2020

Knowledge and Use of Health Services Related to Mother-to-Child Transmission of HIV in Nigeria

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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the review committee have been made.

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Walden University
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Abstract

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by

Uduak Bassey

MSc, Brunel University, 2008

BSc, University of Calabar, 2000

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

Walden University

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Abstract

HIV has remained a global public health issue despite efforts to curb the trend; especially in sub-Saharan African countries where more than 50% of those infected are women, creating implications for infant transmission. The purpose of this study was to assess trends in knowledge of prevention of mother-to child transmission (PMTCT) of HIV and use of PMTCT-related maternal health services (measured by antenatal care [ANC] in health facilities, use of HIV counseling and testing [HCT] during ANC, and use of skilled birth attendant at delivery [SBA]); as well as the association between knowledge and use of health services among reproductive aged women in Nigeria. The health belief model was the theoretical framework. Secondary data analysis was done using data from the United Nation Children's Fund Multiple Indicator Cluster Survey conducted in Nigeria in 2007, 2011, and 2016/2017. Chi square for trend analysis showed progressive decline in the proportion of women who had good knowledge of PMTCT and who used skilled birth attendant at delivery over the three periods ($p < 0.05$). The proportion of women who accessed ANC at health facilities increased in 2011 but decreased in 2016 ($p < 0.05$), which was a trend also reflected in the proportion of women who used HCT services. Finally, binary logistic regression showed that knowledge significantly predicted use of HCT during ANC in 2016 ($p < 0.05$, $OR = 1.557$, 95% CI [1.330-1.822]) while controlling for age, educational attainment, marital status, and area of residence. Results from this study may be applied through redesigning interventions specifically for women, which could improve engagement with HIV-preventive health services and reduce the rate of infant infection.

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Acknowledgments

My sincere appreciation goes to my committee members: Dr. Peter Anderson (committee chairperson), Dr. Paul Silverman (committee member) and Dr. Kai Stewart (University Reviewer) for your support and guidance throughout the various stages of my study. I am particularly grateful to my chair- Dr. Anderson, whose commitment and willingness to review several drafts of my work in a timely manner contributed immensely to my success. I appreciate the kind assistance of Dr. Taylor and Dr. Htway from the Center for Research Quality, Lisa Presley (Walden University Librarian), and Angie Drennen (Writing center).

To my husband, Essien and my children-Mireille, Ivana, Kayla and Ryan- my consistent cheerleaders, who were very understanding and willing to exist without me throughout my study, thank you for your love, support and sacrifices.

To my siblings- Emem, Grace, Abasiubong, Ubong, & Edidiong- thank you for being there for me every step of the way. You guys rock. To my aunty, Grace Udoka Edoho-ukwa, you always found the right words to spur me on in the difficult times, thank you. I am eternally grateful for the love of family and friends, thank you all for believing in me and for all the encouragement.

Special thanks go to my parents- Elder (Prince) and Mrs. U. J. Udoka, whose love, faith in me, and tireless prayers literally sustained me in the most difficult seasons.

My ultimate gratitude belongs to God- my father, my friend, my strength, my all. Thank you!!

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Section 1: Foundation of the Study and Literature Review

Introduction

Despite international efforts to curb the spread of HIV, the epidemic is still on the rise. As at 2018, about 37.9 million people were living with HIV globally, and 1.7 million people were newly infected (United Nations Program on HIV and AIDS [UNAIDS], 2019). Most of the people living with HIV reside in low- and middle-income countries, and over 60% of them live in sub-Saharan Africa (Avert, 2018). Nigeria, which is the most populous nation in Africa, is the second largest contributor to the global statistics (Faust, Ekholuenetale, & Yaya, 2018).

Apart from regional differences in prevalence, demographic disparities also exist. Women are disproportionately affected by HIV and AIDS due to vulnerabilities resulting from gender-based economic and sociocultural inequalities (Avert, 2019b). Currently, women make up more than half the number of people living with HIV (UNAIDS, 2019b; Avert, 2019b); and among reproductive aged women, AIDS- related illnesses remain a growing cause of mortality (Avert, 2019b). Because maternal health is closely tied to child health, the burden of HIV on women is transferred directly to children. About 90% of HIV infection in children is a result of mother-to-child transmission (MTCT) (Avert, 2019a; Oladele et al., 2017; Olakunde et al., 2019), which supports the need to prioritize prevention of MTCT (PMTCT) of HIV programs for epidemic control.

There have been several international interventions to curtail the spread of HIV. As a follow up to its PMTCT scale up interventions of 2011 and 2015, UNAIDS launched the *Super Fast-Track Framework and Action Plan of 2017* with the aim of

"reducing the pediatric infection rate to 5% or less among breastfeeding mothers and 2% or less among non-breastfeeding mothers by 2020" (Avert, 2019a). The targets for this intervention were 23 priority countries (Angola, Botswana, Burundi, Cameroon, Chad, Côte d'Ivoire, the Democratic Republic of the Congo, Ethiopia, Ghana, India, Indonesia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Nigeria, South Africa, eSwatini, Uganda, the United Republic of Tanzania, Zambia and Zimbabwe), where 87% of children living with HIV reside and from where about 87% of new pediatric infections were recorded in 2016 (UNAIDS, 2017),

Although some countries have recorded some progress, Nigeria remains one of four countries in the world where annual infant infection is over 10,000 (Avert, 2019a). In 2017, of the 180,000 children who were newly infected with HIV, 159,000 were from sub-Saharan Africa and of this number, 36,570 were from Nigeria (Olakunde et al., 2019). Nigeria's low coverage of PMTCT services has been implied in the country's slow progress toward reduction of infection in children (Oladele et al., 2017; Olakunde et al, 2019). Over the years, Nigeria has implemented several strategies to curb the spread of HIV, but evidence suggests progress has been slow. Most of the strategy has focused on educational awareness programs, but the impact of such campaigns in increasing knowledge and motivating health seeking behavior has not been significant (Faust et al., 2017).

This study is needed to assess the impact of current interventions in increasing knowledge of PMTCT among reproductive aged women and facilitating uptake of relevant maternal health services. In ensuring a HIV-free generation, the role of mothers

cannot be overemphasized (Thompson, Havenga, & Naude, 2015). As the primary care givers, women are directly affected and impacted by HIV and directing interventions to this population can significantly reduce the HIV prevalence especially in children (Mogobe et al., 2016; Thompson et al., 2015). When women are equipped with the right knowledge, they can adopt risk reduction measures to ensure their infants are not exposed to HIV. This would lead to better health outcomes for the mothers, less infant infection, and a significant reduction in economic and social burden of HIV in Nigeria.

Problem Statement

Eliminating pediatric infection is critical to the global fight against HIV, and it is a feasible approach. PMTCT interventions, if followed as prescribed, can reduce the rate of infections in babies born to women living with HIV from 45% to as little as 5% (Avert, 2019a). As such, it remains a viable option to eradicating new pediatric infections, which contributes significantly to global disease incidence (Endalamav, Demsie, Eshetie, & Habtewold, 2018). Most children and adolescents living with HIV reside in sub-Saharan African countries including Nigeria, and in 2016, this region accounted for 87% of new infections in children aged 0-14 years (UNAIDS, 2017). Despite the scale up of PMTCT interventions in the 23 Global Plan priority countries, MTCT of HIV remains a growing concern, especially in low resource settings, where current evidence indicates that outcomes in terms of maternal compliance with PMTCT guidelines and subsequent infant infections are less than optimal (Olakunde et al., 2019).

Knowledge of disease risk and benefits of health action can influence decisions to adjust lifestyles. Over the years, international recommendations on certain aspects of HIV

care and treatment, especially related to MTCT, have changed with national guidelines that are periodically updated to reflect new evidence (Faust et al., 2018; Yaya, Bishwajit, Danhoundo, & Seydou, 2016). Through the years, a major component of HIV interventions has been the education campaigns aimed at creating awareness, addressing misconceptions, and general information dissemination on available prevention, care, and treatment services (Faust et al., 2018). Being equipped with the right information can lead to uptake of relevant health services and adoption of health practices that minimize HIV exposure to the child.

Although there is an acknowledgement that knowledge plays a significant role in use of health services (Faust et al., 2018; Zoboli et al., 2017), trends in HIV-related knowledge have not been extensively studied, especially in sub-Saharan Africa (Faust et al., 2018). Previous studies have examined knowledge trends in Uganda (Opio, as cited in Faust et al., 2018), Ethiopia (De Coninck, Feyissa, Ekström, & Marrone, 2014), South Africa (Ramirez-Avila et al., 2015), and Nigeria (Faust et al., 2018). Previous trend analysis on HIV-related knowledge in Nigeria showed that general knowledge on HIV had improved from 2003 to 2013, but knowledge on PMTCT was low (Faust et al., 2018). However, these previous studies did not consider specifically how PMTCT knowledge among reproductive age women impacts their decision to use maternal health services, which was the aim of this study. Because information dissemination constitutes a major portion of Nigeria's strategic plan to eradicate HIV, it is important to assess the extent to which this strategy is facilitating adoption of health behavior that can lead to expected outcomes in the most vulnerable population—women and children.

Purpose of the Study

The purpose of this study was to assess the trend in PMTCT-related knowledge and the trend in use of PMTCT-related maternal health services over a 10-year period among women of reproductive age in Nigeria. In addition, the interaction between knowledge and use of maternal health services in the specified period was assessed. Secondary data from the United Nation Children's Fund (UNICEF) Multiple Indicator Cluster Survey (MICS) for Nigeria for 2007, 2011, and 2016/2017 were compared to establish possible changes in knowledge of PMTCT and use of PMTCT-related maternal health services over the years. This study is unique because of its focus on PMTCT knowledge at three different points in time with consideration that over that period, HIV care and treatment guidelines have been revised (Faust et al., 2018; Winskell et al., 2018). Because knowledge is a determinant of health behavior, and improving knowledge has been a major point of the HIV prevention national strategy (National Agency for the Control of AIDS, 2017), it is important to evaluate trends in HIV and PMTCT-related knowledge and assess its role in the use of maternal health services.

Research Questions and Hypotheses

Research Question 1: Over three time periods (2007, 2011, 2016/2017), is there a statistically significant difference in knowledge of PMTCT of HIV among reproductive aged women in Nigeria while controlling for age, education and marital status?

$H_0$1: Over three time periods (2007, 2011, 2016/2017), there is no statistically significant difference in knowledge of PMTCT of HIV among reproductive aged women in Nigeria while controlling for age, education and marital status.

H_a1: Over three time periods (2007, 2011, 2016/2017), there is a statistically significant difference in knowledge of PMTCT of HIV among reproductive aged women in Nigeria while controlling for age, education and marital status.

Research Question 2: Over three time periods (2007, 2011, 2016/2017), is there a statistically significant difference in uptake of PMTCT-related maternal health services (as measured by antenatal attendance at health facilities, HIV counseling and testing during antenatal visits, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria while controlling for age, education and marital status?

$H_0 2$: Over three time periods (2007, 2011, 2016/2017), there is no statistically significant difference in uptake of PMTCT-related maternal health services (as measured by antenatal attendance at health facilities, HIV counseling and testing during antenatal visits, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria while controlling for age, education and marital status.

$H_a 2$: Over three time periods (2007, 2011, 2016/2017), there is a statistically significant difference in uptake of PMTCT-related maternal health services (as measured by antenatal attendance at health facilities, HIV counseling and testing during antenatal visits, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria while controlling for age, education and marital status.

Research Question 3: Over three time periods (2007, 2011, 2016/2017), is there a statistically significant association between knowledge of PMTCT of HIV, and uptake of PMTCT-related maternal health services (as measured by antenatal attendance, HIV counseling and testing during antenatal, and use of skilled birth attendant at delivery)

among reproductive aged women in Nigeria, while controlling for age, education and marital status?

$H_0$3: Over three time periods (2007, 2011, 2016/2017), there is no statistically significant association between knowledge of PMTCT of HIV, and uptake of PMTCT-related maternal health services (as measured by antenatal attendance, HIV counseling and testing during antenatal, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria, while controlling for age, education and marital status.

H_a3: Over three time periods (2007, 2011, 2016/2017), there is a statistically significant association between knowledge of PMTCT of HIV, and uptake of PMTCT-related maternal health services (as measured by antenatal attendance, HIV counseling and testing during antenatal, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria, while controlling for age, education and marital status?

Theoretical Framework

Theories serve as a framework on which to design interventions, and they can be used to assess perceptions as well as explore how to change unhealthy behavior. The theoretical framework for this study was the health belief model (Rosenstock, 1974). The theory has been used extensively to assess individual level factors influencing preventive health behavior and decision to access health services (Glanz, Rimer & Viswanath, 2015). The theory is based on constructs such as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy

(Rosenstock, 1974; Glanz et al., 2015; see Figure 1). In the context of this study, health messages that are done with consideration to individuals' perception of disease susceptibility, understanding of the severity of the disease, perception of barriers and benefits to taking up health actions, and self-efficacy can enhance chances for uptake of health services. The health belief model works on the assumption that a mother's belief of susceptibility to the disease (or predisposition to pass it to her child)—predicated by her level of knowledge and her understanding of the severity of the disease in addition to the benefits of taking up suggested health actions to prevent transmission of HIV to her child—would determine her willingness to use PMTCT-related health services and continue in care and treatment as prescribed and prevent MTCT of HIV.

