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Predictors of HIV Testing Amongst Women of Childbearing Age in Nigeria

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This is to certify that the doctoral dissertation by

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Walden University
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Abstract

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by

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MPH, Usmanu Danfodio University, 2009

MBBS, Ahmadu Bello University, 1995

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

HIV infection is still a public health issue in Nigeria. One of the sustainable development goal targets is to eliminate new HIV infections by the year 2030. Women of childbearing age are a vital group to focus on in eliminating new infections because HIV infection can be transmitted from women to their partners and their children. Nigeria accounts for about one-third of the cases of mother-to-child infections in the world. The purpose of this three manuscript dissertation was to investigate socioecological factors, demographic factors and knowledge of mother-to-child transmission of HIV infection (MTCT) as they relate to HIV testing in women of childbearing age. Social-ecological model of health promotion was used as the theoretical framework for the studies. Data from women aged 15 to 49 years that participated in the 2013 Nigeria Demographic and Health Survey were analyzed using logistic regression. Knowledge about HIV, attitude to HIV, perceived risk of HIV, age, marital status, employment status, educational status, knowledge of prevention of MTCT, knowledge of MTCT during delivery and breastfeeding were positive predictors of HIV testing. At the same time, cultural belief about HIV and geographic location were negative predictors of HIV testing. Knowledge of MTCT during pregnancy and comprehensive knowledge of MTCT were not predictors of HIV testing. This study provides insight into the areas to focus on by programs to enhance HIV testing in women of childbearing age to eliminate MTCT. The positive social change implications of this study include its contribution in achieving the UNAIDS' 95-95-95 target and the sustainable development goal of zero new HIV infections by 2030.

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Dedication

This dissertation is dedicated to my husband – Air Commodore (Dr) Bashir Adam Yakasai (Retired).

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Part 1: Overview

Introduction

HIV infection is a pandemic affecting the world, but sub-Saharan Africa has a higher burden. At the end of 2018, 37.9 million people were living with HIV globally, while 770,000 people died from HIV-related illnesses within the same period (United Nations Programme on HIV/AIDS [UNAIDS], 2019a). Globally, 6,000 young women aged 15 – 24 years were estimated to become infected with HIV every week, while in sub-Saharan Africa, young women aged 15 – 24 years were twice more likely to be living with HIV than men (UNAIDS, 2019b). Nigeria is said to have the second-highest burden of HIV in the world, second to South Africa (Awofala & Ogundele, 2018). HIV is a disease of public health importance that requires measures to halt new infections and control the infection spread.

Knowledge of the mode of spread of HIV is essential in preventive measures. Transmission routes of HIV include sexual transmission, mother-to-child transmission, transfusion of infected blood or blood products, sharing of contaminated sharp objects such as needles by injection drug users, and any other route that involves contact with blood. Infection with HIV damages the immune system. This causes deficiency in immunity, leading to a higher risk of acquiring opportunistic infections associated with increased morbidity and mortality. The use of highly active antiretroviral drugs stops the replication of the virus leading to the restoration of the immune system and better quality of life. Effective treatment leads to a low or undetectable amount of the virus in the blood with minimal chance of transmitting the virus to another person. This is the basis for HIV

treatment to prevent transmission of HIV to others and prevent mother-to-child transmission of HIV.

Problem Statement

HIV infection is a significant public health problem in Nigeria. The prevalence of HIV is higher in young women compared to their male counterparts. The 2018 Nigeria HIV/AIDS Indicator and Impact Survey (NAIIS) report revealed that the prevalence rate of HIV in women aged 15 – 49 years is 1.9%. This is higher than that of their male counterparts which is 0.9% (National Agency for the Control of AIDS [NACA], 2019). Those in the range 15 – 49 years are women of reproductive age. Therefore, preventing HIV in this age group is pertinent to the control of HIV infection. The NAIIS report also revealed that only 45.3% of women aged 15 – 49 years living with HIV had viral suppression, implying a continued chance of transmitting HIV to their children (NACA, 2019). The most prevalent route of HIV infection in Nigeria is heterosexual transmission (Awofala & Ogundele, 2018). Therefore, it is crucial to consider the sexually active age group when conducting prevention measures. Furthermore, globally, mother to child transmission of HIV (MTCT) accounts for 90% of HIV infection in children, and Nigeria accounts for 30% of global MTCT (Inyang & Rimande-Joel, 2015; NACA, n.d.; Namara-Lugolobi et al., 2017).

Testing for HIV is the entry point for preventing MTCT (PMTCT) and the use of treatment as prevention because testing allows for the identification of HIV-positive cases that are enrolled for treatment. Effective treatment leads to reduction or undetectable viral load. HIV clients with undetectable viral load have little chance of

transmitting HIV. As such, treatment is used as a preventive measure. Some studies have shown a low testing rate of 36.5% in sub-Saharan Africa, including Nigeria (Asaolu et al., 2016). It was estimated that 50% of HIV-positive people are not aware of their status in Nigeria (Oleribe et al., 2018). Abiodun et al. (2014) found an HIV testing rate of 30.4% among youths in a university. An HIV testing rate of less than 15% amongst adolescents in secondary school was observed by Alabi et al. (2018) in Nigeria. Studies conducted among pregnant women in Nigeria also showed low HIV testing rates of 36.3% in western Nigeria and 20.7% in northern Nigeria (Olowokere et al., 2018; Oyefabi et al., 2018). The 2018 NAIIS survey revealed that out of the 1.9 million people living with HIV in Nigeria, only 67% were aware of their HIV status. About half of them (52%) were on antiretroviral therapy, and only 42% had viral suppression (NACA, 2019). HIV testing rate is low both in pregnant women and the general population in Nigeria.

Some authors, such as Akinwande et al. (2012), Namara-Lugolobi et al. (2017), and Strauss et al. (2002), investigated the predictors of HIV testing at the hospital level. While Strauss et al. (2002) studied the predictors in drug users, Brown et al. (2018) studied age and ethnicity as predictors of HIV testing in the United States. Holtzman et al. (2016) examined predictors of HIV in men having sex with men in Canada. Bibiana et al. (2018) investigated factors affecting HIV testing in women of reproductive age in a community in Nigeria. Ehiri et al. (2016) studied how cultural and religious factors affected HIV in pregnant women and their partners. To eliminate HIV as a public health problem, there is a need to strengthen HIV testing in women of childbearing age. Little literature exists about the factors that affect HIV testing in women of childbearing age at

a national level in Nigeria. I intend to fill this gap by studying predictors of HIV testing among women aged 15 – 49 years on a national level in Nigeria. While Lepine et al. (2015) studied factors that affected HIV testing among couples using the 2008 National Demographic and Health Survey (NDHS) data, I used the 2013 NDHS data focused on women of reproductive age group.

