), suggesting that women with greater decision-making power and control over resources are more likely to prioritize their children's health and seek out immunization services.

In addition to immunization, maternal empowerment has been associated with other positive health outcomes, such as increased access to maternal health services, improved child nutritional status (Cunningham et al., 2015), reduced child mortality rates (Pratley, 2016), and better mental health outcomes for both mothers and children (Murphy-Graham & Leal, 2015).

In the Nigerian context, maternal empowerment is an important component of child immunization. Nigeria is a patriarchal society where societal norms often limit women's decision-making power and access to resources (Oni et al., 2018). Thus, maternal empowerment plays a crucial role in child immunization. Previous research suggests that empowered women are more likely to seek healthcare for their children and make decisions about their health, including vaccinations. Specifically, women's decision-making autonomy, their ability to access and control resources, and freedom from domestic violence have all been identified as important areas of empowerment affecting child vaccination rates in Nigeria (Ewerling et al., 2019; Adebowale et al., 2020).

Despite some progress in recent years, Nigeria remains a patriarchal society with deeply entrenched gender inequality, limiting Nigerian women's access to education, healthcare, and economic opportunities (UN Women, 2021). These limitations restrict their ability to make decisions for themselves and their families. In such circumstances, decision-making authority in the home is likely to rest solely with men, even if it harms their female partners. Conversely, women who are more empowered may be more likely to improve their children's chances of survival and proper development by providing them with adequate care and nutrition (Antai D., 2012).

Maternal empowerment has the potential to significantly impact the vaccination of Nigerian children, as well as other aspects of their health and well-being. By addressing the barriers to maternal empowerment and promoting gender equality, policymakers and public health practitioners can work towards better health outcomes for children and their mothers in Nigeria and beyond.

1.1.4. SWPER

The Survey-based Women's Empowerment Index for Low-Income Countries (SWPER) is an innovative indicator designed to calculate maternal empowerment using Demographic and Health Survey (DHS) data from low-income countries. Developed by Ewerling and colleagues in 2017, SWPER was constructed through principal component analysis (PCA) based on fifteen related indicators (Ewerling et al., 2017). The SWPER score ranges from 0 to 15, with a higher score indicating a higher level of female empowerment. The SWPER score is calculated by summing the responses to the 15 indicators for each individual and then dividing by 15 to obtain the average score.

Table 1.2. Three domains and Fifteen Questions of SWPER for Measuring Maternal Empowerment (Ewerling, 2017)

Empowerment Dimension	Questions
Attitude to violence	Beating Not justified if: 1. Wife goes out without telling husband 2. Wife neglects the children 3. Wife argues with husband 4. Wife refuses to have sex with husband 5. Wife burns the food
Social independence	6. Frequency of reading newspaper or magazine 7. Woman education in completed years of schooling 8. Education difference: woman minus husband completed years of schooling 9. Age difference: woman age minus husband age 10. Age at first cohabitation 11. Age of woman at first birth who usually decides on
Decision-making	12. Respondent's health care 13. Large household purchases 14. Visits to family or relatives 15. Respondent worked in last 12 months

SWPER encompasses three subdomains: attitude to violence, social independence, and decision-making. These subdomains represent assets and agents among women in partnerships (married or unionized).

1) attitude to violence: This subdomain is closely related to women's intrinsic concept related to gender norms for violence. It reflects the acceptance or rejection of violence against women within intimate partner relationships.
2) social independence: This subdomain consists of the preconditions that enable women to achieve their goals. It includes indicators such as educational level, access to information, age at significant life events, differences in spouses' assets, and access to information.
3) decision-making: This subdomain measures the degree of participation in family decisions and can be considered a measure of instrumental choice. It captures women's ability to

influence decisions within their household and assert their preferences.

The Survey-based Women's Empowerment Index for Low-Income Countries (SWPER) is divided into three subdomains-attitude to violence, social independence, and decision-making-for several reasons. Firstly, this division allows for a more comprehensive understanding of women's empowerment, capturing its multidimensional nature (Kabeer, 1999; Malhotra et al., 2002). Combining SWPER into a single composite score may oversimplify the construct and overlook important nuances. The division into subdomains recognizes that empowerment is context-dependent and varies across cultural, social, and economic contexts (Sen, 1999; Malhotra et al., 2002). This approach enables researchers to explore how empowerment is perceived and experienced within specific domains, acknowledging contextual relevance and cultural variations.

Moreover, the division into subdomains facilitates targeted interventions and policy implications, as it helps identify specific areas that require focused interventions (Kishor & Subaiya, 2008; Duvvury et al., 2016). Each subdomain represents a distinct aspect of empowerment that may have unique determinants and implications for outcomes such as childhood vaccination coverage (Kishor & Subaiya, 2008). Lastly, dividing SWPER enhances the psychometric properties of the index, allowing for the evaluation of reliability and validity within each subdomain (Malhotra et al., 2002). This ensures coherence and alignment with the theoretical underpinnings of women's empowerment.

SWPER has been validated and used in several countries, including India, Nepal, and Malawi, and has been found to be a reliable and valid measure of women's empowerment in this context (Ewerling et al., 2017). Moreover, it is the first individual-level indicator that enables comparisons over time across many countries to assess the association between empowerment and multiple health interventions and outcomes.

The parameters used for calculating SWPER, which allow comparisons and time trend analysis within and between countries, are available in more than 60 countries with DHS. This widespread availability makes it a valuable tool for researchers and policymakers to assess the impact of women's empowerment on various health outcomes, including childhood vaccination completion.

Several studies have used SWPER as both a dependent and explanatory variable, exploring its relationship with various health outcomes, such as vaccination, maternal health services utilization, and child nutrition. Regression analysis based on DHS data has been the primary method employed in investigating the causal relationships between SWPER and these outcomes, with studies conducted for specific countries as well as comparative analyses of multiple countries (Ewerling et al., 2017).

For example, researchers have utilized SWPER to examine the impact of maternal empowerment on childhood vaccination rates, finding that higher SWPER scores are associated with increased vaccination coverage. This research supports the importance of maternal empowerment in improving health outcomes for children and highlights the potential of SWPER as a tool for assessing the effectiveness of empowerment interventions.

SWPER is a comprehensive and versatile index for measuring maternal empowerment, with applications in a variety of health outcomes, including childhood vaccination completion. By using SWPER to explore the relationship between maternal empowerment and health outcomes, researchers and policymakers can better understand the role of women's empowerment in promoting child health and develop targeted interventions to improve health outcomes for mothers and their children.

1.2. Purpose of Research

This study aims to investigate the relationship of maternal empowerment on the vaccination of Nigerian children through secondary analysis. The objective is to identify effective health

interventions to increase vaccination coverage and address childhood vaccination inequality in Nigeria. Moreover, this study aims to provide policy suggestions for global health that can contribute to the vaccination of children in other African countries in the future.