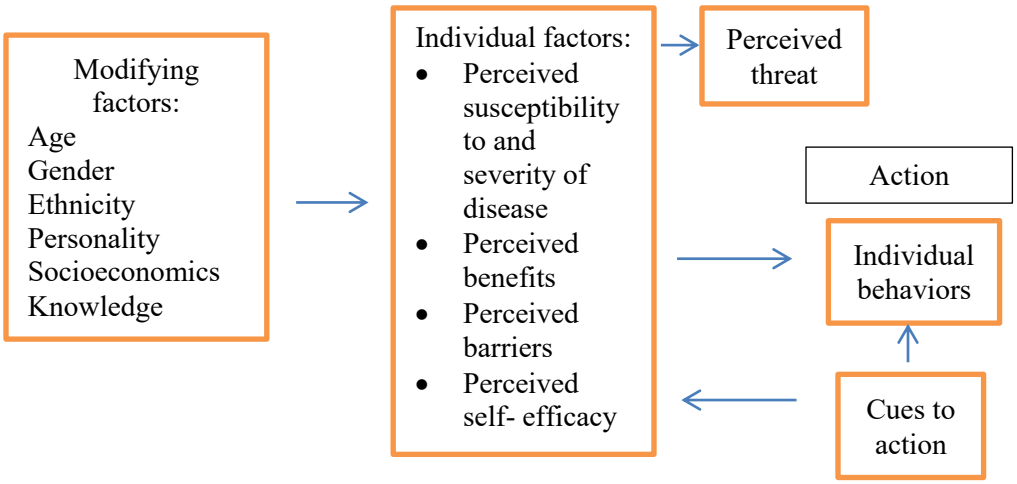

Figure 1. Components of the health belief model. Adapted from *Health Behavior: Theory, Research, and Practice*, by Glanz, Rimer, and Viswanath, 2015, p. 79.

Nature of the Study

This quantitative cross-sectional study was done using routinely collected data from the UNICEF MICS for Nigeria, focusing on data collected in 2007, 2011, and

2016/2017. The aims of the study were to assess trends in knowledge and use of PMTCT-related maternal health services over the three periods (2007, 2011, and 2016/2017) by reproductive aged women in Nigeria. The dependent variables were knowledge of PMTCT among women of childbearing age and use of PMTCT-related maternal health services (as measured by antenatal attendance, HIV counseling and testing (HCT) during antenatal care (ANC), and use of skilled birth attendant at delivery). The predictor variable was time measured as a categorical variable. Because the MICS contains data on respondents 15-49 years, data for those older than 49 years were excluded. Additionally, because the focus was on reproductive aged women, only female respondents were included in the analysis.

Literature Search Strategy

I carried out a literature search on the Walden University library databases including EMBASE, EBSCO, Science Direct, PubMed, CINAHL & MEDLINE combined search, and PsycINFO as well as on external sites such as Google scholar and other organizational websites including World Health Organization, UNICEF, and UNAIDS. The search terms I used included *prevention of mother-to-child transmission* OR *PMTCT*, AND *knowledge* OR *attitude* OR *perception* AND *Nigeria* OR *Africa* AND *antenatal* or *ANC* AND *HIV*. The scope of the literature was mainly papers published between 2014 and 2019 from peer-reviewed journals. A few articles from earlier years or non-peer review sources were included based on relevance to the topic as trend studies conducted in Africa were limited.

Literature Review Related to Key Variables and Concepts

Prevention of Mother-to-Child Transmission of HIV

A viable way to reduce HIV prevalence globally is through successful implementation of a PMTCT of HIV strategy. The PMTCT plan involves a four step approach that highlights the need to prevent primary infection among women of childbearing age, prevent unwanted pregnancies in women who are HIV positive, prevent vertical transmission, and provide care, treatment, and support for women living with HIV and their offspring (Avert, 2019a). Most health care facility-based interventions are focused on the prevention of vertical transmission by targeting a reduction in risk of infection in pregnancy, during labor and childbirth, and during breastfeeding (Avert, 2019a). In the absence of an intervention, the rate of vertical transmission of HIV from mother to child is about 15%-40%, with 5%-10% of infections occurring during pregnancy, 10%-20% during labor and delivery, and 5%-20% occurring during breastfeeding (Ben-Nathan & Hazanov, 2015). This highlights the importance of maximizing the perinatal period for HIV prevention interventions.

In 2013, the World Health Organization revised its HIV treatment guideline recommending that all HIV positive pregnant and breastfeeding mothers continue with lifetime antiretroviral regardless of their CD4 count in an approach known as “option B+”(Gumede-Moyo, Filteau, Munthali, Todd, & Musondu, 2017). This method was aimed at overcoming barriers to antiretroviral drug access based on CD4 count eligibility (Vrazo et al., 2017). Although other priority countries adopted the strategy at its inception, Nigeria finally commenced implementation by 2016 (Gumuede-Moyo et al.,

2017). In the option B+ era, women could be initiated on antiretroviral once test results confirmed seropositivity. This had the advantage of prompt initiation in treatment and reduction in chances of infant infection, but it also highlighted other challenges. The sudden initiation in treatment without adequate time for an individual to accept a positive result has been shown to affect adherence to treatment, which could be further compounded by fear of discrimination and alienation when status is disclosed to partner and/or family (Ehiri et al., 2016). Although PMTCT programs are effective in preventing infection in children, this is dependent on service uptake and retention in care and treatment (Vrazo et al., 2017). The PMTCT cascade includes attendance at ANC clinics, HCT, initiation on antiretroviral (for positive women), opting for safe delivery methods, practicing safe infant feeding, ensuring infant follow up visits with HIV testing and treatment initiation, family planning, and linkage to long-term HIV care (Gimbel et al., 2014; Gumede-Moyo et al., 2017).

Antenatal Care and Prevention of Mother-to-Child Transmission

ANC refers to the care provided by skilled health workers to pregnant women or adolescent girls to increase the chances of obtaining positive pregnancy outcomes for both the mother and the baby (World Health Organization, 2010). ANC clinics afford pregnant women the opportunity to interact with healthcare providers and increase the chance for uptake of life saving interventions. Every year, approximately 190,000 HIV positive women give birth in Nigeria, and a significant number of these women are diagnosed during pregnancy or at delivery (Psaros, Remmert, Bangsberg, Safren & Smit, 2015). Thus, integration of PMTCT services into ANC and other maternal and child

health care delivery systems provides a way to eliminate infant infection, although this is dependent on effective collaboration with health system stakeholders, the clients, and the community (Tkelab, Chojenta, Smith, & Loxton, 2019).

The World Health Organization (2010) recommended the integration of PMTCT services into routine maternal, newborn, and child health programs to ensure equitable access to care for perinatal women who are HIV positive. Under this strategy, PMTCT services would be offered as part of standard care for all pregnant women who attend ANC clinics. This strategy was adopted by 22 Global Plan priority countries and led to a 60% reduction in new infant infection by the 2015 deadline (Haroz, Zinkernagel & Kiragu, 2017). Thus, PMTCT services are offered as standard care at most antenatal clinics, which have been suggested to be a facilitator to uptake of PMTCT services because it minimizes the chances of stigma, and in low resource settings the economic burden of repeat visits for HIV services is eliminated (Ben-Nathan & Hazanov, 2015). However, low uptake of ANC services has been reported by several studies (Apagu, Tagurum & Hassan, 2014; Endalamav et al., 2018; Ben-Nathan & Hazanov, 2015). Although Nigeria scaled up PMTCT service delivery by decentralizing PMTCT services from secondary and tertiary health care facilities to primary health centers and private sector health care providers, which led to the creation of about 7,265 PMTCT facilities (National Agency for the Control of AIDS, 2019), PMTCT coverage rates stands at about 27%-30% and regional disparities remain (Oladele et al., 2017; Olakunde et al., 2019).

The World Health Organization recommends at least four ANC visits through the course of a pregnancy, but global statistics show that only about 50% of women achieve

the recommended frequency (Sibanda et al., 2018). In Nigeria, ANC coverage rate is about 61%, which is significantly lower than the recommended 90% coverage by the World Health Organization and shows that about a third of eligible women do not access ANC during pregnancy (Dahiru & Oche, 2015; Fagbamigbe & Idemudia, 2015). Nigeria's ANC statistic is still lower than some African countries; Ghana has a rate of about 78.2%, Benin Republic has a rate of 58.2%, Liberia's ANC coverage is estimated at 78.1%, Sierra Leone at 76%, Lesotho at 70.4%, and Zimbabwe at 64.8% (Dahiru & Oche, 2015). This low uptake of ANC has been suggested as one of the major determinants of high maternal mortality in the country (Fagbamigbe & Idemudia, 2015).

Many reasons have been suggested for poor uptake of ANC in low resource settings. In a Zimbabwean population, Sibanda et al. (2018) indicated that nonattendance at ANC was primarily due to economic reasons. Women who were not financially independent or did not have the approval and commitment of their husbands (who sometimes needed to be persuaded by female relatives), experienced delays with ANC registration or did not register at all for ANC through the course of their pregnancy. This finding is similar to a study conducted in a Nigerian setting, where financial constraint was also indicated as the main reason for delayed or nonattendance at ANC clinics (Fagbamigbe & Idemudia, 2015). Economic challenges affect payment for services and can impact accessibility, as women may not be able to afford the transportation cost to health centers far from their homes. But offering free ANC services to women, especially in poor settings, have not always resulted in higher ANC attendance, which suggests that other factors may be interacting with financial barriers as a deterrent to accessing care

(Tkelab et al., 2019). Other concerns cited for ANC nonattendance have included long wait times at the clinics, which has been implicated in low rate of male partner participation in maternal health care (Yah & Tambo, 2019), poor attitude of health care providers (Zegeye et al., 2018), sociocultural preference for home delivery attended by traditional birth attendants (TBAs; Chea et al., 2018; Kea, Tulloch, Datiko, Theobald & Kok, 2018), and lack of consideration for contextual elements during program implementation (Sibanda et al., 2018).

Though the potential for improved maternity outcomes exist, integration of PMTCT interventions with ANC service delivery, in practice, is challenged by the complex interactions between health systems and social and environmental factors, especially in low resource settings. Attendance at ANC clinics is the first step in accessing PMTCT services; however, the pregnant woman must undergo HCT, which is an important step toward the uptake and success of PMTCT interventions.

HIV Counseling and Testing

HCT during pregnancy provides an opportunity for identification of HIV-positive women and prompt initiation in treatment, care, and support to minimize risk of infant infection. However, several factors influence HIV testing among pregnant women including access to testing sites, lack of confidentiality, and stigma (Ehiri et al., 2016; Sibanda et al., 2018). There is some evidence to show that women are willing to take up HIV testing services during ANC visits, but this evidence has not matched actual uptake of services in studied populations (Cornelius, Erekaha, Okundaye, & Sam-Agudu, 2018). One suggestion for this disparity between intent and action is the multilevel barriers to

uptake of services that impacts not just HIV testing but maximization of other PMTCT health services (Balogun & Owoaje, 2015; Ben-Nathan & Hazanov, 2015; Cornelius et al., 2018).

To improve access to testing, several countries have integrated HIV testing into their pre- and post-natal services. Evidence from high-income countries show that MTCT has been reduced greatly due to the standardization of HIV testing at regular prenatal visits, and similar experiences have been reported in countries in sub-Saharan Africa, though the rates are less significant than those seen in industrialized nations (Ben-Nathan & Hazanov, 2015). Additionally, the adoption of the Option B+ strategy by priority countries in sub-Saharan Africa has contributed significantly to the increase in HIV testing among pregnant women during ANC in these countries (Gumede-Moyo et al., 2017).

Although HIV testing is generally done when women first present at ANC or during labor and delivery (Balogun & Owoaje, 2015), women in low resource settings have been known to boycott ANC or attend in late pregnancy, which presents a challenge to timely antiretroviral initiation (Olakunde et al., 2019). To close this HIV testing gap, routine (opt-out) testing is done at delivery points. But due to the urgency of the situation, HIV testing at delivery does not allow for proper counseling, and the fear of possible infection often drives health care workers to carry out testing of women perceived as high risk without informed consent (Vieira et al., 2017).

Despite a rise in HIV testing in ANC in the current dispensation of option B+, uptake and retention along later stages of PMTCT cascade has been low (Gumede-Moyo

et al., 2017). Cultural norms such as the preference for TBAs have also contributed to the low uptake of HIV testing within formal health sectors (Chizoba et al., 2017). More than 50% of births in Nigeria still occur at homes under the assistance of untrained or trained TBAs or family members who have little to no knowledge of HCT or PMTCT (Chizoba et al., 2017).

Skilled Birth Attendant at Delivery

One of the factors that affects maternal and child health outcomes is the presence of a skilled birth attendant at delivery (Abiodun et al., 2015; Chea et al., 2018; Dahiru & Oche, 2015). Over the years, there has been growing awareness on the need for professional assistance at delivery, which has improved health seeking behavior of pregnant women and uptake of ANC services (Dahiru & Oche, 2015). Nevertheless, presenting for ANC does not directly imply that a woman would deliver her child in a health facility. In many societies in Africa, pregnancy is seen as a normal physiological process that a woman undergoes and as such is not a serious condition that requires advanced medical attention except in an emergency (Ehiri et al., 2016; Sinai, Anyanti, Khan, Daroda, & Oguntunde, 2017). These perceptions encourage the practice of home deliveries where women prefer the services of unskilled or semiskilled TBAs, which has been implicated in high rate of pregnancy related morbidity and mortality in sub-Saharan Africa (Chea et al., 2018).

In Nigeria, about 65% of births still occur at home under the supervision of TBAs (Abiodun et al., 2015; Chizoba et al., 2017). This high rate of home deliveries is similar to findings from other low resource settings where sociocultural norms promote

patronage of unofficial health professionals (Chea et al., 2018). Factors influencing low uptake of hospital deliveries include long distance to health facilities, security concerns if a woman goes into labor in the middle of the night, high obstetric charges, nonattendance at ANC, poor attitude from health workers, sociocultural norms including need for spousal approval and/or commitment, and previous successful home delivery (Chea et al., 2018; Sinai et al., 2017). In the context of HIV and PMTCT, women in rural communities where health care workers are personally known by service users may be hesitant to seek help from formal health sectors due to concerns of confidentiality (Ehiri et al., 2018). This often leads to reliance on TBAs who are mostly older women perceived to be more sympathetic and patient with their clients than nurses and who may not require the women to carry out HIV testing before being attended to (Ehiri et al., 2016, 2018). However, home deliveries present several challenges such as increased risk for vertical transmission, as birthing attendants may not be knowledgeable enough to counsel clients or integrate PMTCT activities in their routine obstetric care (Chizoba et al., 2017), thus impacting desired PMTCT outcomes in low resource settings.