Purpose of the Study

The purpose of this study was to understand the factors that predict HIV testing in women of childbearing age. Targeting women of the reproductive age group is important because of the sexual mode of transmission of HIV and transmission of HIV from mother to child. Prevention of HIV in women of childbearing age is essential to attaining an HIV-free generation. I investigated how demographic factors, socioecological factors, and knowledge of mother to child transmission of HIV (MTCT) relate to HIV testing by women aged 15 – 49 years in Nigeria. Understanding the relationship between these factors and HIV testing will allow for a targeted intervention to improve HIV testing rates amongst women of childbearing age in Nigeria. HIV testing is the starting point for HIV treatment, leading to the suppression of viral load. A patient with suppressed viral load has a very minimal chance of transmitting the virus to another person. Therefore, treatment can serve as a preventive measure. HIV testing is also the entry point for PMTCT. Prevention of HIV and PMTCT is essential to the elimination of HIV infection.

Theoretical Framework

I used the socioecological model of health promotion as the framework for this study. There is an interplay between various factors in determining health behavior and

health promotion. The socioecological model of health promotion considers multiple factors and provides a framework for intervention measures based on the identified factors (Tehrani et al., 2016). The socioecological model identifies the interaction between individual, interpersonal, community, and organizational factors in determining health behavior. The health behavior that I investigated in this research was HIV testing.

This socioecological model has been utilized in HIV epidemiological studies (Baral et al., 2013). The theory provides a comprehensive approach to the factors that affect behavioral outcomes in health promotion, such as HIV testing by women of childbearing age. HIV testing provides the basis for HIV prevention in terms of taking measures to remain negative and providing treatment for positive cases to reduce viral load and prevent transmission to others, including their children.

The research questions of this study align with the various factors identified in the model as they affect the behavior of HIV testing by women of childbearing age. The variables that I examined in the research questions are age, marital status, geographic location (urban vs. rural), employment status, educational status, knowledge of HIV/AIDS, attitudes about HIV/AIDS, perceived risk of HIV/AIDS, cultural belief, and knowledge of mother to child transmission of HIV. Age, marital status, employment, and educational status are personal factors, while attitude about HIV/AIDS and perceived risk of HIV/AIDS are interpersonal factors. Cultural belief is a community factor because the norms and beliefs in the community affect the individual belief of the women of childbearing age. Knowledge of HIV/AIDS and knowledge of mother-to-child transmission of HIV can be considered personal and organizational factors because the

existing policies determine how women access information about HIV, including mother-to-child transmission within the communities.

The combination of these factors as they affect the dependent variable, which is HIV testing in women of childbearing age, informed my choice of the socioecological model of health promotion as the theoretical framework for the study. In addition to identifying the influence of the various levels, the model also provides the possible levels of intervention for health promotion (McLeroy et al., 1988). Therefore, the use of the model in this research also provides a framework for intervention measures based on the study's findings.

Social Impact

One of the targets of the sustainable development goals is the elimination of HIV as a public health problem by the year 2030 (United Nations, n.d.). In 2017, the 90-90-90 target by 2020 and 95-95-95 target by the year 2025 was launched by UNAIDS towards eliminating the HIV epidemic (UNAIDS, 2017a). The 95-95-95 target aimed at having 95% of people living with HIV know their status, 95% of those who know their status should be on antiretroviral therapy, and 95% of those on antiretroviral therapy should have viral suppression by the year 2025 (UNAIDS, 2017a). Those who are virally suppressed have minimal risk of transmitting the virus. Therefore, treatment is used as a prevention measure (Montaner et al., 2014).

The coverage for the first 95 is low for young people aged 15 – 49 years in Nigeria. Data by UNAIDS shows that only 34% of young people aged 15 – 49 years in Nigeria are aware of their HIV status (Odiachi, 2018; UNAIDS, 2017b). An HIV testing

rate of 25.4% was found in adolescent girls and young women in the study by Ajayi et al. (2020) using the 2017 Multiple Indicator Cluster Survey. The same age group is also the reproductive age group.

In this present study, I investigated how socioecological, demographic, and knowledge of PMTCT relates to HIV testing in women of the reproductive age group. Understanding the factors that influence HIV testing in women of reproductive age group will allow for age-specific interventions to address the issue of low testing rate (Ajayi et al., 2020; Odiachi, 2018). This study will lead to the social change of understanding how socioecological factors, demographic factors, and knowledge of PMTCT affect HIV testing in women of childbearing age in Nigeria. This can be used to plan how to improve HIV testing amongst women of reproductive age group. Improving HIV testing will increase access to HIV treatment and prevent transmission from mother to child (UNAIDS, 2017c). The aim of eradicating HIV infection as a public health problem by the year 2030 starts with people knowing their status and preventing transmission to babies (United Nations, n.d.).

Background

Focusing on women of childbearing age is vital to the prevention and control of HIV/AIDS. Despite the various efforts by government and non-governmental organizations to control HIV infection, it is still a public health problem. HIV is still a significant cause of morbidity and mortality worldwide and in Nigeria. However, there has been a decline in the prevalence of HIV in Nigeria, with the current value being 1.4%, but the rate is higher in youths (NACA, 2019). The prevalence of HIV in women

of reproductive age group is 1.9% higher than their male counterparts and higher than the national average. Nigeria is far from attaining the 95% testing rate to eliminate HIV new infections by the year 2030. Studies have shown that the HIV testing rate in Nigeria is low amongst youths, pregnant women, and among women of reproductive age group (Ajayi et al., 2020; Asaolu et al., 2016; Gunn et al., 2016; Okeafor & Okeafor, 2017; Olowokere et al., 2018).

Studies were conducted in various parts of the world to understand the factors related to HIV testing in various populations. Asaolu et al. (2016) studied the factors that affect HIV testing amongst youths in three sub-Saharan African countries. Pahlavan et al. (2015) found a low return rate to receive HIV test results by heterosexual subjects in Paris regardless of socioeconomic status. In Uganda, Lubogo et al. (2015) investigated factors that affect access to HIV services amongst youths, while McGarrity et al. (2018) studied factors that predicted the use of HIV services by men having sex with men. In Malawi, Mkandawire (2017) studied the factors that affect HIV testing in adolescent girls. In Nigeria, Ijeoma et al. (2018); Nworie and Ugwuoke (2018); Ehiri et al. (2016); Ajayi et al. (2020, 2021) studied the factors that affect HIV testing in various groups. Globally, predictors of HIV testing, including socioecological, demographic, and knowledge of PMTCT, were investigated. Some of the findings are stated below.