Previous studies have shown that children's vaccination is influenced by maternal education (Abadura et al., 2015), wealth levels (Babirye et al., 2012; Luman et al., 2003; Sanou et al., 2009), maternal age (Babalola et al., 2009; Ibnouf et al., 2007; Wiysonge et al., 2012), paternal education (Kidane et al., 2008; Wiysonge et al., 2012), place of residence (Babirye et al., 2012), and other factors. Additionally, some previous studies have found that maternal empowerment affects childhood vaccination (Kitamura et al., 2013; Danis et al., 2010); However, research on the relationship between women's empowerment and childhood vaccination in Nigeria remains scarce. Therefore, this study will address this gap in knowledge by examining the effect of maternal empowerment on childhood vaccination in Nigeria, which has not been adequately explored in previous studies. The findings of this study will serve as a basis for implementing optimal health interventions to increase childhood vaccination coverage rates in Nigeria and resolve childhood vaccination inequality. Furthermore, the results of this study can be used for global health interventions by comparing the analysis results with other African countries and countries around the world in the future, which can ultimately contribute to improving international health vaccination rates and reducing child deaths.

The fundamental hypothesis of this study is based on the notion that 'maternal empowerment will positively impact childhood vaccination in Nigeria.' Specifically, this research aims to verify the hypothesis that each of the three subdomains of the SWPER concept, namely attitude to violence, social independence, and decision-making, will positively affect childhood vaccination in Nigeria.

Table 1.3. Research Hypotheses

Hypothesis 1	Attitude to violence will have a positive effect on childhood vaccination.
Hypothesis 2	Social independence will have a positive effect on childhood vaccination.
Hypothesis 3	Decision-making will have a positive effect on childhood vaccination.

Chapter 2. Methods

2.1. Data Source and Study Samples

This study utilized the 2018 Nigerian Demographic and Health Survey (NDHS) data, developed by the US Agency for International Development (USAID), to investigate women aged 15–49 who responded to the survey, as well as their infants aged 13 to 59 months who were expected to receive all nine primary vaccinations. The data collection was conducted from 14 August to 29 December 2018, with pre-tests administered from 30 April to 20 May 2018. The survey employed a stratified two-stage sampling method (NPC, 2018), with the DHS data selected via equal probability systematic sampling after determining the number of clusters by specifying the assignment of selected households through a stratification process.

The study population for this research comprised 5,172 children aged between 13 and 59 months, who were expected to have completed all EPI-recommended vaccinations within their first year of life. Among the entire dataset, excluding missing values, 676 children completed all nine doses, and 1,800 children did not complete the recommended vaccinations. The SWPER analysis was limited to married women; hence, 2,316 children were included in the final analysis after excluding unmarried subjects.

2.2. Conceptual Model

The present study is grounded in Kabeer's conceptual framework of women's empowerment, which offers a comprehensive and multidimensional approach to understanding the phenomenon. In this context, Kabeer's framework considers three domains: resources, agency, and transformative changes, which are particularly relevant for understanding the impact of maternal empowerment on childhood vaccination.

The resources domain includes both material and non-material resources that are critical to women's empowerment. Material

resources encompass access to education, healthcare, and employment opportunities, while non-material resources consist of knowledge, skills, social networks, and cultural capital. These resources are essential for women to build the foundation necessary for empowerment and to challenge traditional gender norms and power structures (Kabeer, 1999).

The agency domain refers to women's actual agency or their ability to make choices and take action in their own lives. This includes the ability to make decisions about their own health and the health of their children, as well as their ability to challenge gender norms and power structures that perpetuate gender inequality. Agency is not only about making individual choices but also about women's collective action and participation in decision-making processes that affect their lives and communities (Kabeer, 1999).

The transformative changes domain refers to the ways in which women's empowerment involves not only increased access to resources but also a challenge to the social norms and power structures that perpetuate gender inequality, thereby creating opportunities for change. This aspect of Kabeer's framework emphasizes the importance of understanding the broader context in which women's empowerment occurs, as well as the ways in which empowered women can contribute to social transformation and improved health outcomes for their children (Kabeer, 1999).

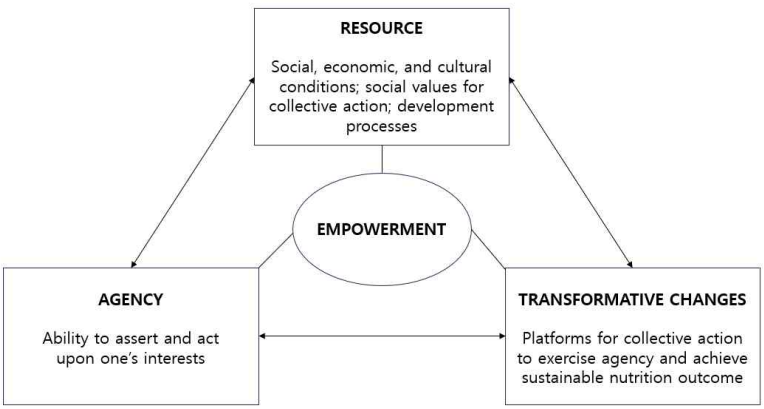

Figure 2.1. The Empowerment Framework by Kabeer (1999)

In the context of this study, Kabeer's framework is particularly relevant as it considers three critical elements of women's empowerment: resources, agency, and transformative changes, all of which are relevant for understanding the impact of maternal empowerment on childhood vaccination. The three subdomains of SWPER used by Ewerling in her study – attitude to violence, social independence, and decision-making – are closely related to the agency domains of Kabeer's empowerment framework. By examining these domains, we can gain a deeper understanding of the relationship between women's subjectivity and children's vaccination.

Kabeer's empowerment framework acknowledges that the relationship between women's empowerment and children's outcomes is complex and multifaceted. It suggests that increasing institutions and resources may lead to better children's health outcomes, but that gender norms and power structures may contradict this goal. Additionally, it is important to consider the ways in which women's ability to make decisions about their health may be limited by social and cultural constraints. Incorporating Kabeer's empowerment framework into this study provides a more sophisticated understanding of the relationship between maternal empowerment and childhood vaccination in Nigeria, taking into account the complexities of the empowerment process and the broader context in which it occurs (Kabeer, 1999).

2.3. Model for Analysis

The statistical analysis was conducted using Stata version 17.0, with national weights provided by the DHS assigned before determining the level of significance. In this study, a 0.05 criterion was applied. First, correlation analysis were conducted among the three subdomains of the SWPER index, as well as between these subdomains and a range of control variables. Ordinal control variables (including age of mother, maternal education, paternal education, wealth index, and age of child) were examined using

Spearman's correlation test. Categorical control variables (place of residence and place of delivery) were explored using Cramer’s V correlation test.

The differences in childhood vaccination were examined using the Wald Chi-square test. The study then investigated the relationship between Nigerian maternal empowerment and childhood vaccination completion through logistic binomial regression analysis. This analysis controlled for several factors found to influence childhood vaccination according to previous studies. The dependent variable was a binomial variable with 1 indicating completion of 9 doses of the EPI-recommended vaccines, and 0 when not. In addition, the explanatory variables were the three subdomains of SWPER, which were categorized as ‘Low,’ ‘Medium,’ and ‘High’ levels. Control variables were selected based on previous studies.

The logistic regression model allowed for the examination of the relationship between maternal empowerment and childhood vaccination while accounting for potential confounding factors. Additionally, the model's fit was assessed through the use of goodness-of-fit tests to ensure the adequacy of the model in explaining the data. By incorporating these tests, the study aims to provide robust and reliable results in understanding the relationship between maternal empowerment and childhood vaccination in Nigeria.

2.4. Definitions of Variables

2.4.1. Dependent Variable

The dependent variable in this study, referred to as "EPI full vaccination," is a binomial variable comprising two categories:

1) EPI full vaccination: This category represents instances where all nine doses of the four vaccines recommended for vaccination in the first year of life in Nigeria have been administered.