Predictors of Uptake of Prevention of Mother-to-Child Transmission Services

Uptake of PMTCT-related maternal health services is dependent on a number of factors ranging from individual to policy level factors. Although certain barriers are context specific and evidence of their role may be controversial, some determinants are similar across many settings (Ben-Nathan & Hazanov, 2015). Barriers to uptake of health services can be grouped into policy level factors, health system factors and individual level factors. Of these, individual level factors are considered readily modifiable (Apagu

et al., 2014; Cornelius et al., 2018). Individual level factors such as socio-demographic variables have been suggested to be strong predictors of maternal health service use in many settings.

Sociodemographic factors as predictors of maternal health service use

Education as a predictor for health service use: Generally, having higher education is associated with higher rate of health service use as it facilitates understanding of health information (Mogobe et al., 2016). Sibanda et al. (2018) found that higher education was correlated with use of ANC and PMTCT services in their Zimbabwean population. This agrees with findings from similar settings in Africa where higher education was correlated with better understanding of PMTCT guidelines and thus increased rate of retention in care (Schnack et al., 2016), as well as higher rate of hospital deliveries using skilled birth attendants (Chea et al., 2018). Similarly, in Bangladesh (another low resource setting), high maternal education was correlated with uptake of ANC and use of skilled attendants during delivery (Anwar, Nababan, Mostari, Rahman & Khan, 2015).

Educated women are likely to be employed and thus would be financially independent and able to afford ANC registration and other obstetric charges which often act as a barrier to women's uptake of lifesaving services. In several studies, it has been shown that women who were dependent financially on their husbands had to wait for spousal approval to register for ANC and/or afford transportation expenses for repeat clinical visits (Adelekan et al., 2014; Al- Mujtaba et al., 2016; Ehiri et al., 2018; Kea, Tulloch, Datiko, Theobald & Kok, 2018; Sibanda et al., 2018). Also, higher education

could enhance health literacy enabling women make informed decisions to improve their health and that of their offspring.

Health literacy is defined as the ability to obtain, understand and utilize health information in order to achieve positive health outcomes (Brabers, Rademakers, Groenewegen, van Dijk & Jong, 2017). Health literacy with regards to PMTCT can be enhanced when one is knowledgeable enough to understand basic information shared over mass media, during ANC classes, or other settings. In the current realities of periodic changes to HIV/PMTCT guidelines, including evolution of new drug combinations requiring conscientious efforts to understand treatment combinations, time intervals between medications, engagement in the use of technologies to improve retention in care and treatment, having a functional level of health literacy-with basic literacy and numeracy skills- would be essential for effective HIV management and self-care (Cunha, Galvão, Pinheiro, & Vieira, 2017; Mogobe et al., 2016; Thompson, Havenga & Naude, 2015).

In spite of evidence showing that education plays a major role in health literacy and could improve use of health services and adherence to medication regimen, some evidence suggests that education could negatively impact health service uptake. Educated people have been shown to falter in adhering to instructions given by health professional and could be prone to rely on self- treatment (Cunha et al., 2017). It can be argued that such findings may be context and disease specific. For example, if one is managing an intermittent treatable disease like malaria, it is possible that educated people could self-medicate due to the routine nature of malaria therapy (Chipwaza et al., 2014). But HIV

treatment regimen and daily self-management is different, and often consists of a complex set of requirements which is dependent on individualized clinical stage, CD4 counts, and viral suppression. As such, education would more likely facilitate engagement with the health system in order to ensure positive health outcomes (Schnack et al., 2016).

Overall, there is compelling evidence to show that education could improve knowledge and hence increase the rate of uptake of ANC services, HIV testing and use of skilled birth attendant at delivery, which are important requirements for successful PMTCT outcomes (Chea et al., 2018; Schnack et al., 2016). Therefore education will be controlled for in the statistical analysis.

Marital status as a predictor of health service use: Social support is vital to achieving positive health outcomes when one is living with a chronic illness. Studies have shown that being married or in a stable relationship can affect uptake of PMTCT services and initiation on HIV treatment (Gourlay et al., 2015; Helleringer, 2017; Sibanda et al., 2018). Male partner involvement has been linked to increased rate of ANC attendance (Gunn et al., 2016; Sibanda et al., 2018), uptake of HIV testing services (Sibanda et al., 2018), initiation on antiretroviral (Gourlay et al., 2015), use of skilled birth attendant at delivery (Spangler, Onono, Bukusi, Cohen & Turan, 2014), and overall retention in post-partum care (Vrazo et al., 2017; Weiss et al., 2014). Increased uptake of ANC services could be facilitated through financial and moral support from male partners especially in paternalistic societies where women are not empowered to make important decisions on their own (Merga, Woldemichael & Dube, 2016). Merga et al. (2016) in

their study showed that women who had discussed ANC and HIV testing services with their husbands were six times more likely to engage in PMTCT program than those who had not discussed with their partners. This is similar to findings from other low resource setting were prior discussion with partners increased health seeking behavior of pregnant women (Spangler et al., 2014). Participation at ANC clinics, especially in facilities where PMTCT services are integrated, would more likely lead to uptake of HCT services, which is the point where many pregnant women are first diagnosed (Schnack et al., 2016). Having a supportive spouse could facilitate initiation on HIV treatment and subsequent adherence in care since the financial and psychological burden of a positive diagnosis can be shared (Merga et al., 2016).

However, the evidence on the protective factor of being married as it relates to HIV management is controversial. Ehiri et al. (2016) found that among respondents in their study, being married was associated with less uptake of HIV testing and consequently PMTCT services. In settings were HIV testing was carried out as part of routine ANC services, positive pregnant women have been found not to disclose their HIV status to their partners for fear of domestic violence, divorce or stigmatization from spouses, and extended family members (Ehiri et al., 2016; Merga et al., 2016; Schnack et al., 2016; Spangler et al., 2014; Yah & Tambo, 2019). The evidence suggests that non-disclosure is a significant barrier to maternal health service uptake and can occur when partner's serostatus is unknown (Spangler et al., 2014), or when pregnant women are diagnosed during initial ANC visits but are unable to accept a positive result (Schnack et al., 2016).

Being married or in a stable relationship could be a facilitator for uptake of PMTCT related health services, but this is dependent on other factors including active male partner involvement which could lead to couples HCT, and disclosure of HIV status to partner (Gourlay et al., 2015). Male partner involvement holds several benefits including long term spousal support which is crucial to protect against stigmatization of the woman, especially in an African setting where mother-in-laws and other extended family members participate actively in the care of the baby during the post-partum phase (Gourlay et al., 2015; Merga et al., 2016; Spangler et al., 2014). Thus, marital status is an important confounder and was controlled for during the statistical analysis.

Age as a predictor of health service use: Age has been shown to play a contributory role in women's health seeking behavior. Older women, especially of higher socioeconomic class, were more likely to use HCT services in a Zambian population study (Muyunda, Mee, Todd, Musonda & Michelo, 2018). This is similar to a Nigerian based study, where the likelihood of ANC attendance was increased 200% in women 35 years and older (Dahiru & Oche, 2015). Similarly, Helleringer (2017) found that in 12 countries located in West and Central Africa, age played a significant role in determining uptake of HIV testing and adherence to treatment. This investigator found that among adolescents aged 10-19 years, HIV testing was low for a variety of reasons. Typically, pregnant adolescents were unmarried, were from a low socioeconomic class, and lacked knowledge that HIV could be passed from a mother to her infant (Helleringer, 2017). In settings were adolescent marriage was practiced, teenage wives were less likely than older women to utilize HIV testing since they lacked autonomy (they required permission

and financial support from their husbands to utilize pregnancy related health services) (Helleringer, 2017).

In contrast, Musarandega et al. (2017) found no difference between adolescent and adult ANC clients in uptake of ANC services, HIV testing during ANC, and initiation of HIV treatment. The authors reported earlier registration for ANC among adolescent pregnant women, although completion rate of the World Health Organization recommended four ANC visits was equally low among adolescent and adult women (Musarandega et al., 2017). Early initiation of ANC among younger women could be because younger women may not have prior pregnancy experiences and as such, would be more concerned about pregnancy related health risks than older women who may have some experiences from previous pregnancies (Helleringer, 2017). The results of low rate of ANC completion among youths could be due to poor attitudes from health care providers, stigmatization and low knowledge of MTCT, which is similar to the findings from other studies (Callahan, Modi, Swanson, Ng'eno & Broyles, 2017; Gourlay et al., 2015; Helleringer, 2017). Young, unmarried pregnant women were less likely than older married women to take up maternity related health services for fear of discrimination from health care providers as both being pregnant as an under aged single woman and living with HIV are stigmatized conditions in many African settings (Gourlay et al., 2015; Kea et al., 2018). This variable was controlled for in the statistical analysis.

Knowledge of prevention of mother-to-child transmission as a determinant for maternal health service use. PMTCT strategies rely on effective dissemination of information concerning risk factors and protective factors with the ultimate goal of

facilitating engagement in HIV prevention activities; therefore, assessing the role of knowledge in women's use of maternal health services is important. Several studies have shown that a general awareness of MTCT has increased over the years in many sub-Saharan African countries where international efforts have focused towards elimination of MTCT (Faust et al., 2017; Luba et al., 2017; Mutabazi, Zarowsky & Trottier, 2017; Ramoshaba & Sithole, 2017), although knowledge prevalence is dependent on several factors. Apagu, Tagurum and Hassan (2014) showed that knowledge preceded motivation to access preventive health services in their study population, especially among participants who had higher educational attainment and higher income. This is similar to the study by Faust et al. (2017), where the authors indicated that in the Nigerian context, amongst other things education, and wealth inequality impacted knowledge and therefore the adoption of preventive health behavior. Their findings indicated that those in the lower socioeconomic strata of the population had poor knowledge of HIV and its mode of transmission, especially MTCT routes (Faust et al., 2017). Although the knowledge of MTCT was better among females than male participants in their study population, that knowledge did not translate to women's awareness of risk reduction measures (Faust et al., 2017). Similar evidence has been reported in South Africa (Ramoshaba & Sithole, 2017), and Ethiopia (Luba et al., 2017) were women had heard about MTCT but were not completely knowledgeable of exact mode of transmission, or how infant infection could be prevented. This evidence suggests that awareness programs may not be focusing on available, context specific risk reduction options and hence may not result in uptake of preventive health programs among women This observation has been made by Katirayi

et al. (2017) whose findings from a two country-study pointed out that HIV prevention messages may not be accurate, or up to date, and may not be addressing previous misconception that could limit message acceptance; thus reducing its impact in motivating women to take up preventive health care.

Definitions

CD4 count: A measure of the number of CD4 cells in the blood of a HIV positive patient. The test is used to determine how functional the immune system is.

Health Literacy: Health literacy is defined as the ability to obtain, understand and utilize health information in order to achieve positive health outcomes (Brabers et al., 2017).

Health services: All services dealing with the diagnosis and treatment of disease, or the promotion, maintenance, and restoration of health.

Option B+: A PMTCT strategy where expectant mothers living with HIV are offered treatment for life irrespective of their CD4 count.

PMTCT maternal health services: All pregnancy related health services that involve PMTCT including antenatal clinics, HIV testing and counseling and delivery with the aid of skilled birth attendants in health facility

Assumptions

In this study, I assumed that information from the secondary data was accurate and free of error. I also assumed that interviewers were objective and did not manipulate data while entering information into the data management systems. Additionally, I

assumed that respondents gave honest information about their knowledge/ attitudes and practices on the use of PMTCT-related maternal health services.

Scope and Delimitations

I used a quantitative approach to assess trends in knowledge of PMTCT and trends in the use of PMTCT-related maternal health services among reproductive aged women who had a live birth two years or less, prior to each MICS. I focused on data from 2007, 2011 and 2016/2017 only, and did not include data from other MICS rounds.

Significance, Summary and Conclusions

This study was carried out to investigate trend in knowledge of PMTCT and trend in use of PMTCT-related maternal health services among reproductive aged women in Nigeria, analyzing data within a 10-year period, where most of the recent changes in the national strategy to curb HIV had happened. Information dissemination is a main component of the national strategic response to curbing HIV in Nigeria, therefore it is expedient to assess if current efforts have impacted knowledge of PMTCT and use of maternal health services among reproductive aged women, whose role in elimination of pediatric infection cannot be overemphasized.

The insight from this study could show how effective the national strategy has been in creating awareness and facilitating uptake of lifesaving interventions among reproductive aged women. Women and children are affected disproportionately by the HIV epidemic; therefore, increasing knowledge of risk reduction measures among women could enhance uptake of preventive health services, adoption of healthier lifestyles and reduction in infant infection. A decrease in incidence and prevalence of

HIV could also ease the social and economic burden of HIV in the country. Furthermore, the study's findings could guide revision of current policies by highlighting gaps in awareness and use of preventive health services which could lead to effective resource allocation.

Section 2: Research Design and Data Collection

Introduction

Since its first appearance almost four decades ago, HIV has contributed to about 32 million deaths worldwide (UNAIDS, 2019), disproportionately impacting women and children in the poorest parts of the globe (Avert, 2019b). Nigeria is the most populous country in Africa and contributed 9% to the HIV global burden in 2013 (Faust et al., 2017), with more than 10,000 children infected through vertical transmission annually (Avert, 2019a). Despite global and national efforts to curb this trend, elimination of pediatric infection—a feasible approach to slowing incidence and prevalence—has been challenging (Oladele et al., 2017; Olakunde et al., 2019). Factors influencing this challenge include the low uptake of preventive services that are integrated into routine maternal health services in Nigeria (Oladele et al., 2017; Olakunde et al., 2019). Because HIV-related knowledge is a strong predictor of adoption of preventive health behavior and has been emphasized in several national and international HIV prevention guidelines (Faust el al., 2017), there is a need to assess what extent the educational programs have contributed to changes in preventive health behavior as it concerns perinatal women.

In this study, I sought to assess trend in PMTCT-related knowledge and use of PMTCT-related health services among reproductive aged women in Nigeria using data from the UNICEF MICS (Rounds 3, 4, and 5). Previous trend analysis in the country had focused on HIV-related knowledge in the general population (Faust et al., 2018), and was not specific to knowledge of PMTCT among reproductive aged women, which is

important because women play a crucial role in the prevention of MTCT (Mogobe et al., 2016; Thompson et al., 2015).