Socioecological Factors

The socioecological factors investigated by various authors in previous studies are socioeconomic status, stigma, perceived HIV risk, perceived barrier to HIV services, comprehensive knowledge of HIV, sociocultural and religious factors. In the United

States, Stewart et al. (2017) found that social factors such as disclosure of HIV-positive status among congregants and permitting cohabiting couples to be a member of the church were associated with the chance of African American churches having an HIV program and, by extension, providing HIV testing services for the congregation.

Socioeconomic status was significantly associated with HIV testing in Paris and Nigeria (Gunn et al., 2016; Lépine et al., 2015; Pahlavan et al., 2015). Stigma and perceived risk were associated with HIV testing (Ayodele, 2017; Bibiana et al., 2018; Kort et al., 2017: Lépine et al., 2015). Noroozi et al. (2017) found that a lower level of HIV-related stigma was significantly associated with HIV testing in people who inject drugs (OR 2.78, 95% CI 1.15–5.2).

Another socioecological factor studied as affecting HIV testing was HIV knowledge (Ajayi et al., 2020; Asaolu et al., 2016; Hoang et al., 2019; Jayalakshmi, 2016; Lepine et al., 2015). Ehiri et al. (2016) also found that sociocultural factors affect HIV testing in pregnant women. The various factors were studied in the general population, youths, and pregnant women. Considering these factors in women of childbearing age will provide an avenue for planning intervention measures and setting targets for countering low HIV testing rates in women of childbearing age.

Demographic Factors

Age, marital status, geographic location, educational status, and employment status are some demographic factors that were studied by previous researchers. Noroozi et al. (2017), in a study conducted among people who inject drugs in Tehran, found that

educational status was associated with HIV testing (adjusted odds ratios [AOR] 1.12, 95% CI 1.44–4.42). Still, age was not associated with HIV testing in the study.

In another study restricted to men who participated in the 2012 Demographic and Health Survey in Haiti, Conserve et al. (2017) showed that educational status and marital status were associated with HIV testing in Haitian men. Married men were more likely to have an HIV test than unmarried men (AOR 2.57, 95% CI 2.07-3.19). At the same time, the odds of testing HIV in participants increased from 1.63 for those with a primary level of education to 3.25 for those with education higher than primary level. A recent study by Mandiwa and Namondwe (2019) showed that married men (AOR 3.03; 95% CI 2.51–3.65) and men with education higher than primary (AOR 3.02; 95% CI 2.33–3.91) were more likely to test for HIV. Men aged 30 – 39 years were more likely to test for HIV than their counterparts aged 15 – 18 years (AOR 3.00; 95% CI 2.35–3.82).

In addition to age, marital status, educational status, and area of residence were also associated with HIV testing. Similarly, in a study in Ethiopia, higher education and urban residence were significantly associated with HIV testing among women (Nigatu et al., 2015). Women with primary education were twice more likely to test for HIV than women without education (AOR 2.29, 95% CI 2.14–2.46), while women with primary education were about six times more likely to test for HIV than women with no education (AOR 5.88, 95% CI 5.18–6.67), and women with secondary or higher education were nine times (AOR 9.41, 95% CI 7.99–11.08) more likely to test for HIV than women with no education.

In Nigeria, Gunn et al. (2016), using NDHS 2013, found that age, educational status, area of residence was significantly associated with HIV testing by pregnant women in the antenatal clinic (ANC). Only 37% of pregnant women aged 15 – 19 years tested for HIV compared to 30 – 39 years, which had the highest percentage, 58.4% ($p < 0.0001$). The higher the level of education, the higher the number of women that tested for HIV, 30% for pregnant women with no education, 44.4% for women with primary education, 67% for women with secondary education, and 89.1% for women with tertiary education ($p < 0.0001$). For the area of residence, 66.9% of pregnant women in urban areas tested for HIV compared to 40.7% of pregnant women in rural areas (Chi-square $p < 0.0001$).

A similar result was observed in a recent study of pregnant women by Ajayi et al. (2021)**.** They found significant relationships between HIV testing in pregnant women compared to age groups, educational status, and area of residence. Pregnant women older than 24 years were more likely to test for HIV (AOR 1.33, 95% CI 1.04–1.69), those with higher education (AOR 6.94, 95% CI 5.07–9.49) and residing in urban areas (AOR 1.26, 95% CI 1.07-1.50) were also more likely to test for HIV. Kanma-Okafor et al. (2019) in a comparative study amongst male and female secondary school students in Nigeria, found that mother's educational status was significantly associated with HIV testing by the female students ($p = 0.036$).

Age and occupation were significantly associated with the level of awareness of voluntary counseling and testing of HIV in women of childbearing age in Nigeria (Bibiana et al., 2018). Ajayi et al. (2020) studied factors that affect HIV testing among

adolescents and youths using the 2017 Multiple Indicator Cluster Survey. They found that the odds for ever testing for HIV was higher in those aged 20–24 years (AOR 1.52, 95% CI 1.34–1.72), those with higher HIV knowledge (AOR 1.62, 95% CI 1.24–2.11), those that are married (AOR 2.42, 95% CI 1.98–2.97), those with higher educational attainment (AOR 5.85, 95% CI 4.39–7.81), respondents with higher media exposure (AOR 1.64, 95% CI 1.36–1.97), those with positive stigma belief towards people living with HIV (AOR 2.93, 95% CI 2.47–3.49), and those that belonged to the wealthiest quintile (AOR 1.99, 95% CI 1.53–2.60). Socioecological factors are associated with the HIV test in various groups, including women of childbearing age.