2) Non-EPI full vaccination: This category represents cases where one or more of the nine doses of the four recommended vaccines have not been administered in the first year of life in Nigeria.

Nigeria follows the WHO recommendation that children are considered fully immunized if they receive Bacillus Calmette-Guérin (BCG) against tuberculosis (one dose), polio (four doses), DTP (three doses), and measles (one dose) vaccines (NPC & ICF International, 2014; Ophori et al., 2014).

Table 2.1. Comprehensive EPI Vaccination Schedule for the First Year of Life in Nigeria (NPC, 2014)

Period	Vaccine
At birth	BCG + Polio0
6 weeks	DPT1 + Polio1
10 weeks	DPT2 + Polio2
14 weeks	DPT3 + Polio3
9 months	Measles

2.4.2. Explanatory Variables

The explanatory variables in this study include three subdomains of the SWPER global index: attitude to violence, social independence, and decision-making. These subdomains were calculated using the DHS questionnaire. To calculate the SWPER index for this study, I followed the method proposed by Ewerling et al. (2017), utilizing the 15 question items listed in Table 1.2. I extracted the necessary variables from the Nigerian 2018 Standard DHS data and classified the factors for each of the three subdomains using principal component analysis (PCA). The resulting scores were then reconstructed into categorical variables, which were classified into three categories: 'Low,' 'Medium,' and 'High' levels.

Table 2.2. SWPER Three Subdomains and Categorical Standards for Measuring Maternal Empowerment

Subdomain	Categorical Standard
Attitude to Violence	Low: ≤ −0.7 Medium: −0.7 to 0.4 High: >0.4
Social Independence	Low: ≤ −0.559 Medium: −0.559 to 0.293 High: >0.293
Decision−making	Low: ≤ −1.0 Medium: −1.0 to 0.6 High: >0.6

2.4.3. Control Variables

The control variables in this study consist of variables that could potentially affect childhood vaccination. These variables were selected based on previous studies and an analysis of Nigerian DHS data from 2003 to 2018. The control variables include age of mother, maternal education, paternal education, wealth index, place of residence, age of child, and place of delivery. The categorization method and characteristics of each variable used in the study are described in Table 2.3. Ryoko (2021) identified maternal education, wealth index, and place of residence as significant predictors of children's vaccination, while Iloh (2018) identified age of mother, age of child, and place of delivery as variables that can influence vaccination. Furthermore, paternal education was included as a variable that could affect vaccination and is relevant to the study.

Table 2.3. Variables Used in the Research

Variable	Description	Measurement
Dependent Variable		
EPI Full Vaccination	A total of 9 vaccines given in the first year of life (BCG 1, Polio 4, DPT 3, Measles 1)	0=None or partially vaccinated 1=Fully vaccinated
Explanatory Variables (Three subdomains of SWPER)		
Attitude to Violence	The mother's attitudes towards the use of physical punishment as a means of disciplining children	0=Low 1=Medium 2=High
Social Independence	The level of autonomy of the mother and her ability to make decisions independently	0=Low 1=Medium 2=High
Decision-Making	The mother's ability to make decisions regarding her own health and the health of her child	0=Low 1=Medium 2=High
Control Variables		
Age of Mother	The age of the mother at the time of the child's birth	0=15~24 1=25~34 2=35~49
Maternal Education	The highest level of education attained by the mother	0=No education 1=Primary school 2=Secondary 3=Higher than secondary
Paternal Education	The highest level of education attained by the father	0=No education 1=Primary school 2=Secondary 3=Higher than secondary
Wealth Index	The economic status of the household in which the child was born	0=Poorest 1=Poorer 2=Middle 3=Richer 4=Richest
Place of Residence	Whether the child was born in an urban or rural area	0=Rural 1=Urban
Age of Child	The age of the child at the time of the survey	0=12-36 months 1=37-59 months

Variable	Description	Measurement
Place of Delivery	The place where the child was born	0=Home 1=Public 2=Private

All variables, encompassing the explanatory, control, and dependent variables, were systematically classified into distinct categorical formats.

2.5. Ethical Considerations

Prior to conducting the face-to-face interview, DHS obtained informed consent from all participants, and the Nigeria Health Research Council had already granted ethical approval for data collection. To carry out this research, the study relied on secondary data from the 2018 Nigeria DHS, which was made anonymous by removing all personal identifiers of the respondents. Therefore, using this data is classified as exempt research. This study has also been approved as exempt research (Approval No.: IRB No. E2303/003-004) by the Institutional Review Board (IRB) of Seoul National University.

Chapter 3. Results

3.1. Correlation Analysis

Correlation analysis were conducted among the three subdomains of SWPER, as well as between these subdomains and a range of control variables. Ordinal control variables (including age of mother, maternal education, paternal education, wealth index, and age of child) were examined using Spearman's correlation test. Categorical control variables (place of residence and place of delivery) were explored using Cramer’s V correlation test.

A significant correlation was observed among three subdomains of the SWPER: attitude to violence, social independence, and decision-making. The p-values in these relationships were all notably below the 0.05 threshold, reinforcing the existence of a meaningful positive association among them.

Upon evaluating the correlations between the SWPER subdomains and an array of control variables, the results appeared distinctly heterogeneous. Several control variables indicated a substantial correlation with the SWPER subdomains, while others exhibited negligible or no correlation. Of particular note among these controls were maternal education and wealth index, which were statistically significant. These elements appear to be integrally linked to maternal empowerment, as evidenced by the significant results they presented.

Thus, while the correlations between the SWPER and the various control variables displayed considerable variability, it is compelling to note that maternal education and the wealth index – components that seemingly influence maternal empowerment – demonstrated substantial significance. This adds depth to the comprehension of these complex relationships.

Table 3.1. Correlation Analysis

* p−value <0.05

Variable	Attitude to Violence	Social Independence	Decision−making
Attitude to Violence	−	−	−
Social Independence	0.2432*	−	−
Decision−making	0.1584*	0.3583*	−
Age of Mother	0.0357	0.1655	0.0631
Maternal Education	0.2790*	0.7366*	0.4613*
Paternal Education	0.2248	0.4662	0.3706
Wealth Index	0.2784*	0.5431*	0.3450*
Place of Residence	0.1931	0.3410	0.1985
Age of Child	−0.0090	−0.0060	0.0665*
Place of Delivery	0.1819	0.3530	0.2337

3.2. Chi−square Test

Table 3.2. presents the results of the chi−square test conducted to examine the differences in EPI full vaccination based on subject characteristics. The results of the chi−square test revealed statistically significant associations for all three subdomains of SWPER, which are the main explanatory variables in this study, as well as the overall control variables. These findings suggest that the variables included in the study are important factors that impact the completion of the EPI vaccine in Nigeria among children aged 13 to 59 months. Additionally, the inclusion of one paternity−related variable, in addition to the variables already identified using Nigerian DHS data and previous studies for all control variables, could explain the significance observed for all the

variables.

While it's important to note that statistical significance does not necessarily imply practical significance or causality, it is important to interpret the results of the chi-square test with caution. However, the significant p-value for all variables in the chi-square test indicates an association between vaccination completion status and the explanatory and control variables. These results suggest that maternal empowerment, as measured by the three subdomains of SWPER, and control variables such as the age of the mother, maternal education, paternal education, wealth index, place of residence, age of the child, and place of delivery are significantly associated with childhood vaccination in Nigeria.