In the previous section, I described the evidence in literature on the role of knowledge and other sociodemographic factors on the use of health services in low resource settings. Additionally, I described the scope of the study, defined operational terms, and listed assumptions, and limitations of the study. In this section I describe how the sample was drawn and the sampling frame with the inclusion and exclusion criteria. Furthermore, procedures for gaining access to data, permissions, and procedure for recruitment of subjects is discussed in this section. Finally, I describe the threats to internal and external validity to the study as well as the ethical concerns related to data access and confidentiality.

Research Design and Rationale

I used a cross-sectional quantitative approach to analyze trends in PMTCT knowledge and use of PMTCT-related maternal health services among reproductive aged women in Nigeria using secondary data from UNICEF MICS Rounds 3, 4 and 5. Possible interaction of the variables was also assessed. The UNICEF MICS is a nationally representative survey of men and women in Nigeria between 15 and 49 years old. Data for this study were derived from individual female respondents who had a live birth within 2 years of the data collection. Data from each year was merged prior to analysis.

The quantitative approach was appropriate because it allowed for a comparison of changes in knowledge of PMTCT and use of PMTCT-related maternal health services across three periods, and it also allowed for assessment of an interaction between

knowledge and uptake of health services, which were the aims of this study. The dependent variables included knowledge of PMTCT and use of maternal health services (as measured by antenatal attendance, HCT during antenatal, and use of skilled birth attendant at delivery). For both research questions, time was the independent variable and was categorized into three times: 2007, 2011, and 2016/2017. All dependent/outcome variables were recoded as categorical variables: knowledge of PMTCT was dichotomized as high and low (depending on participant's response on awareness of modes of MTCT) and antenatal attendance, HCT during ANC, and use of skilled birth attendant at delivery was recoded as *yes* or *no*.

I intended to use a four-way analysis of covariance (ANCOVA) test to assess the impact of time on the outcomes of interest - PMTCT knowledge, ANC attendance, HIV testing and counseling during ANC, and use of skilled birth attendant during delivery, while controlling for education, age, and marital status - but I did not (see explanation on page 39). Using one statistical test minimized the chances for type I and type II error that can occur with several statistical tests. I did not validate the secondary data for completeness or correctness under the assumption that the data quality was assured by the National Bureau of Statistics and UNICEF. I managed missing data at the analysis stage.

Methodology

This study was based on secondary analysis of the UNICEF MICS collected in 2007, 2011, and 2016/2017 from the Nigerian populace. The data were retrieved and downloaded from the UNICEF electronic data management system. Prior to using the data, permission were sought from UNICEF, which usually requires an online

registration and receipt of their response via e-mail. Data for reproductive aged women who had a live birth within 2 years of each survey were extracted. Respondents with incomplete information were excluded from the study.

Population

The population of interest for this study included women between the ages of 15 and 49 who had been pregnant in the 2-year period preceding data collection. This is the ideal group for the study as PMTCT-related maternal services are integrated into antenatal and postnatal services in formal health sectors in Nigeria (Olakunde et al., 2019), and likelihood of adoption of services would be more evident among perinatal women. In 2010 Nigeria launched its national strategic response to HIV aimed at educating and encouraging uptake of preventive health services. This was implemented between 2010 and 2015 and led to an updated strategic framework that is currently being implemented (National Agency for the Control of AIDS, 2017). Therefore, examining data from the MIC Survey just before, during, and after the implementation of the national strategy illustrated whether the intervention produced any change in knowledge and use of health systems among women in Nigeria.

Sampling and Sampling Procedures

The sample of respondents for the MICS was drawn in multiple stages. First, a random sample of enumeration areas was selected proportionally to the size of each enumeration area. Then, within each enumeration area, a random sample of 20–30 households was selected. Finally, within each household, all women aged 15–49 years old were interviewed. A total of 27,093, 33,699 and 36,176 women were interviewed for

each survey year. Sampling weights were then calculated and adjusted for nonresponse to ensure that the data are representative of the population of interest. For this study, the sample size was all eligible reproductive aged women who had a live birth two years prior to each survey.

Instrumentation and Operationalization of Constructs

I used secondary data for my analysis and because this did not involve the use of instruments for data collection, review of instrument validity and reliability was not needed. The dependent variables were knowledge of PMTCT and use of PMTCT- related maternal health services. Knowledge of PMTCT was based on responses to question on awareness of routes of MTCT of HIV and responses were dichotomized as *good* and *poor* knowledge depending on how many correct answers participants gave. PMTCT-related maternal health services was measured using three variables- ANC at health facilities, HCT during ANC, and use of skilled birth attendant during delivery, since these were the variables available in the MICS dataset.

The independent variable was time measured at three points (2007, 2011, and 2016/2017). Time was categorized into three groups: time 1, time 2 and time 3. Other demographic characteristics such as marital status, education and age were also considered. Marital status was categorized as married or not married; education was categorized as high or low education using secondary education as the benchmark; age was categorized as young (ages below 35) and older (35 years and above).

Data Analysis Plan

I exported all data into the SPSS version 25 software for analysis. I cleaned the data by ensuring all data elements were available and recoded variables into categories. I excluded participants with missing data or incomplete information.

Research questions and hypotheses. Research Question 1: Over three time periods (2007, 2011, 2016/2017), is there a statistically significant difference in knowledge of PMTCT of HIV among reproductive aged women in Nigeria while controlling for age, education and marital status?

$H_0$1: Over three time periods (2007, 2011, 2016/2017), there is no statistically significant difference in knowledge of PMTCT of HIV among reproductive aged women in Nigeria while controlling for age, education and marital status.

H_a1: Over three time periods (2007, 2011, 2016/2017), there is a statistically significant difference in knowledge of PMTCT of HIV among reproductive aged women in Nigeria while controlling for age, education and marital status.

Research Question 2: Over three time periods (2007, 2011, 2016/2017), is there a statistically significant difference in uptake of PMTCT related maternal health services (as measured by antenatal attendance at health facilities, HCT during antenatal visits, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria while controlling for age, education and marital status?

$H_0$2: Over three time periods (2007, 2011, 2016/2017), there is no statistically significant difference in uptake of PMTCT related maternal health services (as measured by antenatal attendance at health facilities, HIV counseling and testing during antenatal

visits, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria while controlling for age, education and marital status.

H_a2: Over three time periods (2007, 2011, 2016/2017), there is a statistically significant difference in uptake of PMTCT related maternal health services (as measured by antenatal attendance at health facilities, HIV counseling and testing during antenatal visits, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria while controlling for age, education and marital status.

Research Question 3: Over three time periods (2007, 2011, 2016/2017), is there a statistically significant association between knowledge of PMTCT of HIV, and uptake of PMTCT related maternal health services (as measured by antenatal attendance, HIV counseling and testing during antenatal, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria, while controlling for age, education and marital status?

$H_0$3: Over three time periods (2007, 2011, 2016/2017), there is no statistically significant association between knowledge of PMTCT of HIV, and uptake of PMTCT related maternal health services (as measured by antenatal attendance, HIV counseling and testing during antenatal, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria, while controlling for age, education and marital status.

H_a3: Over three time periods (2007, 2011, 2016/2017), there is a statistically significant association between knowledge of PMTCT of HIV, and uptake of PMTCT related maternal health services (as measured by antenatal attendance, HIV counseling

and testing during antenatal, and use of skilled birth attendant at delivery) among reproductive aged women in Nigeria, while controlling for age, education and marital status?

Inferential statistics. I conducted descriptive analysis for the variables detailing frequencies and percentages. I also carried out inferential analysis using multivariate analysis to assess association between dependent and independent variables. The level of significance was set at 0.05 and the decision rule was to reject the null hypothesis if *p* value is less than 0.05; in such a case, an association between the predictive and outcome variables was confirmed.

Threat to Validity

Since the sampling was not done through randomization, selection bias constituted a threat to internal validity of the study. I minimized this threat by clearly defining the target population. External validity, on the other hand refers to the extent to which the results of the study can be extrapolated to the general population (Creswell, 2011). I addressed issues of external validity by ensuring the study was appropriately powered and by acknowledging this limitation during results interpretation. Additionally, I addressed issues on reliability – that may arise when using secondary dataset because data quality cannot be enhanced during use – by describing this limitation in the limitation section of the study. Construct validity describes the appropriateness of the theoretical framework to the nature of the study (Creswell, 2011). This was addressed by ensuring the constructs within the selected theoretical model aligned with the hypothesis

tested in the study. Since no instrument was used for data collection, issues relating to instrumentation were not considered as they did not impact the validity of the results.

Ethical Procedures

I requested for and obtained permission to use the UNICEF MICS round 3, 4, and 5 data from UNICEF MICS team. Permission to use data was granted after filling an online request form which specified the purpose for use of data. I sought and received approval to collect and analyze data from the Walden University IRB (Approval # 12-16-19-0599654).

Summary

In this section, I described the research design and methodology I employed in the study. The population of interest was reproductive aged women between the ages of 15 and 59 who had a live birth two years prior to the MIC surveys in Nigeria. The study design was a quantitative cross-sectional design with data extracted from three rounds of the MICS carried out in 2007, 2011 and 2016/2017.

The predictor variables I considered were time, education, marital status and age, while the outcome variables were knowledge of PMTCT and use of maternal health services. I intended to use four-way ANCOVA to explore interactions between variables while controlling for confounders using SPSS version 25 statistical software, however this was not done (see explanation on page 39). The analysis included both descriptive and inferential analysis. The inferential analysis was done at the multivariate level. The power level was set at 80%, while *p*-value was set at 0.05. I will describe the results of the data analysis in the next section.

Section 3: Presentation of the Results and Findings

Introduction

The aim of this study was to examine the trend in knowledge of PMTCT of HIV and trend in use of PMTCT-related maternal health services (as measured by antenatal attendance at health facilities, HCT during antenatal visits, use of skilled birth attendant at delivery) among reproductive aged women in Nigeria who have had a live birth in the 2 years prior to the surveys in 2007, 2011, and 2016/2017 using secondary data from the UNICEF MICS. I conducted descriptive and inferential statistical analysis to assess the association between predictor and outcome variables using SPSS version 25.

The research questions pertained to whether there was a difference in knowledge of PMTCT of HIV, difference in uptake of PMTCT related maternal health services, and a significant association between knowledge of PMTCT of HIV, and uptake of PMTCT related maternal health services among reproductive aged women in Nigeria who had a live birth in the 2 years prior to the survey, over three time periods (2007, 2011, 2016/2017), while controlling for age, education, marital status and area of residence. For the first research question, time (measured at three time points) was the independent variable, and knowledge of PMTCT was the dependent variable. The second research question had time as the independent variable (measured at three time points) and the dependent variables were ANC attendance at health facilities, HCT during ANC visits, and use of skilled birth attendant at delivery. For the third research question, knowledge of PMTCT was the predictor and the outcome variables remained ANC attendance at health facilities, HCT during ANC visits, and use of skilled birth attendant at delivery.

The covariates in this study were age, educational attainment, marital status and area of residence. In this section, I describe the data collection process, timeframe and response rate of the sample population, univariate descriptive analysis, bivariate analysis, multivariate analysis and a summary of the findings from the data analysis.

Data Collection of Secondary Data Set

The UNICEF MICS is conducted by the National Bureau of Statistics, Nigeria, with technical support from UNICEF. The MICS are population-based surveys that provide estimates on key indicators relating to maternal and child health across six geopolitical zones of the country. Data from the MICS are internationally comparable data that are used to guide policies and programs geared toward achieving sustainable development goals and other internationally agreed upon commitments (National Bureau of Statistics & UNICEF, 2017). Two-stage sampling design was used in the MICS, which involved selection of enumeration areas within each state and subsequent selection of households within each enumeration area. Selecting households through a multistage sampling design provides a nationally representative sample of the country being investigated (Ayede et al., 2018).

Data from the third, fourth, and fifth rounds of the MICS conducted in Nigeria in 2007, 2011, and 2016/2017 were retrieved from the UNICEF MICS website. The data were factual and were retrieved without an issue and contained variables that could facilitate answering of the research questions. Thus, there were no discrepancies from the data collection plan reported in Section 2.

The population of interest was women of reproductive age (15-49 years) living in Nigeria when the third, fourth, and fifth rounds of the UNICEF MICS were conducted (2007, 2011, and 2016/2017 respectively). Women who responded to questions regarding antenatal attendance at health facility, HCT, use of skilled birth attendant during delivery and knowledge of PMTCT, and who had live births in the 2 years prior to each surveys were included. A total sample size of 27,093; 33,699; and 36,176 was obtained for surveys done in each of the times, which totaled 96,968 when the data files were combined. However, some participants did not meet the inclusion criteria and thus were excluded from data analysis. Those excluded were respondents who did not have a live birth in the 2 years prior to each survey (19,596) or those who had missing data on any of the variables of interest (69,269). This left a total sample size of 8,103, which was the final sample size used for data analysis. The comparison between those who had and those who did not have a live birth in the 2 years prior to each survey was limited to demographics and knowledge of PMTCT because all the respondents who did not have a live birth in the 2 years preceding the surveys had missing data on use of maternal health services (Table 4).

Discrepancies

The variables were categorized as described in Section 2, and because the outcome variables were dichotomized, binary logistics regression was chosen for analysis rather than ANCOVA as proposed in Section 2. Additionally, because the population of interest was limited to reproductive aged women who had a live birth in the 2 years prior to each survey, this phrase was included in the research questions and hypotheses. Upon

further review of the literature, area of residence was also identified as an important confounder and added as a covariate in my study.

Time Frame and Response Rate

The 2007 MICS was conducted using trained interviewers between March 2007 and April 2007. The total response rate was 85.3% for women. For the 2011 survey, the timeframe for interviews was February 2011 to March 2011, and the response rate for women was 91.4%. The 2016/2017 survey was conducted between September 2016 and January 2017, with a total response rate of 93.9% for women (National Bureau of Statistics & UNICEF, 2017).