Knowledge of Mother to Child Transmission of HIV

Despite the various efforts aimed at preventing and controlling HIV, the prevalence is still high in women and children under the age of 15 years in Nigeria (Olakunde et al., 2019). HIV testing coverage among pregnant women in Nigeria is as low as 37.3% in 2019 (UNAIDS, 2017b). HIV testing being the entry point for PMTCT and the use of treatment as prevention is vital to eliminating new HIV infections in children. Knowledge of MTCT in women may be a factor in determining those that test for HIV leading to treatment and preventing new HIV infections in children. Several studies have been conducted about knowledge of PMTCT, in South Africa, Haffejee et al. (2016) found low knowledge of PMTCT amongst women, especially knowing the mode of transmission of HIV from mother to child. Haile et al. (2016) found that the difference in the proportion of women having adequate knowledge of MTCT and PMTCT that ever tested for HIV or not was significant ($p < .0001$), therefore knowledge of MTCT and

PMTCT was associated with HIV testing in women of childbearing age in Tanzania. Low HIV testing rate among pregnant women attending antenatal care in Swaziland (56%) and HIV testing among the respondents was significantly associated with higher education and higher parity (Sagna & Schopflocher, 2015). In Ethiopia, where utilization of PMTCT was low, HIV testing was significantly associated with knowledge of MTCT by pregnant women (AOR 0.376, 95% CI 0.156-0.909) (Alemu et al., 2018; Tessema et al, 2019).

There were also higher odds of testing for HIV by women who believed HIV could be transmitted to babies during pregnancy, labor, delivery, and breastfeeding (Tessema et al., 2019). HIV testing rate was as high as 77.56% in East African countries and the HIV testing was significantly associated with respondent age, marital status, wealth index, educational level, and HIV knowledge (Worku et al., 2021). Yaya et al. (2016) found that the educational status of women and sex of household head was associated with HIV knowledge. Abebe et al. (2020) found 61% of the pregnant women attending antenatal care in the study facility had adequate knowledge of PMTCT option B+ which involves taking ARVs lifelong. They also found that pregnant women's knowledge of prevention of mother-to-child transmission B+ option was significantly associated with age, employment status, and educational status. In a study by Merga et al. (2016), they found that the utilization of PMTCT services (which includes HIV testing) to be significantly associated with the age (25– 34 years) of respondents (AOR 0.46, 95% CI 0.22-0.97).

Overview of the Manuscripts

HIV testing is the gateway to HIV treatment as prevention and the entry point for preventing mother-to-child transmission of HIV. In these three studies, I evaluated the factors that predict HIV testing in women of childbearing age. These factors are grouped into three parts. These are (a) socioecological factors as predictors of HIV testing in women of childbearing age, (b) demographic factors as predictors of HIV testing in women of childbearing age, (c) knowledge of mother to child transmission of HIV as a predictor of HIV testing in women of childbearing age. The dependent variable HIV testing was measured as whether the respondent ever tested for HIV.

Manuscript 1

In this quantitative study, I focused on the relationship of socioecological factors of women of childbearing age in Nigeria with HIV testing.

Specific Problem

There is a need to strengthen HIV testing in women of childbearing age. Little literature exists about the socioecological factors that affect HIV testing in women of childbearing age at a national level in Nigeria.

Research Question

The research question for this study was: To what extent is there an association between socioecological factors (knowledge of HIV/AIDS, attitudes about HIV/AIDS, perceived risk of HIV/AIDS, cultural beliefs about HIV/AIDS) and HIV testing among women aged 15 – 49 years in Nigeria.

Nature of the Study

The study design for this research is quantitative. I selected the quantitative method for the study because it involved examining the relationship between some independent variables and a dependent variable to answer the research question of "What predictive effects do socioecological factors have on HIV testing in women aged 15-49 years in Nigeria?"

In this study, I used secondary data collected through a cross-sectional survey that examined the variables at a particular point in time. The independent variables are knowledge about HIV, perceived risk of HIV, attitude about HIV, and cultural belief. The dependent variable is whether the respondent has ever tested for HIV. The relationship between the dependent and the independent variables was analyzed using Chi square and logistic regression. The study population are women aged 15 – 49 years in Nigeria.

Types and Sources of Data

The source of data for the study was secondary data from the 2013 Nigeria National Demographic and Health Survey. The survey was nationwide and involved the administration of questionnaires in selecting households. There were separate questionnaires for men and women. I extracted the variables for data analysis from the data of the women-specific questionnaires in the 2013 Nigeria National Demographic and Health Survey database.

Analytical Strategies.

I used descriptive statistics and logistic regression analyses to test the hypotheses related to the research question.

Manuscript 2

This quantitative study focused on the relationship between demographic factors of women of childbearing age in Nigeria with HIV testing.

Specific Problem

There is a need to strengthen HIV testing in women of childbearing age. Little literature exists about the demographic factors that affect HIV testing in women of childbearing age at a national level in Nigeria.

Research Question

To what extent is there an association between the following demographic factors: age, marital status, geographic location [urban vs. rural], employment status, and educational status and HIV/AIDS testing among women aged 15 – 49 years in Nigeria?

Nature of the Study

The study design for this research is quantitative. I selected quantitative method was for this study because it examined the relationship between variables to answer the main research question of "What relationship do demographic factors have with predicting HIV testing among women aged 15 – 49 years in Nigeria?". The database of a study that utilized a cross-sectional survey for data collection was utilized for the study. The independent variables are age, marital status, geographic location, employment, and educational status. The dependent variable is whether the respondent has ever tested for HIV.

Types and Sources of Data

The source of data for this study was secondary data from the 2013 Nigeria National Health and Demographics Survey. The survey was nationwide, involving the administration of questionnaires to sample households with separate questionnaires for men and women. The data from the women-specific questionnaires in the database was utilized for this study. The variables needed for analysis were extracted from the 2013 Nigeria National Demographic and Health Survey database.

Analytical Strategies

The analytic strategies used are descriptive statistics, Chi-squared test, and logistic regression to determine the relationships of the demographic factors as predictors of HIV testing in women aged 15 – 49 years.

Manuscript 3

In this quantitative study, I focused on the relationship between knowledge of mother-to-child transmission of HIV and HIV testing.

Specific Problem

There is a need to strengthen HIV testing in women of childbearing age. Little literature exists about the knowledge of mother-to-child transmission of HIV as it affects HIV testing in women of childbearing age at a national level in Nigeria.

Research Question

To what extent is there an association between the knowledge of mother-to-child transmission of HIV and HIV testing in women aged 15 – 49 years in Nigeria?

Nature of the Study

The study design for this research is quantitative. I selected the quantitative method for the study because it involved examining the relationship between variables to answer the main research question of "Whether knowledge of mother to child transmission of HIV is a predictor of HIV testing in women aged 15 – 49 years in Nigeria?". The independent variable is knowledge of transmission of HIV from mother to child. The dependent variable is whether the respondent has ever tested for HIV. The study population was women aged 15 – 49 years in Nigeria.