These findings have implications for improving childhood vaccination coverage in Nigeria, as they indicate the importance of considering maternal empowerment and control variables. Therefore, it is crucial to include these variables in further analysis to gain a better understanding of the relationship between maternal empowerment and childhood vaccination in Nigeria.

Table 3.2. Chi−square Test

* p−value <0.05

Variable	Category	EPI Full Vaccination		x2	p−value
		Completed (n=626, %)	Not completed (n=1,690, %)		
Attitude to Violence	Low	64 (10.2)	453 (26.8)	90.82	0.000*
	Medium	42 (6.7)	177 (10.5)		
	High	520 (83.1)	1,060 (62.7)		
Social Independence	Low	94(15.0)	872 (51.6)	390.77	0.000*
	Medium	128 (20.4)	438 (25.9)		
	High	404 (64.5)	380 (22.5)		
Decision−making	Low	139 (22.2)	767 (45.4)	167.10	0.000*
	Medium	261 (41.7)	677 (40.1)		
	High	226 (36.1)	246 (14.6)		
Age of Mother	15~24	113 (18.1)	437 (25.9)	15.69	0.000*
	25~34	334 (53.4)	833 (49.3)		
	35~49	179 (28.6)	420 (24.9)		
Maternal Education	No education	91 (14.5)	1,046 (61.9)	547.59	0.000*
	Primary school	83 (13.3)	263 (15.6)		
	Secondary	341 (54.5)	333 (19.7)		
	Higher than secondary	111(17.7)	48 (2.8)		
Paternal Education	No education	53 (8.5)	820 (49.1)	380.28	0.000*
	Primary school	94 (15.1)	255 (15.3)		
	Secondary	317 (50.9)	465 (27.8)		

Variable	Category	EPI Full Vaccination		χ2	p−value
		Completed (n=626, %)	Not completed (n=1,690, %)		
	Higher than secondary	159 (25.5)	130 (7.8)		
Wealth Index	Poorest	46 (7.3)	564 (33.4)	494.19	0.000*
	Poorer	63 (10.1)	438 (25.9)		
	Middle	123 (19.6)	345 (20.4)		
	Richer	168 (26.8)	235 (13.9)		
	Richest	226 (36.1)	108 (6.4)		
Place of Residence	Rural	264 (42.2)	1,241 (73.4)	196.16	0.000*
	Urban	362 (57.8)	449 (26.6)		
Age of Child	12−36 months	397 (63.4)	964 (57.0)	7.67	0.006*
	37−59 months	229 (36.6)	726 (43.0)		
Place of Delivery	Home	176 (28.1)	1,264 (74.8)	423.22	0.000*
	Public	300 (47.9)	283 (16.7)		
	Private	150 (24.0)	143 (8.5)		

3.3. Binary Logistic Regression Analysis

To examine the association between maternal empowerment and childhood vaccination in Nigeria, the present study utilized data from the 2018 Nigerian Demographic and Health Survey. Three models were fitted for evaluating goodness of fit: Model 0 only included the dependent variable, Model 1 incorporated the dependent variable and three explanatory variables, while Model 2 included all variables–explanatory, control, and dependent. Among these, Model 2 demonstrated superior fit (LR chi2: 689.13, prob>chi2=0.0000), outperforming both Model 0 and Model 1 (LR chi2: 221.37, prob>chi2=0.0000). The final analysis thus utilized

Model 2, incorporating control variables previously shown to influence childhood vaccination, such as the mother's age, maternal and paternal education, wealth index, place of residence, child's age, and place of delivery.

Logistic regression analysis was employed to investigate the association between the three subdomains of SWPER–attitude to violence, social independence, and decision–making–and childhood vaccination. All three domains were positively correlated with childhood vaccination completion. However, the significance of these associations varied.

In descending order of influence, the decision–making domain had the strongest impact on childhood vaccination completion, demonstrating statistical significance at the 'High' levels of maternal empowerment. The likelihood of childhood vaccination completion increased by 1.28 and 1.67 times at the 'Medium' and 'High' levels, respectively, compared to the 'Low' level. In contrast, while the social independence and attitude to violence domains exhibited positive correlations with vaccination completion, these did not reach statistical significance.

More specifically, in the social independence domain, the second most influential, the likelihood of vaccination completion increased by 1.11 and 1.37 times at the 'Medium' and 'High' levels, respectively, compared to the 'Low' level. Meanwhile, in the attitude to violence domain, the third in influence, the probability of vaccination completion increased by 1.23 and 1.36 times at the 'Medium' and 'High' levels, respectively, compared to the 'Low' level.

Despite the differing levels of significance, all three subdomains of SWPER demonstrated a positive direction, with odds ratios greater than 1. This reveals the nuanced and complex relationship between different facets of maternal empowerment and childhood vaccination completion in Nigeria, underscoring the need for more research and customized interventions to boost the nation's vaccination rates.

In conclusion, maternal empowerment, particularly within the domain of decision–making, can meaningfully contribute to

childhood vaccination. By enabling mothers to make informed decisions about their children's health, we can advance toward improved health outcomes in Nigeria.

Table 3.3. Binary Logistic Regression Analysis

* p−value <0.05

Variable	Category	EPI Full Vaccination	p−value
		OR (95% CI)	
Attitude to Violence	Low	1.00	
	Medium	1.23(0.68−2.22)	0.497
	High	1.36(0.87−2.14)	0.180
Social Independence	Low	1.00	
	Medium	1.11(0.69−1.79)	0.672
	High	1.37(0.81−2.32)	0.236
Decision−making	Low	1.00	
	Medium	1.28(0.88−1.88)	0.202
	High	1.67(1.01−2.74)	0.044*
Age of Mother	15~24	1.00	
	25~34	1.12(0.77−1.63)	0.544
	35~49	1.42(0.90−2.22)	0.130
Maternal Education	No education	1.00	
	Primary school	1.45(0.85−2.46)	0.170
	Secondary	1.99(1.09−3.64)	0.025*
	Higher than secondary	3.22(1.39−7.49)	0.007*
Paternal Education	No education	1.00	
	Primary school	2.82(1.70−4.66)	0.000*
	Secondary	2.64(1.66−4.22)	0.000*
	Higher than secondary	2.01(1.13−3.57)	0.018*
Wealth Index	Poorest	1.00	
	Poorer	1.05(0.61−1.80)	0.852
	Middle	1.16(0.69−1.97)	0.578
	Richer	1.71(0.99−2.96)	0.055
	Richest	3.12(1.58−6.17)	0.001*
Place of Residence	Rural	1.00	
	Urban	1.24(0.86−1.79)	0.253
Age of Child	12−36 months	1.00	
	37−59 months	0.72(0.53−0.97)	0.033*
Place of Delivery	Home	1.00	
	Public	2.21(1.52−3.22)	0.000*
	Private	1.50(0.93−2.43)	0.095

Chapter 4. Discussion

4.1. Implications of the Study

This study underscores the critical role of maternal empowerment, particularly decision-making, in enhancing childhood vaccination in Nigeria. The significant correlations observed among the SWPER subdomains underscore the interconnectedness of various aspects of maternal empowerment. Progress in one domain, such as decision-making, appears to be associated with improvements in other areas, such as attitude towards violence and social independence. Despite this interconnection, the decision-making domain stood out as a potent predictor of childhood vaccination completion in the logistic regression analysis. This result reinforces the particular importance of decision-making empowerment for promoting vaccination coverage. It suggests that empowering women to make informed health decisions can have especially beneficial impacts on child health outcomes in Nigeria. These findings align with previous research that has identified decision-making power as a critical factor affecting maternal and child health outcomes (Pande & Astone, 2007; Raj & Saggurti, 2014).