Results

Univariate Analysis

Descriptive statistics for demographic variables. I considered the demographic information of age, educational attainment, marital status, and area of residence as covariates. Table 1 displays the demographic information of the sampled population for each survey year.

Table 1

Frequency and Percentage Summaries for Age, Marital Status, Educational Attainment, and Area of Residence by Survey Year

Year of Survey	Variables (8103)		Frequency	Percentage
	Age			
2007		<35 years	821	80.4
		35 years and above	200	19.6
		Total	1021	100
2011		<35 years	2341	80
		35 years and above	586	20
		Total	2927	100
2016/2017		<35 years	3253	78.3
		35 years and above	902	21.7
		Total	4155	100
	Education			
2007		Below Secondary	291	28.5
		Secondary and above	730	71.5
		Total	1021	100
2011		Below Secondary	811	27.7
		Secondary and above	2116	72.3
		Total	2927	100
2016/2017		Below Secondary	1156	27.8
		Secondary and above	2999	72.2
		Total	4155	100
	Marital Status			
2007		Married	961	94.1
		Not married	60	5.9
		Total	1021	100
2011		Married	2762	94.4
		Not married	165	5.6
		Total	2927	100
		Married	3909	94.1
		Not married	246	5.9
2016/2017		Total	4155	100
	Area of residence			
2007		Rural	510	50
		Urban	511	50
		Total	1021	100
2011		Rural	1091	37.3
		Urban	1836	62.7
		Total	2927	100
2016/2017		Rural	1833	44.1
		Urban	2322	55.9
		Total	4155	100

Descriptive statistics for dependent variables. The dependent variables were knowledge of PMTCT and use of PMTCT-related maternal health services (measured by ANC attendance at health facilities, HCT during ANC visits, and use of skilled birth attendant at delivery). Tables 2 and 3 show the distribution of participants for the dependent variables. Respondents were asked about the three routes of MTCT. Participants who responded correctly to two or three questions were categorized as having *good* knowledge of PMTCT. Participants who had one correct answer or no correct answer to the three questions were categorized as having *poor* knowledge of PMTCT.

Table 2

Frequency and Percentage Summaries of Knowledge of Prevention of Mother-to-Child Transmission of HIV for Each Survey Year

Year of Survey	Variables (8103)	Frequency	Percentage
	Knowledge of PMTCT		
Year 1 (2007)	Good*	914	89.5
	Poor**	107	10.5
	Total	1021	100
Year 2 (2011)	Good	2351	80.3
	Poor	576	19.7
	Total	2927	100
Year 3 (2016/2017)	Good	3251	78.2
	Poor	904	21.8
	Total	4155	100

Note. *Good knowledge = correctly identifying two or three routes of MTCT; **Poor knowledge = correctly identifying one or not identifying any of the MTCT routes

Table 3

Frequency and Percentage Summaries of Use of Prevention of Mother-to-Child Transmission-Related Maternal Health Services for Each Survey Year

Year of Survey	ANC attendance by health professionals	Frequency	Percentage
Year 1 (2007)	Yes	998	97.7
	No	23	2.3
	Total	1021	100
Year 2(2011)	Yes	2870	98.1
	No	57	1.9
	Total	2927	100
Year 3(2016/2017)	Yes	3952	95.1
	No	203	4.9
	Total	4155	100
	HIV counseling and testing during ANC visits		
Year 1 (2007)	Yes	744	72.9
	No	277	27.1
	Total	1021	100
Year 2 (2011)	Yes	2161	73.8
	No	766	26.2
	Total	2927	100
Year 3 (2016/2017)	Yes	2983	71.8
	No	1172	28.2
	Total	4155	100
	Use of skilled birth attendant at delivery		
Year 1 (2007)	Yes	844	82.7
	No	177	17.3
		1021	100
Year 2 (2011)	Yes	2305	78.7
	No	622	21.3
		2927	100
Year 3 (2016/2017)	Yes	2985	71.8
	No	1170	28.2
	Total	4155	100

Table 4

Comparison of Women who had Live Birth and Those who did not have Live Birth in 2 Years Prior to Each Survey

	Had no live birth in last 2years prior to survey (N=19596)		Had live birth in last 2years prior to survey (N=8103)	
Variables	Frequency	Percentage	Frequency	Percentage
Age category				
15 – 24 years	1754	9.0	1733	21.4
25 – 34 years	6814	34.8	4682	57.8
35 – 44 years	7896	40.3	1589	19.6
≥35 years	3132	16.0	99	1.2
Marital status				
Married	16896	86.2	7632	94.2
Not married	2700	13.8	471	5.8
Educational level				
None/Pre-school	2074	10.6	457	5.6
Primary	6705	34.2	1801	22.2
Secondary	8028	41.0	4324	53.4
Above secondary	2789	14.2	1521	18.8
Area of residence				
Rural	8264	42.2	3434	42.4
Urban	11332	57.8	4669	57.6
Knowledge of PMTCT				
Good	15207	77.6	6516	80.4
Poor	4389	22.4	1587	19.6

Bivariate Analysis

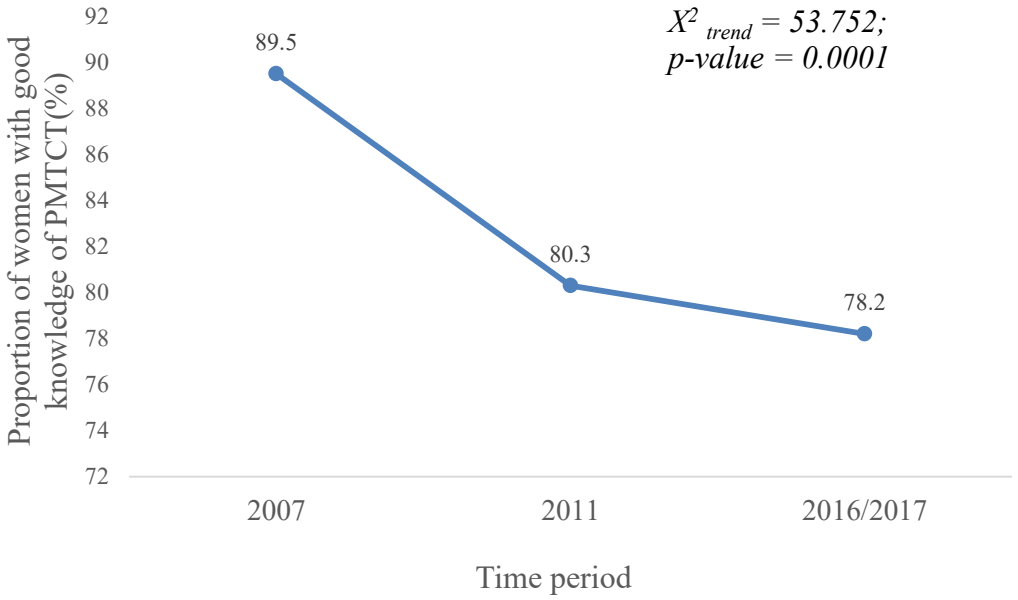

Figure 2. Trend in knowledge of prevention of mother-to-child transmission over three periods.

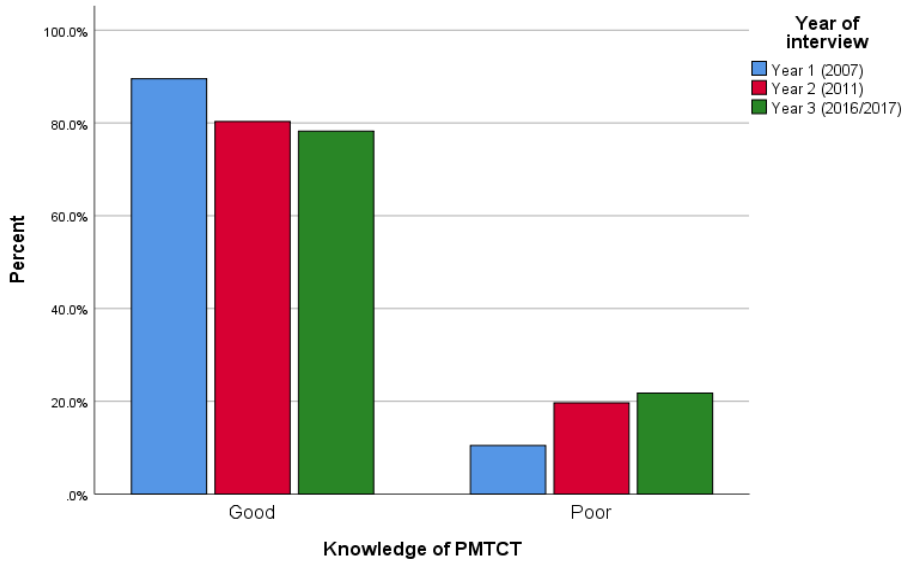

Figure 3. Proportion of women who had good or poor knowledge of prevention of mother-to-child transmission across the three periods.

Table 5

Crosstabulation of Women's Knowledge of Prevention of Mother-to-Child Transmission Over Three Periods

Variables	Knowledge of PMTCT of HIV		Total *n* (%)	χ^2 (*p*-value)	Crude Odds ratio (95% CI)
	Good Knowledge *n* (%)	Poor Knowledge *n* (%)			
Time period**					
Year 1	914 (89.5)	107 (10.5)	1021 (100.0)	53.752	1.36
Year 2	2351 (80.3)	576 (19.7)	2927 (100.0)	(0.0001)	(1.25 –
				*	1.48)
Year 3	3251 (78.2)	904 (21.8)	4155 (100.0)		
Age category					
<35 years	5131 (80.0)	1284 (20.0)	6415 (100.0)	3.169	0.87
≥35 years	1385 (82.0)	303 (18.0)	1688 (100.0)	(0.057)	(0.76 –
					1.00)
Marital status					
Currently married	6145 (80.5)	1487 (19.5)	7632 (100.0)	0.860	1.11
Not married	371 (78.8)	100 (21.2)	471 (100.0)	(0.354)	(0.89 –
					1.40)
Educational level					
Below secondary	1801 (79.8)	457 (20.2)	2258 (100.0)	0.850	0.94
Secondary and Above	4715 (80.7)	1130 (19.3)	5845 (100.0)	(0.357)	(0.84 –
					1.07)
Area of residence					
Rural	3118 (79.5)	805 (20.2)	3923 (100.0)	4.218	0.89
Urban	3398 (81.3)	782 (18.7)	4180 (100.0)	(0.040)	(0.79 –
					0.99)

Note. *Statistically significant ($p<0.05$); ** χ^2 trend; CI = Confidence Interval

The proportion of women who had good knowledge of PMTCT was 89.5%, 80.3% and 78.2% for year 2007, 2011 and 2016/2017 respectively. More women had

good knowledge of PMTCT in 2007, than in 2011 and 2016. The proportion of women who had good knowledge of PMTCT decreased in successive years, controlling for age, education, marital status and area of residence. The difference in knowledge of PMTCT was significant across the three years ($p<0.05$). For research question 1, the null hypothesis of no difference is rejected and the alternative hypothesis is accepted.

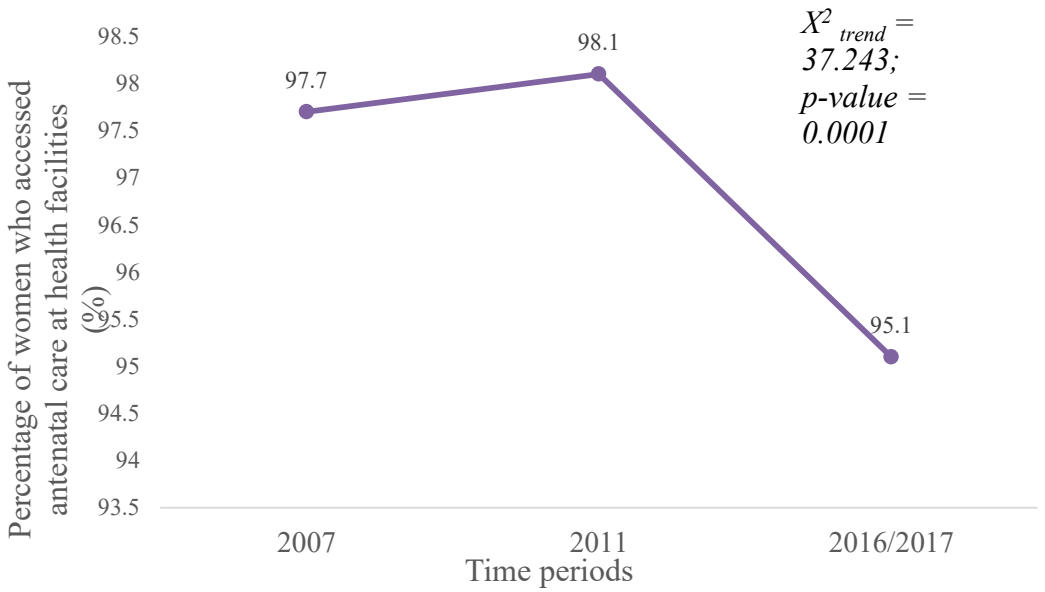

Figure 4. Trend in antenatal care attendance at health facilities among reproductive aged women over three periods.

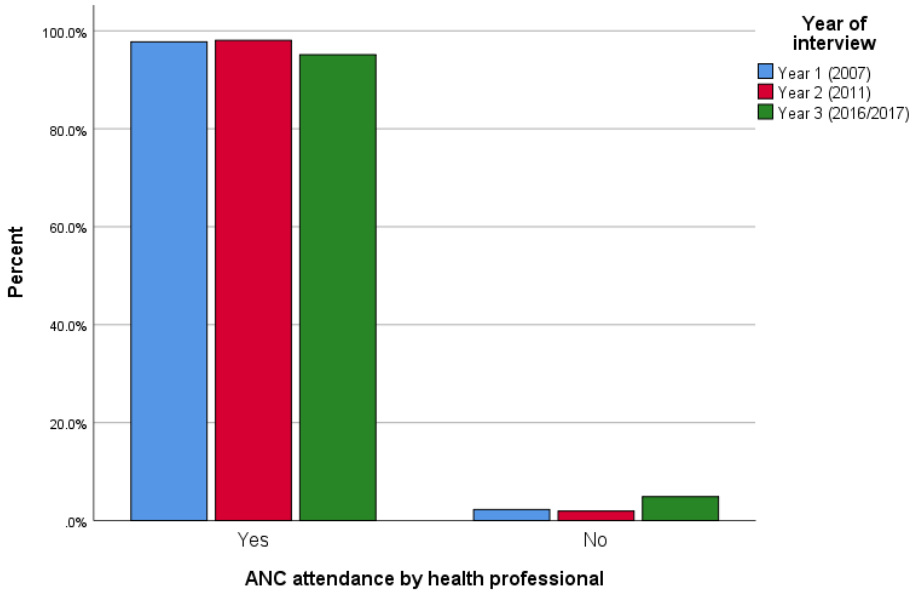

Figure 5. Comparison of women's antenatal care attendance at health facility over the three periods.