Types and Sources of Data

The source of data for the study was secondary data from the 2013 Nigeria National Demographic and Health Survey. The survey was nationwide and involved the administration of questionnaires to a sample of selected households. In addition to the household questionnaire, there were separate questionnaires for men and women. I utilized the data from the women-specific questionnaires for this study. Furthermore, the required variables were extracted from the 2013 Nigeria National Demographic and Health Survey database for analysis.

Analytical Strategies

I analyzed the relationship between the dependent and the independent variables using Chi-squared tests and logistic regression.

Significance

One of the targets of sustainable development goals is eliminating HIV as a public health problem by the year 2030 (United Nations, n.d.). In 2017, the 95-95-95 target was

launched by the Joint United Nations Programme on HIV/AIDS (UNAIDS) towards the elimination of the HIV epidemic (UNAIDS, 2017a). The 95-95-95 target aimed at having 95% of people living with HIV know their status, 95% of those who know their status should be on antiretroviral therapy, and 95% of those on antiretroviral therapy should have viral suppression by the year 2025 (UNAIDS, n.d.; UNAIDS, 2017a). Those who are virally suppressed have minimal risk of transmitting the virus. Therefore, treatment is used as a prevention measure (Montaner et al., 2014). The coverage for the first 95 is low for young people aged 15-49 years in Nigeria. UNAIDS shows that only 34% are aware of their status (Odiachi, 2018; UNAIDS, 2017b). The same age group is also the reproductive age group. In the present study, I investigated how socioecological, demographic, and knowledge of MTCT relates to HIV testing in women of reproductive age group. Examining women in this age group to understand the factors that influence their testing for HIV will allow for age-specific interventions to address the issue of a low HIV testing rate (Odiachi, 2018). This targeted intervention will lead to a social change of improved testing and assessing antiretrovirals as a preventive measure to reduce transmission of HIV to their partners as well as prevention of mother to child transmission of HIV (UNAIDS, 2017c).

Summary

HIV is still a public health problem in Nigeria. HIV testing is the entry point for the prevention of child transmission of HIV, and HIV test is the starting point for HIV treatment as prevention. To achieve the elimination of new HIV infection by the year 2030, it is pertinent to focus on women of childbearing age because they are sources of

infection for their partners and their children. Evaluating factors that affect HIV testing in women of childbearing age will provide a basis for intervention measures to counter low testing rates in women of childbearing age. Socioecological, demographic, and knowledge of MTCT were evaluated in relation to HIV testing in women of childbearing age. These factors are evaluated in the next section.

Part 2: Manuscripts

Socioecological Predictors of HIV Testing in Women of Childbearing Age in Nigeria

Hassana Bashir Yakasai

Outlet for Manuscript

The *Pan Africa Medical Journal* will be the outlet for this manuscript. The journal is a peer-reviewed journal that is focused on health-related issues in Africa. They accept articles on medicine and public health. The overall mission includes improvement in health outcomes in people in the Africa continent, which includes Nigeria. The manuscript is expected to be under the following headings: title of manuscript, abstract, introduction, methods, results, discussion, conclusion, what is already known on this topic, what this study adds, competing interests, authors' contributions, acknowledgments (if any), maximum of four Tables and/or four Figures, maximum of 50 references. The reference style of the journal is Vancouver style. Citation style will involve numbers within the text that refer to numbered entries in the reference list. The maximum length of the abstract of 250 words, and the maximum length of the main text will be 4,000 words, excluding abstract, references, legends, tables, and figures.

My research was based on understanding the factors that predict HIV testing, which is a gateway to treatment for HIV prevention. HIV is a condition of public health importance in Nigeria and Africa; therefore, I am optimistic that the journal will accept my manuscript. I utilized data collected during the 2013 Nigeria Demographic and Heath Survey.

Website: http://www.panafrican-med-journal.com/

Email: editor@panafrica-med-journal.com

Abstract

Introduction

HIV remains a public health problem in Nigeria. Women within the age of 15 to 49 years, the childbearing age, have a prevalence rate of 1.9%, which is higher than that of their male counterparts of the same age group. Women can transmit HIV to their partners and their children. Nigeria accounts for 30% of global transmission of HIV from mother to child. Therefore, the study seeks to identify the socioecological predictors of HIV testing because HIV testing is the gateway to HIV prevention to achieve the sustainable development goal of zero new infections by the year 2030.

Method

The study was a cross-sectional study, analyzing the 2013 Nigeria demographic and health survey data using SPSS V27.

Results

The results of the study indicated a higher odds ratio for good comprehensive knowledge of HIV ($p < 0.001$, OR = 3.81), good attitude to HIV ($p < 0.001$, OR = 2.50), and high perceived risk of HIV ($p < 0.001$, OR = 2.03). A low odds ratio was observed for good cultural belief despite the significance of the association ($p < 0.001$, OR = 0.83).

Conclusion

Socioecological factors of HIV knowledge, attitude to HIV, perceived risk, and cultural belief are significant predictors of HIV. Programs targeted at women in the age group 15-19 years will enhance HIV testing as the gateway to HIV prevention and achieve the 95-95-95 target and zero new infections by 2030.

Introduction

HIV infection is still a public health problem associated with morbidity and mortality. Sub-Saharan Africa bears the highest burden of HIV, and Nigeria is said to have the second-highest burden of HIV, second to South Africa (Awofala & Ogundele, 2018). About 37.9 million people lived with HIV in 2018 globally (United Nations Programme on HIV/AIDS [UNAIDS], 2019a). It was estimated that 6,000 women aged 15 – 24 years become infected with HIV every week globally. Young women aged 15 – 24 years in sub-Saharan Africa were twice more likely to be living with HIV than their male counterparts (UNAIDS, 2019b). In Nigeria, the prevalence of HIV in women of childbearing age (defined as 15 – 49 years) is 1.9%. This is higher than that of men of the same age group (0.9%; National Agency for the Control of AIDS [NACA], 2019). Heterosexual transmission is the most prevalent route of HIV transmission in Nigeria. However, Nigeria accounts for 30% of mother-to-child transmission of HIV globally (Awofala & Ogundele, 2018; Inyang & Rimande-Joel, 2015).