The nuanced correlation results between the SWPER subdomains and the control variables underscore the complexity of the factors influencing childhood vaccination. A variety of control variables showed differing levels of association with the SWPER subdomains, illustrating the intricate nature of women's empowerment and its interface with a broad socioeconomic spectrum. Two control variables, maternal education and wealth index, were notably distinct in their strong correlations with the SWPER subdomains. This seems to suggest that these variables, which are closely related to maternal empowerment, play a significant role in childhood vaccination outcomes. They act as crucial indicators of maternal empowerment, linking it not only to

the socio-economic status of women but also to the health outcomes of children. This observation doesn't detract from our central finding - the significant role of women's decision-making power in influencing childhood vaccination outcomes. Rather, it adds an additional layer of understanding, indicating that the factors contributing to maternal empowerment, such as maternal education and wealth, may also be essential in promoting positive vaccination outcomes.

Thus, while certain controls do not demonstrate a significant association with the SWPER subdomains, the significant correlation between maternal empowerment factors (specifically maternal education and wealth) and childhood vaccination outcomes reinforces the multifaceted nature of women's empowerment. It also enriches the understanding of its role and its complex interactions within the broader socio-economic context.

Given this, interventions aimed at improving child vaccination coverage should prioritize bolstering mothers' decision-making power. To achieve this, efforts should focus on providing women with access to education, income-generating activities, and resources that strengthen their autonomy. For example, the intervention by the Bangladesh Rural Advancement Committee (BRAC) to improve maternal and child health outcomes through women's empowerment initiatives has shown positive results in increasing vaccination rates (Amin, Li, & Ahmed, 1996). Education can not only increase mothers' knowledge about vaccination but also improve their ability to make informed decisions about their children's health. Income-generating activities can enhance mothers' economic power, allowing them to access healthcare services more easily and reducing financial barriers to immunization.

Furthermore, healthcare providers and community workers should design and implement educational and awareness programs for mothers and caregivers to improve their understanding of the importance of childhood vaccination, the vaccination schedule, and the consequences of not vaccinating their children. Such programs should be culturally sensitive, inclusive, and tailored to address the

unique needs of various communities, taking into consideration local beliefs, values, and barriers to healthcare access. An example of a successful intervention is the Care Group model, which has demonstrated improvements in immunization coverage through the use of community health volunteers to deliver health education messages and promote immunization services in rural Mozambique (Edward et al., 2007).

Addressing gender-based violence through community-based programs that challenge cultural norms and attitudes perpetuating violence against women is also essential. For example, the SASA! intervention in Uganda has been successful in reducing intimate partner violence and improving women's decision-making power within relationships (Abramsky et al., 2014). Mitigating gender-based violence can have a positive influence on child vaccination coverage rates, as women who experience violence may have limited autonomy to make decisions about their children's health. Community-based programs should engage both men and women, promoting the inclusion of men in decision-making processes related to child health, as they often play a significant role in household decision-making.

Collaboration between government agencies, non-governmental organizations, and community leaders is necessary to ensure a comprehensive approach to addressing maternal empowerment and vaccination rates. Such partnerships can facilitate the sharing of best practices, resources, and expertise to better support communities and improve health outcomes.

The Nigerian government should also prioritize strengthening the health system to improve access to vaccines and reduce missed opportunities for vaccination. This can be achieved by investing in training healthcare workers, increasing vaccine availability, and implementing monitoring systems to track vaccine coverage rates. These actions align with the WHO's global immunization strategy, which emphasizes the need for robust health systems to ensure equitable access to vaccines (WHO, 2019).

The proposed interventions can serve as a model for national

health policies in low- and middle-income countries, potentially increasing vaccination rates and reducing child mortality worldwide. As such, it is crucial to implement and evaluate these interventions, using data-driven approaches to assess their effectiveness in improving childhood vaccination coverage in Nigeria and other low- and middle-income countries. By addressing the interrelated factors of maternal empowerment, gender-based violence, and healthcare access, stakeholders can work together to create lasting change and promote the health and well-being of children in Nigeria and beyond.

4.2. Limitations of the Study

One limitation of this study is that it may not fully capture the dynamics of maternal empowerment in Nigeria due to the use of only 2018 Nigeria DHS data. To obtain clearer results, it would be possible to conduct additional analyses using the entire DHS dataset in Nigeria. However, it is worth noting that if data are disclosed after 2020, following the outbreak of Covid-19, this may disrupt the use of the data. Furthermore, a more comprehensive examination of the factors and the inclusion of control variables will enable us to accurately examine the impact of maternal empowerment on childhood vaccination in Nigeria.

This study acknowledges the inherent limitations of the SWPER utilized as a measure of maternal empowerment. SWPER, developed to calculate maternal empowerment using DHS data, encompasses a mix of indicators that may be more perception-oriented rather than reflecting actual behaviors (Ewerling et al., 2017). Maternal empowerment is a multifaceted concept that is challenging to measure in its entirety, embodying both perceptions and actions (Kabeer, 1999; Upadhyay et al., 2014). While the perception-based measures in SWPER provide valuable insights into women's views of their empowerment, they may not fully capture the range of their concrete actions, particularly those actions directly impacting child vaccination. Additionally, the potential discrepancy between

perceived and actual behavior could introduce bias in the results. It's also worth noting that women's perceptions of their own empowerment can significantly impact their actions, including decisions about their children's healthcare (Peterman et al., 2020). Therefore, while SWPER is a robust measure within the existing constraints, future research might seek to augment it with more action-oriented measures of maternal empowerment.

The potential for recall bias must be considered when interpreting the results of this study, as the data used are self-reported. Specifically, this study examines all children between the ages of 13 and 59 months who are expected to have completed all of the vaccines given in the first year of life. This raises concerns about the accuracy of maternal recall regarding vaccination history, particularly among mothers with older children. However, it is worth noting that inoculation cards are available for recording vaccinations, which may mitigate some of these concerns. Despite the potential for recall bias, the study aimed to analyze as many children as possible and therefore included a wide range of children in the analysis.

Although this study analyzed the factors influencing childhood vaccination found in previous studies as control variables, there is a possibility that other variables also affect childhood vaccination in Nigeria. However, the control variables included in the study are variables known to affect children's vaccination using Nigeria's 2018 DHS data, and additional variables were included as control variables using the entire Nigeria DHS data. Nevertheless, future studies could explore other factors that might impact childhood vaccination in Nigeria.

Lastly, since the dependent variable of this study is 'completion of childhood vaccination', it is difficult to measure the effect of maternal empowerment on areas related to children's health other than vaccination. This limits the ability to provide implications for comprehensive child health improvement. Furthermore, the multilevel analysis results for those who received one or more vaccinations and eight vaccinations or less are unknown due to the

binomial variable configuration of the dependent variable, which distinguishes between completing the total of nine vaccinations and not completing the total. Therefore, follow-up studies could conduct more detailed analysis to better understand the effect of maternal empowerment on other areas of child health and the impact of incomplete vaccination coverage on children's health outcomes in Nigeria.