Table 6

Crosstabulation of Women's Antenatal Care Attendance at Health Facility over Three Periods

Variables	ANC attendance by health professionals		Total n (%)	χ^2 (*p*-value)	Crude Odds ratio (95% CI)
	Yes n (%)	No n (%)			
Time period**					
Year 1	998 (97.7)	23 (2.3)	1021 (100.0)	37.243	1.87
Year 2	2870 (98.1)	57 (1.9)	2927 (100.0)	(0.0001)*	(1.52 – 2.30)
Year 3	3952 (95.1)	203 (4.9)	4155 (100.0)		
Knowledge on PMTCT					
Good	6291 (96.5)	225 (3.5)	6516 (100.0)	0.154	1.06
Poor	1529 (96.3)	58 (3.7)	1587 (100.0)	(0.695)	(0.79 – 1.42)
Age category					
<35 years	6186 (96.4)	229 (3.6)	6415 (100.0)	0.545	0.89
≥35 years	1634 (96.8)	54 (3.2)	1688 (100.0)	(0.460)	(0.66 – 1.21)
Marital status					
Currently married	7365 (96.5)	267 (3.5)	7632 (100.0)	0.014	0.97
Not married	455 (96.6)	16 (3.4)	471 (100.0)	(0.907)	(0.58 – 1.62)
Educational level					
Below secondary	2104 (93.2)	154 (6.8)	2258 (100.0)	102.840	0.31
Secondary and Above	5716 (97.8)	129 (2.2)	5845 (100.0)	(0.0001)*	(0.24 – 0.39)
Area of residence					
Rural	3738 (95.3)	185 (4.7)	3923 (100.0)	33.761	0.49
Urban	4082 (97.7)	98 (2.3)	4180 (100.0)	(0.0001)*	(0.38 – 0.62)

*Statistically significant ($p<0.05$); ** χ^2_{trend}; CI = Confidence Interval

The proportion of women who accessed ANC at health facilities were 97.7%, 98.1%, and 95.1% for 2007, 2011 and 2016/2017 respectively. There was an increase in proportion of women who accessed ANC at health facilities in 2011(98.1%) and then there was a decline in 2016/2017 (95.1%). The difference across the years was statistically significant ($p<0.05$).

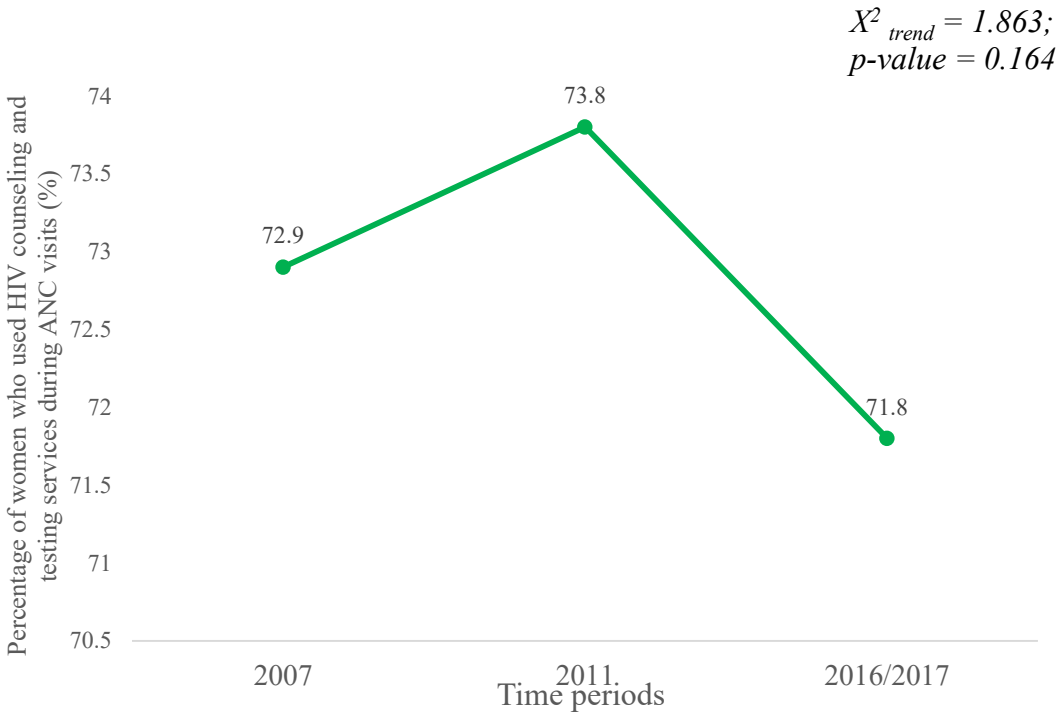

Figure 6. Trend in use of HIV counseling and testing services during ANC visits among reproductive aged women over three periods.

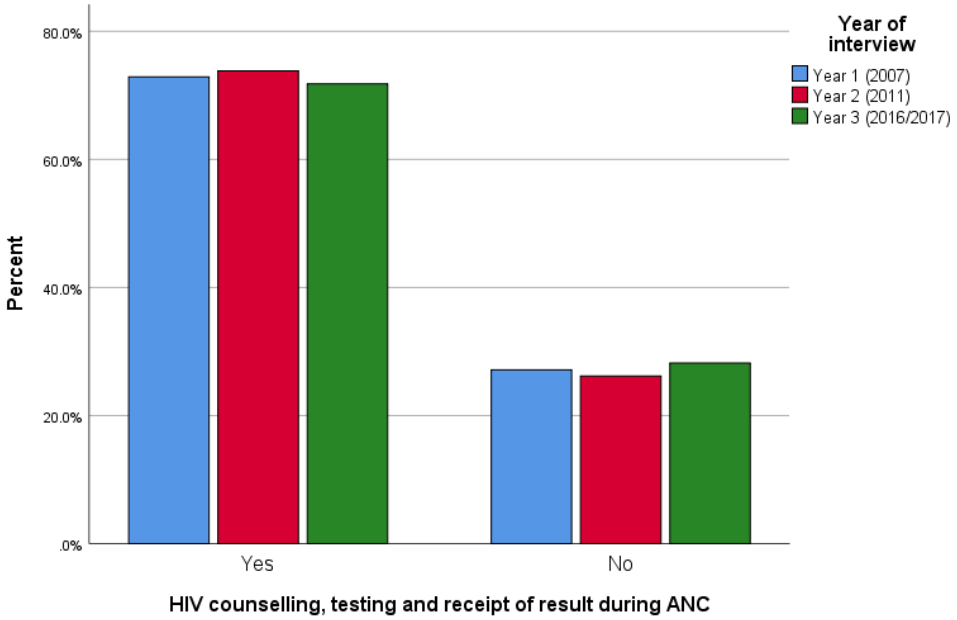

Figure 7. Comparison of women's in use of HIV counseling and testing services during antenatal care across the three time points.

Table 7

Crosstabulation of Women's Use of HIV Counseling and Testing During Antenatal Care at Health Facility Over Three Periods

Variables	HIV counseling and testing during ANC visits		Total *n* (%)	χ^2 (*p*-value)	Crude Odds ratio (95% CI)
	Yes *n* (%)	No *n* (%)			
Time period**					
Year 1	744 (72.9)	277 (27.1)	1021 (100.0)	1.863	1.05
Year 2	2161 (73.8)	766 (26.2)	2927 (100.0)	(0.164)	(0.98 – 1.13)
Year 3	2983 (71.8)	1172 (28.2)	4155 (100.0)		
Knowledge of PMTCT					
Good	4813 (73.9)	1703 26.1)	6516 (100.0)	24.115	1.35
Poor	1075 (67.7)	512 (32.3)	1587 (100.0)	(0.0001)*	(1.12 – 1.52)
Age category					
<35 years	4640 (72.3)	1775 (27.7)	6415 (100.0)	1.729	0.92
≥35 years	1248 (73.9)	440 (26.1)	1688 (100.0)	(0.189)	(0.82 – 1.04)
Marital status					
Currently married	5561 (72.9)	2071 (27.1)	7632 (100.0)	2.639	1.18
Not married	327 (69.4)	144 (30.6)	471 (100.0)	(0.104)	(0.97 – 1.45)
Educational level					
Below secondary	1538 (68.1)	720 (31.9)	2258 (100.0)	32.641	0.73
Secondary and Above	4350 (74.4)	1495 (25.6)	5845 (100.0)	(0.0001)*	(0.66 – 0.82)
Area of residence					
Rural	2811 (71.7)	1112 (28.3)	3923 (100.0)	3.906	0.91
Urban	3077 (73.6)	1103 (26.4)	4180 (100.0)	(0.048)*	(0.82 – 0.99)

Note. *Statistically significant ($p<0.05$) ** χ^2_{trend} CI = Confidence Interval

The proportion of women who utilized HCT services during ANC was 72.9%, 73.8%, and 71.8% for 2007, 2011 and 2016/2017 respectively. More women used HCT services in 2011 than in 2007 and 2016/2016 although these differences were not statistically significant ($p > 0.05$).

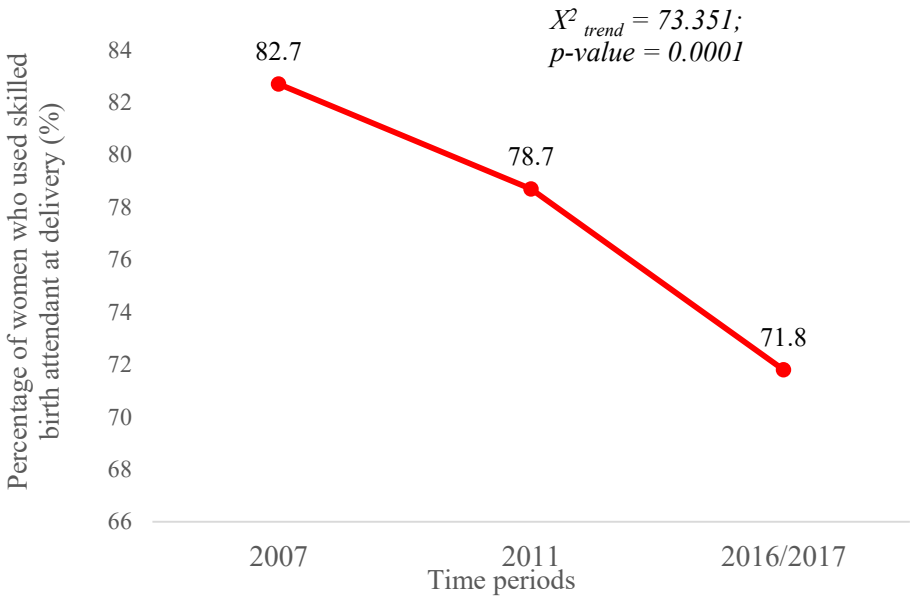

Figure 8. Trend in use of skilled birth attendant at delivery by reproductive aged women over three periods.

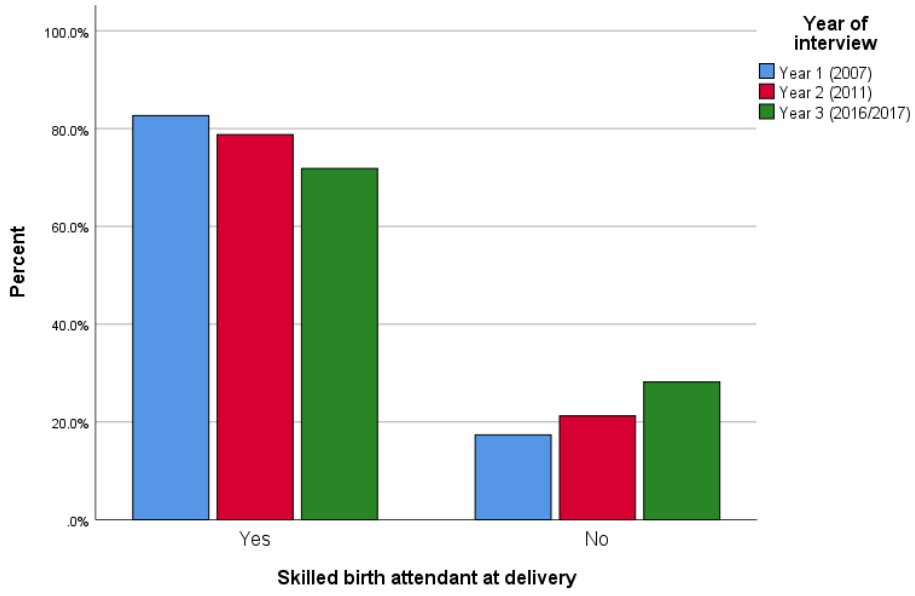

Figure 9. Comparison of women's use of skilled birth attendant at delivery across the three time points.