HIV testing is the entry point for HIV treatment and PMTCT. These are measures that can lead to the elimination of new HIV infections. Studies have shown low HIV testing in Nigeria. HIV testing rate of 30.4% among youths was found by Abiodun et al. (2014), while a study by Alabi et al. (2018) revealed a testing rate of 15% among adolescents in Nigeria. Olowokere et al. (2018) found a testing rate of 36.3% among pregnant women in western Nigeria, while an HIV testing rate of 20.7% was found among pregnant women in northern Nigeria (Oyefabi et al., 2018). The result of the 2018 Nigeria HIV/AIDS Indicator and Impact Survey (NAIIS) revealed that out of the 1.9

million people living with HIV in Nigeria, only 67% were aware of their HIV status, about half of them (52%) were on antiretroviral therapy, and only 42% had viral suppression (NACA, 2019). Nonetheless, Okeafor and Okeafor (2017) found that the rate of HIV testing among women aged 15 – 49 years who participated in the national demographic and health survey of 2003 and 2015 increased from 17.4% to 21.7%. Notwithstanding, the increase is still low compared to the target of 95%.

Some socioecological factors studied in HIV testing are stigma, socioeconomic status, the perceived barrier to HIV services, perceived HIV risk, comprehensive knowledge of HIV, religious and sociocultural factors. Hoang et al. (2019) found that in Vietnam, educational status, occupation, and source of HIV information were associated with knowledge and attitude towards HIV, including HIV testing. Among people who inject drugs in Iran, Noroozi et al. (2017) found that HIV testing was associated with education, income, perceived risk of HIV infection, and lower level of HIV-related stigma. Socioeconomic status was significantly associated with HIV testing in Paris and Nigeria (Gunn et al., 2016; Lépine et al., 2015; Pahlavan et al., 2015).

Lépine et al. (2015) also found that wealth, education, HIV knowledge, stigma, and perceived risk were predictors of HIV testing in women in a relationship with men in Nigeria. In a review of Nigeria DHS 2013 data, Asaolu et al. (2019) observed a statistically significant association between higher education, higher wealth index, having comprehensive HIV knowledge, higher HIV risk perception in terms of having more than one sexual partner and having sexually transmitted disease in the past one year with HIV testing among youths in Nigeria.

Ayodele (2017) studied university students and found that perceived HIV risk was significantly associated with HIV testing. Women with higher education, less stigma toward people living with HIV, have adequate HIV knowledge, and recognized a higher risk for HIV were more likely to test for HIV (Lepine et al., 2015). Gunn et al. (2016), in a review of HIV testing by women attending antenatal care, using the 2013 NDHS, found that stigma, wealth index, and educational status were significantly associated with HIV testing by pregnant women in the ANC. Women with higher education, higher wealth index and less stigma were more likely to test for HIV. Bibiana et al. (2018), in a study of women of the reproductive age group in a community in Nigeria, found a significant association between occupation and level of education with knowledge of voluntary counseling and testing of HIV.

There is a need to strengthen HIV testing in women of childbearing age. Socioecological factors that affect HIV testing have been studied in youths of various groups and also pregnant women. Little literature exists about the socioecological factors that affect HIV testing in women of childbearing age at the national level in Nigeria. Therefore, I filled this gap by studying socioecological predictors of HIV testing (knowledge of HIV/AIDS, attitudes about HIV/AIDS, perceived risk of HIV/AIDS, cultural beliefs about HIV/AIDS) among women aged 15 – 49 years nationwide in Nigeria. Understanding the socioecological factors that predict HIV testing among these women will provide a basis for planning intervention strategies to improve HIV testing in them with the long-term aim of eliminating new HIV infections. While Lepine et al. (2015) studied factors that affected HIV testing among couples using the 2008 National

Demographic and Health Survey (NDHS) data, I used a more recent dataset (2013 NDHS) focused on women within the age 15 – 49 years. The socioecological model of health promotion provided the framework for this study.

Methods

For this study, I used a quantitative secondary data analysis utilizing the 2013 Nigeria Demographic and Health Survey (NDHS) dataset. The 2013 NDHS is a national survey that involved sampling of households. Nigeria is divided administratively into 36 states and 774 local government area. The sample of the households was selected via a three-stage stratified cluster design with samples taken from urban and rural areas of the 774 local government areas of Nigeria. The population for the survey was women aged 15 – 49 years and men aged 15 – 49 years resident in the selected households. 38,948 women aged 15 – 49 years were interviewed using the women questionnaire in the 2013 NDHS. Female respondents aged 15 – 49 years who participated in the 2013 NDHS are this study's target population. I examined and analyzed the association between the socioecological factors and HIV testing among these women. I used a sample size of 17,467 for this study. However, all the women with complete information in the dataset were included for analysis.

Variables

The independent (outcome) variables were knowledge of HIV/AIDS, attitudes about HIV/AIDS, perceived risk of HIV/AIDS, and cultural belief, while the dependent (predictor) variable was HIV testing. I aimed to determine how the independent variables are predictive of HIV testing in women of childbearing age (15 – 49 years).

HIV Testing

The dependent variable was HIV testing. I used the variable "Ever tested for HIV" in the 2013 NDHS dataset as HIV testing variable. "Ever tested for HIV" variable has a dichotomous response of "yes" or "no" and it was used as such.

Knowledge of HIV/AIDS

In the women's questionnaire used for 2013 NDHS, there were questions about HIV/AIDS knowledge. I scored the responses of the seven questions to get the HIV related knowledge score which was used for analysis. The questions "Ever heard of AIDS, know a place to get an HIV test, reduce the risk of getting HIV: Always use condoms, to reduce the risk of getting HIV: have one sex partner only, who has no other partners, a healthy-looking person can have HIV" have a "yes", "no" or "don't know" options. I recoded the "don't know" option as "no". The "Yes" option was coded as "1" and "No" was coded as "0". For the questions: "Can get HIV from mosquito-bite and Can get HIV by sharing food with a person who has AIDS", "No" was coded as "1" and "Yes" was coded as "0" because the questions tested the ability to reject misconceptions about HIV. The total score for knowledge of HIV ranged from 0 – 7, it was further categorized into low knowledge (score of 0 – 6) and the score of seven as high knowledge.

Attitudes About HIV/AIDS

There were questions in the women's questionnaire that reflect the attitude of the respondents to HIV. I coded the respondents that agreed to the questions "Willing to care for a relative with AIDS, a female teacher infected with HIV, but is not sick, should be

allowed to continue teaching, and would buy vegetable from a vendor" as "yes" and scored "1", those that answered "no" were scored "0." Respondents that disagreed to the questions "People with HIV should be ashamed of themselves, and people with HIV should be blamed for bringing disease to the community" were coded as "yes" and scored "1" while that that agreed were scored "0". The total score for attitude about HIV ranged from 0 – 5, it was further categorized into negative attitude (score of 0 – 2) and positive attitude (score of 3 – 5).