Chapter 5. Conclusion

The findings of this study provide valuable insights into the relationship between maternal empowerment and childhood vaccination coverage in Nigeria. The emphasis on decision-making highlights its significance in improving vaccination rates within the Nigerian context. The proposed interventions, such as training sessions for women, workshops on violence prevention, and community mobilization activities, hold promise for enhancing maternal empowerment and improving child health outcomes in Nigeria.

The role of decision-making power in maternal empowerment cannot be overstated, especially in terms of its impact on child vaccination coverage. Maternal decision-making power is integral as it directs healthcare-related choices and actions for children, particularly in patriarchal societies like Nigeria where women's autonomy can be compromised (Raj & Saggurti, 2014). Empowering mothers to make informed decisions on health matters increases the likelihood of adhering to the recommended vaccination schedule, thus improving vaccination rates (Pratley, 2016). Decision-making not only involves the choice to vaccinate, but also the logistical decisions surrounding healthcare accessibility such as the scheduling and transportation to vaccination appointments. This study's findings support the need to prioritize enhancing decision-making abilities among women through interventions that educate and empower them, which can, in turn, significantly affect childhood vaccination outcomes.

While these findings have important implications for addressing vaccination challenges in Nigeria, it is essential to acknowledge the need for further research to determine the generalizability of the study's conclusions to other LMICs facing similar issues. Each country has unique socio-cultural contexts and health systems, requiring tailored approaches and interventions.

However, the experience gained from this study can serve as a

valuable starting point for other LMICs grappling with low childhood vaccination rates. It highlights the importance of maternal empowerment and its potential impact on vaccination outcomes. Nonetheless, it is crucial to conduct additional research and evaluation to assess the effectiveness and applicability of the proposed interventions in diverse settings.

By focusing on Nigeria's specific challenges and providing insights into the interplay between maternal empowerment and childhood vaccination, this study contributes to the body of knowledge in global health. Policymakers, healthcare providers, and community workers in Nigeria and other LMICs can leverage these findings to design context-specific interventions that address barriers to vaccination and promote better maternal and child health outcomes.

In summary, while this research provides valuable insights into Nigeria's context, further studies are needed to validate and refine the conclusions before applying them directly to other LMICs. The results underscore the significance of maternal empowerment in addressing childhood vaccination challenges and offer a foundation for future research and intervention development in similar contexts.

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Abstract in Korean

Introduction : 전세계적으로 인구를 질병으로부터 보호하기 위한 예방접종 확대 프로그램(EPI)이 시행되어 왔으나, 생애 첫 해에 권장되는 예방 접종을 완료하는 아동의 비율은 저소득 및 중간 소득 국가에서 여전히 낮은 실정이다. 특히 나이지리아는 전 세계 아동 인구 중 예방접종률이 낮은 대표적인 5개국에 속하며 5세 미만 사망률은 1000명당 132명으로 이는 SDG의 목표를 훨씬 상회한다. 즉, 나이지리아 아동의 건강 개선을 위해서는 예방접종률을 높이는 것이 중요하다고 볼 수 있다. 모성 임파워먼트는 모성과 아동의 건강과 관련된 문제에서 여성의 의사결정 권한과 자율성을 강화하는 과정을 의미하는데(Kabeer, 1999), 가부장제 사회인 나이지리아의 경우 여성의 의사결정 권한을 제한하고 중요 자원에 대한 접근을 제한하므로(Oni et al., 2018) 모성 임파워먼트를 아동 예방 접종과 연관성이 있는 분야로 생각해볼 수 있다. 본 연구는 나이지리아에서 모성 임파워먼트와 아동 예방 접종 사이의 관계를 조사하는 것을 목표로 하며, 적절한 보건 중재 도출을 통해 나이지리아의 어린이 예방 접종을 개선하고 궁극적으로 향후 관련 연구를 통하여 아프리카 국가와 전세계 아동 질병을 예방하며 사망률을 감소시키기 위한 초석을 마련하고자 한다.

Method : 본 연구는 2차 자료인 2018년 나이지리아 인구 통계 및 건강 설문조사(Nigerian Demographic and Health Survey, NDHS)의 데이터를 분석하여 생애 첫 해에 나이지리아에서 접종이 권장되는 총 9회의 접종을 모두 받을 것으로 예상되는 13개월에서 59개월 사이의 아동을 대상으로 모성 임파워먼트와 나이지리아 아동 예방 접종의 관계를 살펴보고자 하였다. 데이터 분석을 위해 Stata 버전 17.0을 이용하여 SWPER의 세 하위 도메인과 통제변수 사이의 상관관계 분석, Wald Chi-square test, 로지스틱 회귀분석을 수행하였고(유의수준: 0.05), DHS에서 제공한 국가 수준 대표성을 담보하기 위한 가중치를 할당한 후 분석하였다. 본 연구의 종속변수는 생애 첫 해에 나이지리아에서 접종이 권고되는 총 9회의 백신을 모두 접종한 경우를 1, 아닌 경우를 0으로 조작적 정의하는 이항 변수이다. 설명변수는 SWPER의 세가지 하위 도메인인 ‘폭력에 대한 태도’, ‘사회적 독립성’, ‘의사결정’으로 이는 DHS의 15개 지표값을 바탕으로 모성 임파워먼트 수준을 측정할 수 있는 개념이다. 종합하자면 본 연구는 모계 및 부계 학력, 자산 지수, 거주지, 자녀의 연령

및 분만지, 산모의 연령 등 선행연구를 기반으로 나이지리아 아동 예방접종에 영향을 줄 수 있는 다양한 요인을 통제한 상태에서 모성 임파워먼트의 세가지 하위 도메인과 나이지리아 아동 예방접종의 연관성을 알아보기 위해 로지스틱 이항분석을 실시한 연구이다.

Result : 본 연구의 상관관계 분석 결과 SWPER의 3개 하위 도메인은 상호간에 통계적으로 유의한 연관성을 보였으며, SWPER의 하위 도메인과 통제 변수 사이의 관계는 일부 유의미한 상관관계가 있었으나 조합에 따라 다른 결과를 보였다. 모성 교육 및 자산 지수라는 두 가지 통제 변수는 SWPER 하위 도메인과 강한 상관관계를 보였다. SWPER의 3개 하위 도메인과 통제변수를 포함한 모든 변수가 카이제곱 검정에서 통계적으로 유의한 것으로 나타났다. 통제변수를 적용한 로지스틱 회귀분석 결과 SWPER의 3개 하위 도메인 모두 '중간' 및 '높음'의 경우 오즈비가 1보다 높았고, 이중 의사결정 영역은 특히 모성 임파워먼트가 '높음'의 경우에서 통계적으로 유의한 결과를 보였다. 또한, 세 도메인 모두에서 모성 임파워먼트가 높아질수록 오즈비가 커지는 양의 방향의 결과를 보여 이는 모성 임파워먼트가 나이지리아 아동의 예방접종에 정적 영향을 준다는 가설 1, 2, 3을 입증할 수 있는 결과였다.