Table 8

Crosstabulation of Women's Use of Skilled Birth Attendant at Delivery Over Three Periods

Variables	Use of skilled birth attendant at delivery		Total *n* (%)	χ^2 (*p*-value)	Crude Odds ratio (95% CI)
	Yes *n* (%)	No *n* (%)			
Time period**					
Year 1	844 (82.7)	177 (17.3)	1021 (100.0)	73.351	1.40
Year 2	2305 (78.7)	622 (21.3)	2927 (100.0)	(0.0001)*	(1.29 – 1.51)
Year 3	2985 (71.8)	1170 (28.2)	4155 (100.0)		
Knowledge on PMTCT					
Good	4944 (75.9)	1572 (24.1)	6516 (100.0)	0.550	1.35
Poor	1190 (75.0)	397 (25.0)	1587 (100.0)	(0.458)	(1.12 – 1.52)
Age category					
<35 years	4817 (75.1)	1598 (24.9)	6415 (100.0)	6.244	0.84
≥35 years	1317 (78.0)	371 (22.0)	1688 (100.0)	(0.012)*	(0.75 – 0.97)
Marital status					
Currently married	5785 (75.8)	1847 (24.2)	7632 (100.0)	0.698	1.10
Not married	349 (74.1)	122 (25.9)	471 (100.0)	(0.403)	(0.89 – 1.35)
Educational level					
Below secondary	1287 (57.0)	971 (43.0)	2258 (100.0)	595.265	0.27
Secondary and Above	4847 (82.9)	998 (17.1)	5845 (100.0)	(0.0001)*	(0.25 – 0.30)
Area of residence					
Rural	2839 (72.4)	1084 (27.6)	3923 (100.0)	45.906	0.70
Urban	3295 (78.8)	885 (21.2)	4180 (100.0)	(0.0001)*	(0.63-0.78)

Note. *Statistically significant ($p<0.05$); ** χ^2_{trend} CI = Confidence Interval

The proportion of women who used skilled birth attendant during delivery was 82.7%, 78.7 % and 71.8% in 2007, 2011 and 2016/2017 respectively. There was a decrease in proportion of women who used skilled attendant at delivery in successive surveys. The difference across the three time period was statistically significant ($p<0.05$). Women who were 35 years or older, and had secondary level education or above and lived in urban areas were more likely to use skilled attendant at delivery ($p>0.05$). For the second research question, the null hypothesis of no difference is accepted for use of HCT during ANC visits, but the null hypothesis is rejected for ANC attendance at health facilities and use of skilled birth attendant at delivery.

Multivariate Analysis

Table 9

Binary Logistic Regression Showing Factors Associated with Antenatal Care Attendance at Health Facility for Each Year

Year 1(2007)	Variable	B	OR	95% CI	*p* value
	Area of residence				
	Rural	-.883	.414	.159-1.076	.070
	Urban [R]				
	Age Category				
	<35	-.079	.924	.334-2.558	.880
	>35 [R]				
	Educational Level				
	Below Secondary	-1.091	.336	.143-.791	.013*
	Secondary and above [R]				
	Marital Status				
	Married	-.491	.612	.080-4.670	.636
	Not married [R]				
	Knowledge of PMTCT				
	Good	.259	1.295	.295-5.688	.732
	Poor [R]				
Year 2 (2011)	Area of residence				
	Rural	.464	1.590	.872-2.901	.131
	Urban [R]				
	Age Category				
	<35	-.119	.888	.453-1.739	.729
	>35 [R]				
	Educational Level				
	Below Secondary	-.453	.636	.367-1.103	.107
	Secondary and above [R]				
	Marital Status				
	Married	-.085	.918	.283-2.982	.887
	Not married [R]				
	Knowledge of PMTCT				
	Good	-.302	.740	.401-1.363	.333
	Poor [R]				
Year 3 (2016/2017)	Area of residence				
	Rural	-.646	.524	.375-.461	0.0001*
	Urban [R]				
	Age Category				
	<35	-.406	.667	.461-.964	.031*
	>35 [R]				
	Educational Level				
	Below Secondary	-1.305	.271	.201-.366	0.0001*
	Secondary and above [R]				
	Marital Status				
	Married	.114	1.121	.609-2.061	.714
	Not married [R]				
	Knowledge of PMTCT				
	Good	.120	1.127	.791-1.605	.507
	Poor [R]				

Note. *Statistically significant ($P < 0.05$); *R* = Reference category; CI = confidence interval

Table 10

Binary Logistic Regression Showing Factors Associated with HIV Counseling and Testing During Antenatal Care for Each Year

Year 1(2007)	Variable	B	OR	95% CI	*p*-value
	Area of residence				
	Rural	-.509	.601	.451-.800	0.0001*
	Urban [R]				
	Age Category				
	<35	.095	1.100	.777-1.556	.592
	>35 [R]				
	Educational Level				
	Below Secondary	-.435	.647	.478-.876	.005*
	Secondary and above [R]				
	Marital Status				
	Married	.055	1.057	.593-1.883	.851
	Not married [R]				
	Knowledge of PMTCT				
	Good	.126	1.135	.722-1.782	.584
	Poor [R]				
Year 2 (2011)	Area of residence				
	Rural	.216	1.241	1.040-1.481	.017*
	Urban [R]				
	Age Category				
	<35	-.071	.931	.755-1.149	.505
	>35 [R]				
	Educational Level				
	Below Secondary	-.413	.661	.551-.793	0.0001*
	Secondary and above [R]				
	Marital Status				
	Married	.226	1.253	.887-1.770	.201
	Not married [R]				
	Knowledge of PMTCT				
	Good	.085	1.088	.885-1.338	.421
	Poor [R]				
Year 3 (2016/2017)	Area of residence				
	Rural	-.149	.862	.748-.992	.038*
	Urban [R]				
	Age Category				
	<35	-.202	.817	.689-.969	.021*
	>35 [R]				
	Educational Level				
	Below Secondary	-.160	.852	.730-.994	.042*
	Secondary and above [R]				
	Marital Status				
	Married	.116	1.123	.847-1.489	.419
	Not married R				
	Knowledge of PMTCT				
	Good	.443	1.557	1.330-1.822	0.0001*
	Poor [R]				

Note. *Statistically significant (*P<0.05*); *R* = Reference category; CI = Confidence Interval

Table 11

Binary Logistic Regression Showing Factors with Skilled Birth Attendant at Delivery for Each Year

Year 1(2007)	Variable	B	OR	95% C.I.	*p* value
	Area of residence				
	Rural	-.982	.375	.260-.540	0.0001*
	Urban [R]				
	Age Category				
	<35	-.178	.837	.544-1.285	.415
	>35 [R]				
	Educational Level				
	Below Secondary	-1.222	.295	.208-.417	0.0001*
	Secondary and above [R]				
	Marital Status				
	Married	-.255	.775	.374-1.603	.491
	Not married [R]				
	Knowledge of PMTCT				
	Good	.231	1.259	.738-2.150	.398
	Poor [R]				
Year 2 (2011)	Area of residence				
	Rural	.810	2.247	1.819-2.776	0.0001*
	Urban [R]				
	Age Category				
	<35	-.209	.811	.642-1.025	.080
	>35 [R]				
	Educational Level				
	Below Secondary	-.947	.388	.321-.470	0.0001*
	Secondary and above [R]				
	Marital Status				
	Married	.299	1.349	.930-1.957	.115
	Not married [R]				
	Knowledge of PMTCT				
	Good	.028	1.029	.816-1.297	.811
	Poor [R]				
Year 3 (2016/2017)	Area of residence				
	Rural	-.603	.547	.470-.637	0.0001*
	Urban [R]				
	Age Category				
	<35	-.579	.560	.465-.675	0.0001*
	>35 [R]				
	Educational Level				
	Below Secondary	-1.485	.227	.194-.264	0.0001*
	Secondary and above [R]				
	Marital Status				
	Married	.091	1.096	.809-1.483	.554
	Not married [R]				
	Knowledge of PMTCT				
	Good	.045	1.046	.878-1.247	.612
	Poor [R]				

Note. *Statistically significant ($P < 0.05$); *R* = Reference category; CI = confidence interval

Across the three time periods, there was no statistically significant association between knowledge of PMTCT and ANC attendance at health facilities and use of skilled birth attendant at delivery. Knowledge of PMTCT significantly predicted use of HCT services during ANC only in 2016 ($p<0.05$). Women who had good knowledge of PMTCT were more likely to use HCT services (*OR*- 1.557, 95% C.I. [1.330-1.822]).

Across the three time periods, education significantly predicted use of HCT services and use of skilled birth attendant at delivery. Women who had secondary level education or higher, were more likely to use HCT services or use skilled birth attendants in the three time periods. For ANC attendance at health facilities, education significantly predicted ANC attendance in 2007 ($p<0.05$, *OR* .336, 95% C.I. [.143, .791]). and 2016 ($p<0.05$, *OR* .271, 95% C.I. [.201, .366]). Women who had secondary level education or higher were more likely to attend ANC at health facilities.

Age significantly predicted antenatal attendance at health facilities ($p<0.05$, *OR* .667, 95% C.I.[.461, .964]), use of HCT services during ANC ($p<0.05$, *OR* .817, 95% C.I.[.689, .969]) and use of skilled birth attendant ($p<0.05$, *OR* .560, 95% C.I.[.465, .675]) only in 2016. Women who were 35 years of age and above were more likely to use all the preventive health services in 2016.

Across the three time points, area of residence significantly predicted use of HCT services during ANC. In 2007 and 2016/2017, women who were resident in urban areas were more likely to use skilled birth attendant at delivery. For ANC attendance at health facilities, statistical significance was observed only in 2016. Women residing in urban

areas were more likely to attend ANC at health facilities in 2016 ($p<0.05$, *OR* 0.524, 95% C.I. [.375, .461]).

For the third research question, the null hypothesis of no association between knowledge of PMTCT and use of PMTCT related maternal health services across the three time period is partially rejected since there was significant association between knowledge of PMTCT and use of HCT services during ANC in 2016.

Summary

In conclusion, the results show there was significant difference in knowledge of PMTCT, antenatal attendance at health facility and use of skilled birth attendant at delivery, across the three time points. There was a decline in proportion of women who had good knowledge of PMTCT and used skilled birth attendants in successive surveys. For ANC attendance, there was an increase in proportion of women who accessed ANC at health facilities from 2007 to 2011, after which there was a decrease in 2016.

Knowledge of PMTCT did not significantly predict use of PMTCT related maternal health services (ANC attendance at health facility, and use of skilled birth attendant at delivery) across the three time periods, but there was a significant positive association between knowledge of PMTCT and HCT in 2016, controlling for age, education attainment, marital status and area of residence.

Section 4 provides an interpretation of the result in comparison to findings from relevant literature, limitations, implications for professional practice and recommendations for further research.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

This quantitative cross-sectional study was designed to explore the trend in knowledge of PMTCT and use of maternal health services comparing survey data from 2007, 2011, and 2016/2017 representing the third, fourth, and fifth rounds of the UNICEF MICS conducted in Nigeria. In this study, I used time (measured at three time points) as the independent variable for Research Question 1, with the dependent variable of knowledge of PMTCT. For Research Question 2, time was the independent variable and the dependent variables were antenatal attendance at health facility, HCT during antenatal attendance, and use of skilled birth attendant for delivery. The independent variable for the third research question was knowledge of PMTCT and the outcome variables were antenatal attendance, HCT, and use of skilled birth attendant. Antenatal attendance was defined as the use of health professionals (doctor, nurse or auxiliary midwife) at health facilities for antenatal services, HCT was defined as being informed about HIV, its risk factors and preventive measures, getting tested and obtaining the test result during ANC, and use of skilled birth attendant was defined as the use of health professional (doctor, nurse or auxiliary midwife) for delivery. The control variables were age, educational attainment, marital status and area of residence.

I used descriptive and inferential analysis to present my findings. The results of the analysis showed a significant difference across time for knowledge of PMTCT, ANC attendance at health facilities, and use of skilled birth attendant at delivery. More women had knowledge of PMTCT, accessed ANC at health facility, and used a skilled birth

attendant in 2007 and 2011 than in 2016/2017. Women who were older than 35 years of age were more likely to access ANC at health facility or use skilled birth attendant at delivery. Women with secondary level education or higher and those who resided in rural communities were more likely to utilize all the maternal health services (ANC at health facility, HCT during antenatal, and skilled birth attendant at delivery). Further, knowledge of PMTCT had a significant positive association with use of HCT services only. This section includes an interpretation of the findings, limitations of the study, recommendations for further research, and implications for professional practice toward positive social change.

Interpretation of Findings

In this section, I will discuss the results in relation to existing literature on HIV/PMTCT knowledge prevalence and use of maternal health services among reproductive aged women in Nigeria and similar settings. Since the modification and adoption of the National strategic framework for the prevention of AIDS in Nigeria in 2010, interventions have been geared toward creating awareness of HIV and preventive measures with the expectations that knowledge would lead to increased use of preventive health care services (Faust et al., 2017). The trend in HIV knowledge prevalence has been previously studied in Nigeria, but research on knowledge of PMTCT among reproductive aged women is lacking. More people have been able to correctly identify possible means of HIV transmission in the general Nigerian population, but there has been a lack of knowledge of PMTCT in the studied population, especially among women who play a role in elimination of pediatric infection (Faust et al., 2018). Thus, my study's objectives

were to assess how much change has occurred over the years since the implementation of the HIV National Strategic response in terms of PMTCT knowledge and use of maternal health services among reproductive aged women in Nigeria.

Trend in Knowledge of Prevention of Mother-to-Child Transmission

The results of my study showed that knowledge of PMTCT significantly changed among reproductive aged women across the three periods. There was a progressive decline in proportion of women who had good knowledge of PMTCT from 2007(89.5%) to 2016 (78.2%). The low knowledge of PMTCT in this study corresponds to other recent studies in Nigeria (Faust et al., 2018), Ethiopia (Alemu, Habtewold & Alemu, 2018), and Cameroon (Sama et al., 2017). For example, Sama et al. (2017) observed that among ANC attendees in a community in Cameroon, 76.7% of the women sampled could correctly identify routes of HIV transmission, but most (76.3%) had inadequate knowledge of PMTCT of HIV. Similarly, Alemu et al. (2018) found that only 52% of their studied population had comprehensive knowledge on PMTCT despite active engagement in ANC at formal health centers.