Perceived Risk of HIV/AIDS

There were questions relating to HIV risk in the women's questionnaire used for the 2013 NDHS. I coded a positive response to the questions "Had any STI in the last 12 months, had genital sore/ulcer in last 12 months, had genital discharge in the last 12 months, had more than one sex partner including a spouse in the last 12 months" and negative response to the questions "Condom used during last sex with a most recent partner and Used condom every time had sex with a most recent partner in the last 12 months" as "1", the opposite response was coded as "0". The total score perceived risk HIV ranged from 0 – 5, it was further categorized into low risk (score of 0 – 1), medium risk (2) and high risk (score of 3 – 5).

Cultural Belief About HIV

I used the response to the variable "Can get HIV by witchcraft or supernatural means," which is dichotomous as "Yes" or "No," as cultural belief variable in the study. The "yes" response was recoded as bad cultural belief and the "no" response as good cultural belief.

I used IBM SPSS software version 27 for data analysis. Descriptive statistics and Chi square was used to summarize the respondents' characteristics and the significance of the association between the predictor and outcome variables. At the same time, binary logistic regression was employed to analyze the predictive effects of knowledge of HIV/AIDS, attitudes about HIV/AIDS, perceived risk of HIV/AIDS, and cultural beliefs with HIV testing. Study was approved by Walden University institutional review board. The IRB approval number is 07-17-20-0544515.

Results

Out of the 38,948 women that participated in the survey, 0.01% of the respondents had missing data for the dependent variable, which is HIV testing. 21.2% of the women had missing data for knowledge of HIV/AIDS. 19.8% of the respondents had missing data for attitude to HIV/AIDS. 27% had missing data for the perceived risk of HIV/AIDS, 19.4% of the respondents had missing data for the cultural belief of HIV. The cases with complete data on all the independent variables and the dependent variable were selected for analysis. The final sample size of 17,467 women was used for analysis.

Table 1 shows the sociodemographic characteristics of the 17,467 women aged 15 – 49 years that participated in the 2013 Nigeria demographic and health survey. The result showed that the highest proportion of the women (38.5%) were between the ages of 25 – 34 years and less than 10% were above the age of 45 years. The majority of the women (84.9%) were married. A bit above half of the women (59.4%) lived in rural areas, while 40.6% live in urban areas. Most of the respondents either had no education

(35 %) or only had secondary education (33.7%). Only 11.8% higher than secondary education. 70% of the respondents were working at the time of the survey.

The findings also highlighted that 41.4% of the respondents had tested for HIV while 58.6% had never tested for HIV at the survey time. Most of the respondents (67 %) had low knowledge of HIV, but only about one-quarter of the respondents (24.1%) had good attitude to HIV. Most of the women (79 %) also had a good cultural belief about HIV. The result also showed that most of the women (95.9%) had a low risk of HIV. Table 2 shows HIV testing uptake by socioecological variables.

Knowledge About HIV/AIDS

Results from the logistic regression test indicated that Knowledge about HIV/AIDS is significantly associated with HIV testing; X^2 (1, N=17467) = 185.148, $p <$ 0.001. The result also showed that knowledge of HIV is a predictor of HIV testing (OR = 4.16, 95% CI 3.89 – 4.45, $p < 0.001$) indicating the model was able to distinguish between participant HIV testing. The result also showed that knowledge of HIV explained 1.0% (Cos & Snell R^2) to 13.5% (Nagelkerke R^2) of the variance in HIV testing by women aged 15 – 49 years. Furthermore, the model correctly classified 68% of the cases by HIV testing status.

Attitude About HIV

Results from the logistic regression test indicated that there is a statistically significant association between attitude to HIV/AIDS and HIV testing; $\chi 2$ (1, N = 17467) = 923.423, $p < 0.001$. Attitude to HIV/AIDS is also a predictor of HIV testing (OR = 2.98, 95% CI 2.78 – 3.20, $p < 0.001$) indicating the model was able to distinguish

between participant HIV testing. The result also showed that attitude about HIV explained 5.1% (Cos & Snell R^2) to 6.9% (Nagelkerke R^2) of the variance in HIV testing by women aged 15 – 49 years. Furthermore, the model correctly classified 64.2% of the cases by HIV testing status.

Perceived Risk of HIV

Results from the logistic regression test indicated that there is a statistically significant association between perceived risk of HIV/AIDS and HIV testing; $\chi 2$ (2, N = 17467) = 89.961, $p < 0.001$. The result also showed that the perceived risk of HIV explained 5% (Cos & Snell R^2) to 7% (Nagelkerke R^2) of the variance in HIV testing by women aged 15 – 49 years. Furthermore, the model correctly classified 59.3% of the cases by HIV testing. Medium and high perceived risks were predictive of with HIV testing (OR = 1.95, 95% CI 1.63 – 2.33, $p < 0.001$). and (OR = 2.34, 95% Cl 1.78 – 3.09, $p < 0.001$) respectively.

Cultural Belief About HIV

Results from the logistic regression test indicated that attitude to HIV/AIDS was not significantly associated with HIV testing; $\chi 2$ (1, N = 17467) = 2.182, $p > 0.005$ indicating the model was not able to distinguish between participant HIV testing. The result also showed that cultural belief about HIV does not explain the variance in HIV testing by women aged 15 – 49 years. Both Cos & Snell R^2 and Nagelkerke R^2 were 0%. But the model correctly classified 58.6% of the cases by HIV testing status. Cultural belief was not a predictor of HIV testing (OR = 1.05, 95% CI 0.98 – 1.14, $p > 0.001$).

Socioecological Factors

Multiple logistic regression analysis was performed using SPSS V27 to assess whether socioecological factors such as Knowledge about HIV/AIDS, Attitude towards HIV/AIDS, Perceived Risk of HIV/AIDS, and Cultural Beliefs are predictors of HIV testing among women aged 15 – 49 years in Nigeria. The result showed that socioecological factors were predictors of HIV testing indicating the model was able to distinguish between participant HIV testing. The model as a whole explained between 13.4% (Cox & Snell R squared) to 18% (Nagelkerke R squared) of the variance in HIV testing and correctly classified 68.1% of the cases. Table 3 shows the. Inferential statistics for each predictor variables in the model.