Discussion : 본 연구는 2018년 나이지리아 인구 통계 및 건강 설문조사 데이터의 로지스틱 회귀 분석을 사용하여 나이지리아의 아동 예방접종과 모성 임파워먼트의 관계를 규명하였다. 연구 결과는 나이지리아에서 아동 예방접종을 강화하는 데 있어서 모성 임파워먼트의 중요성을 강조하며, 특히 SWPER의 하위 영역 중 의사 결정이 아동 예방접종과 가장 유의미한 관련이 있는 것으로 나타났다. 분석 결과, 모성 임파워먼트의 하위 도메인 간의 상호 연결성이 있었으나 이러한 상호 연결에도 불구하고 의사 결정 능력은 나이지리아의 낮은 아동 백신 접종률이 제한된 의사 결정 권한 및 제한된 접근 등의 요인에 의한다는 기존의 연구 결과들을 고려하였을 때 여전히 백신 접종 완료의 강력한 예측 인자로 볼 수 있다. 따라서, 나이지리아의 모성 임파워먼트 및 아동 예방접종을 개선하기 위해 본 연구는 교육 및 소득 창출 활동을 통하여 모성 의사 결정 능력을 향상시키는 데 초점을 맞춘 보건 중재를 권장한다. 또한 모성을 위한 교육 및 인식 프로그램 실시, 젠더 기반 폭력 해결, 백신에 대한 접근성을 개선하고 백신 접종 기회 상실을 줄이기 위한 보건 시스템 강화 등이 도움이 될 것이다.

Conclusion : 본 연구는 나이지리아 아동 자료를 기반으로 모성 임파워먼트와 아동 예방 접종의 관계를 조사하였으며 특히 모성의 아동 건강에 대한 의사결정의 중요성을 강조한다. 본 연구의 결과는 아동기 예방 접종 문제를 해결하는데 있어 모성 임파워먼트의 필요성과 특히 의사결정의 중요성을 강조한다는 점에서 궁극적으로 세계보건 분야에 기여하며, 다만 다른 저소득 및 중간 소득 국가에서의 적용 가능성을 탐색하기 위한 추가 연구가 필요하다. 또한 본 연구 결과를 기반으로 한 다양한 보건정책이 성공적으로 수립 및 적용된다면 향후 유사한 맥락의 문제에 당면하는 다른 중저소득국의 보건 정책 수립에도 참고할 만한 근거를 제시할 수 있을 것이다.

Appendices

Table A. Nigeria's Major Statistics, 2015–2020 (World Bank, 2021)

Topic	Indicator	Most recent value
Social	Poverty headcount ratio at $2.15 a day (2017 PPP) (% of population)	30.9 (2018)
	Life expectancy at birth, total (years)	53 (2020)
	Population, total	213,401,323 (2021)
	Population growth (annual %)	2.4 (2021)
	Net migration	−76,364 (2021)
	Human Capital Index (HCI) (scale 0–1)	0.4 (2020)
Economic	GDP (current US$)	440.83 (2021 billion)
	GDP per capita (current US$)	2,065.7 (2021)
	GDP growth (annual %)	3.6 (2021)
	Unemployment, total (% of total labor force) (modeled ILO estimate)	5.9 (2021)
	Inflation, consumer prices (annual %)	17.0 (2021)
	Personal remittances, received (% of GDP)	4.4 (2021)
Institutions	Intentional homicides (per 100,000 people)	22 (2019)
	Statistical performance indicators (SPI): Overall score (scale 0–100)	53.6 (2019)
	Individuals using the Internet (% of population)	36 (2020)
	Proportion of seats held by women in national parliaments (%)	4 (2021)
	Foreign direct investment, net inflows (% of GDP)	0.8 (2021)

Table B. Previous Studies Utilizing SWPER as an Explanatory Variable

Title	Nation (Year)	Journal	Data Source	Method	Outcome Variable
The impact of women's empowerment on their children's early development in 26 African countries	26 nations (2020)	Journal of Global Health	DHS, MICS	Logistic regression	ECDI (Early child development)
Women's Empowerment and Children's Complete Vaccination in the Democratic Republic of the Congo: A Cross-Sectional Analysis	Congo (2021)	Vaccines	MICS	Logistic regression	Complete Vaccination
Relationship between maternal healthcare utilisation and empowerment among women in Bangladesh: evidence from a nationally representative cross-sectional study	Bangladesh (2021)	BMJ Open	DHS	Logistic regression	Utilisation of MHS
Women's empowerment and child nutrition in South-Central Asia; how important is socioeconomic status?	5 nations (2021)	ElSEVIER	DHS	Logistic regression	Wealth Index
Empowerment dimensions and their relationship with continuum care for maternal health in Bangladesh	Bangladesh (2021)	Scientific Reports	DHS	Logistic regression	COC (Continuum of Care)
Is women's empowerment associated with coverage of RMNCH interventions in low- and middle-income countries? An analysis using a survey-based empowerment indicator, the SWPER	62 nations (2021)	Journal of Global Health	DHS	Meta regression	RMNCH (reproductive, maternal, newborn and child health)
Empowering women can improve child dietary diversity in Ethiopia	Ethiopia (2021)	Maternal and Child Nutrition	DHS	Logistic regression	MDD (minimum dietary diversity)

Title	Nation (Year)	Journal	Data Source	Method	Outcome Variable
Gender-Related Inequality in Childhood Immunization Coverage: A Cross-Sectional Analysis of DTP3 Coverage and Zero-Dose DTP Prevalence in 52 Countries Using the SWPER Global Index	52 nations (2022)	Vaccines	DHS	Logistic regression	Slope Index of Inequality (SII) and the Concentration Index (CIX)
Children of more empowered women are less likely to be left without vaccination in low- and middle-income countries: A global analysis of 50 DHS surveys	50 nations (2022)	Journal of Global Health	DHS	Poisson regression	No-DTP Children

Table C. Expanded Logistic Regression Analysis Incorporating Two General Additional Control Variables (Child's Sex and Birth Order)

* p−value <0.05

Variable	Category	EPI Full Vaccination	p−value
		OR (95% CI)	
Attitude to Violence	Low	1.00	
	Medium	1.00(0.54−1.87)	0.992
	High	1.39(0.93−2.09)	0.112
Social Independence	Low	1.00	
	Medium	1.02(0.67−1.55)	0.943
	High	1.40(0.84−2.33)	0.193
Decision−making	Low	1.00	
	Medium	1.08(0.77−1.51)	0.664
	High	1.49(1.01−2.21)	0.045*
Age of Mother	15~24	1.00	
	25~34	1.11(0.75−1.66)	0.595
	35~49	1.69(1.00−2.86)	0.049*
Maternal Education	No education	1.00	
	Primary school	1.61(0.96−2.68)	0.069
	Secondary	1.96(1.12−3.44)	0.018*
	Higher than secondary	3.05(1.37−6.81)	0.006*
Paternal Education	No education	1.00	
	Primary school	2.24(1.38−3.62)	0.001*
	Secondary	2.50(1.60−3.89)	0.000*
	Higher than secondary	2.33(1.35−4.04)	0.002*
Wealth Index	Poorest	1.00	
	Poorer	1.11(0.67−1.82)	0.687
	Middle	1.21(0.74−2.00)	0.447
	Richer	1.70(1.02−2.84)	0.043*
	Richest	2.78(1.54−4.99)	0.001*
Place of Residence	Rural	1.00	
	Urban	1.22(0.90−1.65)	0.207
Age of Child	12−36 months	1.00	
	37−59 months	0.76(0.58−1.01)	0.059
Place of Delivery	Home	1.00	
	Public	2.17(1.62−2.89)	0.000*
	Private	1.71(1.14−2.57)	0.010*
Sex of Child	Male	1.00	
	Female	1.02(0.78−1.35)	0.871
Birth Order	First	1.00	
	Second	1.29(0.82−2.03)	0.275