In a past Nigerian study, respondents could identify means of HIV transmission, but knowledge of MTCT was suboptimal. Knowledge of PMTCT was also significantly lower in 2013 than in 2003 (Faust et al., 2018). This decline in knowledge of PMTCT in more recent years, as shown also in my study, does not support the effectiveness of the National Strategic framework that had been revised in 2010 to reflect the need (among other priority areas) for efforts toward elimination of MTCT of HIV (National Agency for the Control of AIDS, 2017). Several other interventions have also been made by the

government to improve maternal and child health outcomes (Fagbamigbe, Hurricane-Ike, Yusuf & Idemudia, 2017), so the expectation would have been that there would be an increase in level of knowledge in subsequent years as the awareness campaigns continue.

Trend in use of Maternal Health Service

In my study, PMTCT-related maternal health services were ANC attendance at health facility, HCT during antenatal attendance, and use of skilled birth attendant at delivery. The trend analysis showed that ANC attendance at health facilities increased between 2007 (97.7%) and 2011 (98.1%), and then there was a decrease in 2016 (95.1%). For use of HCT during ANC, results from my study showed that there was an increase in the proportion of women who used HCT services from 2007 (72.9%) to 2011(73.8%), after which there was a decrease in 2016 (71.8%), although these differences were not statistically significant.

The trend analysis for use of skilled birth attendant showed a steady decline over the three periods ($p < 0.05$). More women used a skilled birth attendant in 2007 (82.7%); the proportion reduced in 2011 (78.7%) and decreased further in 2016/2017 (71.8%). This evidence of low usage of skilled birth attendant at delivery is similar to finding from a trend study by Fagbamigbe et al. (2017) using data from the Nigerian Demographic and Health Survey, where there was a nonsignificant marginal change in use of a skilled birth attendant from 1990 (32.4%) to 2013 (38.5%) in Nigeria.

Despite several interventions from the Nigerian government to improve maternal health services and encourage engagement in preventive health services (Fagbamigbe et al., 2017), the results showed a declining trend in knowledge of PMTCT, use of ANC at

health facility, use of HCT services during ANC, and use of skilled birth attendant at delivery. An explanation for the declining rate of knowledge over the time despite interventions to increase awareness could be that emphasis has been placed on HIV awareness generally without focused education on MTCT and PMTCT.

Because knowledge and awareness of PMTCT could be precursors to seeking and utilizing preventive health care services, this lack of comprehensive knowledge of PMTCT could be a reason for the observed decline in ANC attendance. As ANC attendance is typically the entry point for other PMTCT related health services, low ANC attendance could directly impact on other PMTCT components including use of HCT services and use of a skilled birth attendant at delivery.

However, there is some evidence to show that ANC attendance itself may not lead to increased use of maternal health services. For instance, Okigbo and Eke (2015) showed that the number of services received during ANC was more positively associated with use of a skilled birth attendant than the number of ANC visits itself among their study participants. This confirms results from Fagbamigbe et al. (2017), where most participants attended ANC clinics during pregnancy but less than half of the population studied utilized a skilled birth attendant at delivery. Additionally, many women still prefer to give birth at home even after attending ANC clinics during the pregnancy (Adewuyi, Zhao, Auta & Lamichhane, 2017; Adedokun & Uthman, 2019). An explanation for such a trend could be that the quality of care or information received during ANC is not sufficient to trigger a change in behavior, but this could also be confounded by other factors including financial ability to afford delivery services

provided in formal health care centers as well as other sociocultural elements that may be barriers to seeking care in formal health sectors (Fagbamigbe et al., 2017). Because women play a major role in child and family health needs, it is essential to target specific interventions to this population if pediatric epidemic control is to be achieved.

Knowledge as a Predictor for use of Maternal Health Services

Awareness of HIV and knowledge of its prevention is presumed to be a predictor of use of health services, which is captured in the National Strategic Framework where educational programs are highlighted as vital components of interventions geared toward increasing uptake of preventive health services (National Agency for the Control of AIDS, 2017). Knowledge can encourage perception of susceptibility, which in turn could lead to active seeking of care. However, in my study, knowledge did not predict use of ANC and use of skilled birth attendant across the three time periods.

For use of HCT services, knowledge of PMTCT had no association in 2007 and 2011, but there was a positive association between knowledge of PMTCT and use of HCT in 2016 ($p < 0.05$, OR = .642, 95% CI = .549-.752). The positive association between knowledge of PMTCT and use of HCT services is similar to findings from an Ethiopian study where women who had comprehensive knowledge of MTCT were more likely to use HCT services (Alemu et al., 2018). Having comprehensive knowledge of MTCT and PMTCT could facilitate HIV testing, as pregnant women would want to know their status and if possible initiate treatment to minimize the risk of transmitting infection to their child.

The next sections will compare association of the covariates that had significant association with the maternal health services of interest, as these services are often offered together in health facilities.

Educational Attainment

There was a significant positive association between higher educational attainment and antenatal attendance, use of HIV Counseling and Testing services as well as the use of skilled birth attendant at delivery in my study. Women with secondary education or higher were more likely to utilize maternal health services. This could be as a result of better understanding of health messages and the implication of preventive measures to the woman's health and that of her child. This is similar to other studies were higher education was correlated with use of ANC and other PMTCT related services (Sibanda et al., 2018; Mogobe et al., 2016). Having higher education could imply better understanding of health messages which enhances engagement with health systems. Also, educated women are more likely to be in paid employment and as such, would be financially independent and able to afford obstetric charges at formal health care facilities. Several studies have shown that women who were financially dependent on their husbands had to wait to get approval or funds to enable them access maternal health services at health facilities (Kea et al., 2018; Ehiri et al., 2016; Sibanda et al., 2018).

Age

Results from my study showed that women who were younger than 35 years of age were less likely to access ANC at health facilities, use HCT services or use skilled birth attendant at delivery. This finding is similar to several studies in Nigeria and other

parts of Africa were the likelihood of engaging in maternal health services increases among those aged 35 and older. In a study by Muyunda et al., (2018), women who were older were more likely to use HCT services in Zambia. Dahiru & Oche (2015) showed increased chance of accessing ANC at health facilities in a Nigerian population in women older than 35 years of age. Typically, older women are more likely to be married, have spousal or other social support which is vital for coping with pregnancy related stress and the added burden of a possible HIV diagnosis. This support facilitates engagement with health systems and is often lacking for pregnant adolescents. Studies have shown that pregnant young adults face discrimination by health professionals as being pregnant as an unmarried woman is often viewed negatively in many African settings (Gourlay et al., 2015; Kea et al., 2018). Another explanation could be that older age is associated with more pregnancy complications, thus women who are older would feel the need to seek professional help rather than risk their lives or that of their baby by using lay or informal health care providers (Adedokun & Uthman, 2019). However, the evidence on the positive association of older age with health service utilization is contradictory. Alemu, Ambaw & Wilder-Smith (2017) showed that women who were between 25- 30 years of age were more likely than older women to use HCT services in their study. Since younger women were more likely than older women to engage with mass media, younger women may have more exposure to HIV/PMTCT messages and this awareness could have contributed to their increased use of preventive health services (Alemu et al., 2017). Younger women were also shown to have more knowledge of PMTCT and thus more

likely to engage in health services in an Ethiopian study (Abebe, Kassaw, & Shewangashaw, 2019).

Area of Residence

The results from my study showed urban dwellers where more likely to use maternal health services than their rural counterparts. Specifically, across the three time periods, urban residence was positively associated with use of HCT services during ANC. In 2007 and 2016, urban residence was positively associated with use of skilled birth attendant at delivery. In 2016, urban residence was positively associated with ANC attendance at health facilities. This observation agrees with evidence from similar setting where urban dwellers have been shown to engage more with maternal health services.

Adewuyi et al., (2017) showed that in their studied population in Nigeria, rural women were less likely than urban women to use skilled birth attendant for childbirth as they preferred home deliveries attended to by TBAs. TBAs are perceived to be more accommodating, non-judgmental and sensitive to the needs of women in labor than formal health care workers. Similarly, rural women were less likely to have facility births than urban women in a study by Adedokun & Uthman (2019), primarily due to constraints such as less access, poor staffing and equipment in available health centers.

In terms of ANC attendance at health facility, Dahiru & Oche (2015) showed that rural women were less likely to use ANC than their urban counterparts in their Nigerian study. Distance to health facility is a known barrier to use of health systems, therefore lack of access (either in terms of limited number of health facilities or poor road network and hence no transportation) to health centers located in rural areas may be an

explanation for reduced likelihood of using formal health care centers in rural communities. Additionally, since ANC use often requires repeat visits and cost implication for services provided, financial constraint may also be a reason why rural women often shy away from formal health care settings. Since urban women may be more educated and in paid employment hence they may be able to take up the financial burden of their health needs without depending on spouses and they might be more likely to engage with formal health care systems.

Limitations

The dataset analyzed in my study were self-reported, and collected retrospectively; as such, it was prone to social desirability and recall biases (Adewuyi et al, 2018). Also, the MICS is not a longitudinal data which makes it difficult to assess individual level changes in knowledge prevalence and use of maternal health services in the years following implementation of the National Strategy on HIV prevention in Nigeria. Additionally, the MICS data does not contain individual level serostatus and use of antiretrovirals which makes it difficult to correlate knowledge level and transmission risk or actual take up of treatment to prevent MTCT for those already infected. Evidence that ties the current level of knowledge to transmission risk or disease prevalence could be more useful in ensuring implementation gaps are identified and closed in subsequent initiatives (Faust et al., 2017). Furthermore, non-availability of relevant data hindered assessment of other social and cultural factors that could play a role in knowledge prevalence and engagement in preventive health services.

Recommendations

Further studies could explore the role of individual components of HIV services to determine what factors contribute to use or non-use of these services. It would be expected that the quality of service could impact on the use of such services even if some of the service may be offered free of charge at Government owned health facilities. For instance, having comprehensive health talks that correctly address misconceptions on HIV and preventive measures, as well as having adequate counseling sessions could encourage uptake of HIV testing and overcome the barrier of stigma which in turn would facilitate returning for test results. Due to lack of data, my study assessed HCT service as a composite variable, thus it was not possible to delineate which specific component of HCT service had less usage. This information could be useful in modifying specific aspects of care in order to improve utilization of services.

Also, since information provided by health professionals may be more detailed and thus enhance knowledge, the number of antenatal clinics attended by pregnant women could impact the level of knowledge. Thus, further research could explore the association between number of times a woman attends ANC (and is educated about PMTCT) and knowledge prevalence or intent to use available PMTCT services.

Although my study examined covariates that were used in similar studies, it is possible that other factors could be affecting use of maternal health services. Despite being aware of HIV and the potential risk for MTCT, a woman's decision-making ability and autonomy to engage in preventive health care may be influenced by her husband, extended family members and the societal values within her community of residence.

Therefore, designing a qualitative study using the constructs such as those found in the Social Cognitive Theory, could shed more light on salient social and cultural factors that could play significant roles in engagement in preventive health care with regards to PMTCT.

Implications for Professional Practice and Social Change

In my study, I examined the role of knowledge of PMTCT in use of PMTCT related maternal health services. The findings of my study could guide subsequent design of interventions, as well as policies with the goal of encouraging women to utilize available preventive health care services towards reduction of MTCT.

Professional Practice

With respect to professional practice, the findings from my study could help in effective delivery of PMTCT services within the formal health settings. From the results, knowledge was a significant predictor for HCT only but had no significant association with antenatal attendance at health facilities and use of skilled birth attendant during delivery. Since HCT services are usually provided within formal health systems, efforts should be targeted at encouraging women to attend antenatal clinics, which is the entry point for PMTCT services or if this window is missed, women could be encouraged to use skilled birth attendant at delivery, since HIV testing can also be done at the point of delivery.

Since it is possible that some women may have attended antenatal clinics but still engaged unskilled or lay health workers at the point of delivery, it is expedient that message content is remodeled and efforts towards dispelling myths about HIV and

MTCT be intensified during health talks at antenatal clinics. While efforts are being made to encourage participation in formal health care settings where some women learn more of MTCT during health talks and have the opportunity to clarify misconceptions through questions and answer sessions (Abebe, et al., 2019), the main route of information dissemination remains mass media. It is important to ensure that message content is simple enough to be understood by less literate women and context specific to ensure message acceptance. Message dissemination through mass media should also be done using social media channels to ensure a wider audience is reached, especially younger women who may be lagging behind in the use of maternal health services offered at formal health facilities. Since the results of this study showed that knowledge alone may not be a sufficient predictor of use of maternal health services, research on demand side and supply side variables that could impact the desired outcome(s) should be explored.

Positive Social Change

The findings of this study could provide evidence of the need for more targeted HIV educational interventions towards women. At the individual level, more knowledge of PMTCT could facilitate engagement in preventive health care services which could have a direct positive impact on the health of families, especially those impacted or affected by HIV. At the community level, targeted awareness programs could correct misconceptions on HIV prevention. In African settings, women tend to rely on older women (e.g., mothers, mother in law, or experienced midwives/ matrons) for advice on obstetric needs, therefore creating interventions that specifically target older women and community women opinion leaders may increase knowledge and could go a long way in

equipping them with relevant information to more effectively counsel younger women in terms of seeking professional obstetric care. Incorporating community women in such interventions could create the needed supportive environment that could facilitate uptake of PMTCT services and retention in care for those who may be living with HIV (Dappaah & Nachinaab, 2019).

Conclusion

I sought to assess the trend in knowledge of PMTCT and use of PMTCT related maternal health services, as well as the association between knowledge and use of maternal health services among reproductive aged women who had a live birth prior to surveys done in the 3rd, 4th and 5th round of the MICS in Nigeria. The results showed a decline in proportion of women who had good knowledge of PMTCT and who used of maternal health services over the three time periods ($p < 0.05$). The proportion of women who accessed ANC at health facilities and who used HCT services decreased in recent years. Also, knowledge was a significant predictor for use of HCT services during ANC but did not significantly predict use of ANC and SBA.

Since engagement in PMTCT preventive services is a key strategy to slowing the rate of infant infection, and evidence suggests that having adequate knowledge of PMTCT is a precursor to engagement in preventive health services (Alemu et al., 2018), ensuring that more women are aware of MTCT routes and PMTCT approaches could facilitate their engagement with relevant services and ultimately reduce the number of new pediatric infections which is critical to reducing global disease prevalence.

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