	Third	1.02(0.64−1.62)	0.929
	Fourth or more	0.86(0.49−1.50)	0.592

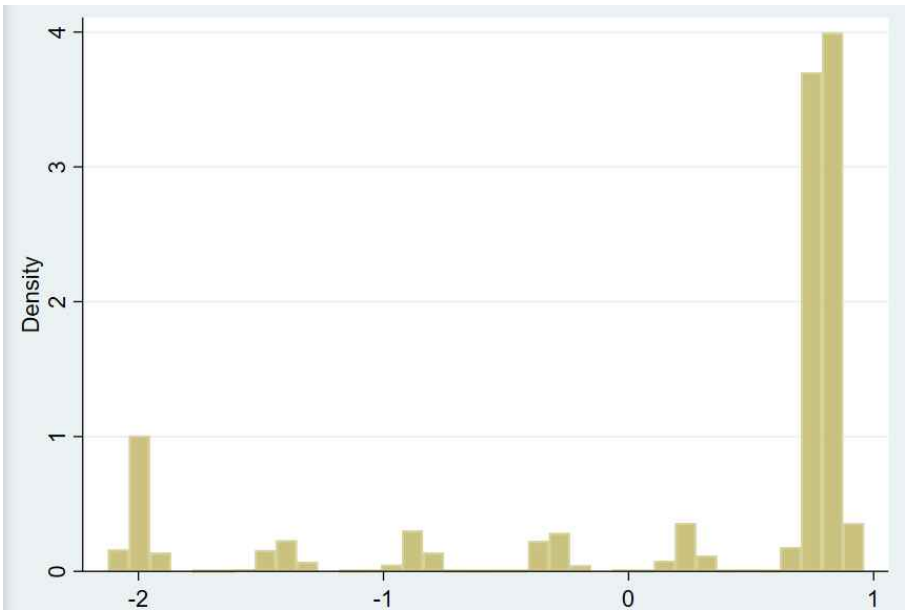
Table D. Logistic Regression Results (Continuous)

* p−value <0.05

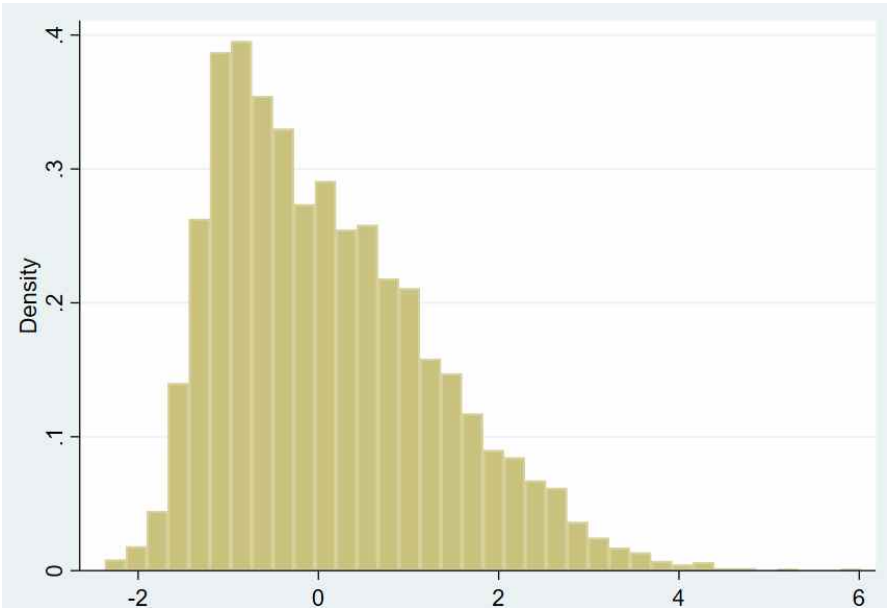
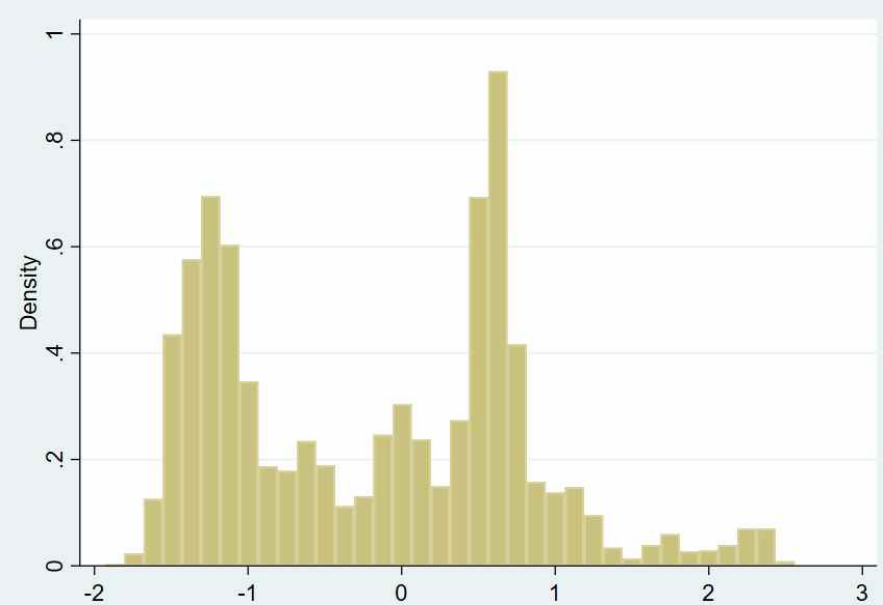
Variable	Category	EPI Full Vaccination	p−value
		OR (95% CI)	
Attitude to Violence	−	1.09(0.91−1.31)	0.327
Social Independence	−	1.16(0.94−1.43)	0.174
Decision−making	−	1.19(0.99−1.44)	0.065
Age of Mother	15~24	1.00	
	25~34	1.11(0.76−1.62)	0.579
	35~49	1.24(0.77−2.00)	0.372
Maternal Education	No education	1.00	
	Primary school	1.22(0.72−2.06)	0.454
	Secondary	2.04(1.12−3.72)	0.020*
	Higher than secondary	3.03(1.23−7.48)	0.016*
Paternal Education	No education	1.00	
	Primary school	2.92(1.74−4.89)	0.000*
	Secondary	2.57(1.60−4.12)	0.000*
	Higher than secondary	2.13(1.18−3.86)	0.012*
Wealth Index	Poorest	1.00	
	Poorer	1.06(0.62−1.80)	0.843
	Middle	1.10(0.64−1.88)	0.729
	Richer	1.62(0.93−2.83)	0.088
	Richest	2.54(1.30−4.97)	0.006*
Place of Residence	Rural	1.00	
	Urban	1.20(0.83−1.74)	0.337
Age of Child	12−36 months	1.00	
	37−59 months	0.74(0.55−1.00)	0.052
Place of Delivery	Home	1.00	
	Public	2.35(1.62−3.41)	0.000*
	Private	1.64(1.04−2.58)	0.035*

Figure A. Histograms of three subdomains of SWPER

1) Attitude to violence



2) Social independence



3) Decision-making