Discussion

The findings of this study showed that knowledge of HIV/AIDS, attitude about HIV and perceived risk of HIV were significant predictors of HIV testing among the studied socioecological factors. The odds ratio for knowledge of HIV/AIDS is 3.81 which imply that those with good HIV knowledge are 3.81 times more likely to test for HIV than those with bad HIV knowledge. Those with good attitude to HIV are 2.50 times more likely to test for HIV. Respondents with medium and high perceived risk of HIV are 1.79 and 2.03 times more likely to test for HIV than those with low risk. On the contrary, respondents with good cultural belief are 0.86 times less likely to test for HIV while controlling for other factors in the model. Despite the low testing rate in this study, it was found that most of the women had good cultural beliefs but low knowledge of HIV, bad attitude to HIV and low risk of HIV. HIV knowledge was found in this study to

be significantly associated with HIV testing similar to other studies in different groups such as couples and women in relationships (Lepine et al.,2015), and youths in Nigeria (Asaolu et al., 2019). High knowledge of HIV is more likely to understand the importance of HIV and also perform HIV test as a preventive measure. High perceived risk of HIV was associated with HIV testing in this study similar to the study among people who inject drugs in Iran (Noorozi et al., 2017). People that have high perceived risk will more likely test for HIV when they have adequate knowledge of the risk factors for HIV infection. Bad attitude in terms of stigma was associated with HIV testing in pregnant women attending ANC (Gunn et al., 2016) and women of reproductive age in Abuja Nigeria (Bibiana et al., 2018). Women with good knowledge of HIV/AIDS, good attitude about HIV, and high perceived risk were more likely to test for HIV while those with good cultural beliefs were less likely to test for HIV. This study found that socioecological factors were significantly associated with HIV testing in women aged 15-49 years in Nigeria.

There is a limitation in generalizing the result of this study because the dataset for the 2013 NDHS was used for the study because there was no response for HIV testing in the 2018 NDHS, a more recent survey. There is a decline in the prevalence of HIV from 3.4% in 2013 (Awofala & Ogundele, 2018) to 1.4% in 2018 (NACA, 2019) and there is a lot of measures in place towards the prevention and control of HIV. Therefore, the results of this study may not be currently generalizable. As with the use of secondary data, no all the variables required were available in the dataset. I used response for five questions to

compute HIV/AIDS knowledge instead of eight questions and five questions to compute attitude to HIV instead of seven questions.

Conclusion

The finding of this study implies that improving the level of knowledge of HIV, improving attitude to HIV and risk assessment can improve HV testing in women aged 15-49 years in Nigeria. Increasing HIV testing rate in these women will lead to getting higher percentage of women living with HIV to know their status and take action accordingly to prevent transmission to their partners and their children. HIV testing is the entry point for HIV treatment which can be used as prevention because treatment leads to reduction in viral load and women with undetectable viral load will not transmit HIV to their partners and children as such the 95-95-95 target by 2025 (UNAIDS, n.d.a; n.d.b) and the sustainable development goal of elimination of HIV as public health problem (United Nations, n.d.) can be achieved.

I recommended that the study should be replicated using the dataset for the 2018 NAIIS survey when available to the public or the next NDHS data to have a current picture of the predictive effect of socioecological factors on HIV testing in women aged 15-49 years in Nigeria. Therefore, it is recommended that the government develop programs targeted at women of childbearing age to improve their knowledge of HIV, including the risk factors for contacting HIV, and change their attitude to HIV. The positive social change of improving HIV testing spans across individuals, families, communities, and the country. I also recommend researching the effect of COVID 19 on HIV testing by women of childbearing age,

What is already known on this topic

1. Educational status, perceived risk and HIV knowledge were predictors of HIV testing in women who were in a relationship with men in Nigeria.
2. Educational status, higher wealth index, comprehensive HIV knowledge, HIV risk perception are associated with HIV testing among youths (males and females) in Nigeria.
3. Educational status is significantly associated with HIV testing by pregnant women that attend antenatal clinic in Nigeria.

What this study adds

1. Good comprehensive knowledge of HIV is positively predictive of HIV testing in women of childbearing age in Nigeria.
2. Good attitude to HIV is positively predictive of HIV testing in women of childbearing age in Nigeria.
3. High perceived risk of HIV is positively predictive of HIV testing in women of childbearing age in Nigeria.
4. Good cultural belief about HIV is negatively predictive of HIV testing in women of childbearing age in Nigeria.

Competing interests

There is no competing interest.

Author's contribution

Hassana Bashir Yakasai got ethical approval, conducted the analysis of secondary data and wrote the manuscript of this study.

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Table 1

Sociodemographic Characteristics of the Respondents

Sociodemographic variables	Frequency (n)	Percentage (%)
Age distribution (years)		
15 - 24	4453	25.5
25 - 34	6728	38.5
35 - 44	4602	26.3
45 - 49	1684	9.6
Marital status		
Single	1676	9.6
Married	14825	84.8
Living with partner	481	2.8
Widowed	186	1.1
Divorced	137	0.8
Separated	162	0.9
Place of residence		
Urban	7086	39.9
Rural	10381	60.1
Level of Education		
No education	6107	35.0
Primary	3406	19.5
Secondary	5890	33.7
Higher	2064	11.8

N=17467

Table 2

HIV Testing Uptake by Socioecological Variables

Outcome variable	Total		HIV testing status				p-value
			Never tested		Ever tested		
	n	%	n	%	n	%	
Knowledge of HIV/AIDS							
Good	5780	33.0	2058	20.1	3704	51.1	<0.001
Inadequate	11707	67.0	8171	79.9	3538	48.9	
Attitude to HIV							
Good	4209	24.1	1614	15.8	2595	34.9	<0.001
Bad	13258	75.9	8613	84.2	4845	65.1	
Perceived risk of HIV							
High	214	1.23	82	0.80	132	1.82	<0.001
Medium	507	2.90	217	2.12	290	4.00	
Low	16746	95.8	9928	97.08	6818	94.17	
Cultural belief about HIV							
Good	13802	79.0	8042	78.6	5780	79.6	0.140
Bad	3665	21.0	2185	21.4	1480	20.4	

Table 3

Logistic Regression Analysis Predicting HIV Test by Socioecological Factors

							95% confidence interval	
Predictor variable	β	S.E	Wald	df	Sig	Odds Ratio	Lower	Upper
Knowledge about HIV	1.339	0.035	1488.812	1	<0.001	3.813	3.559	4.086
Attitude to HIV	0.915	0.039	562.747	1	<0.001	2.496	2.314	2.692
Low perceived risk of HIV			55.302	2	<0.001			
Medium perceived risk of HIV	0.561	0.098	35.052	1	<0.001	1.787	1.475	2.166
High perceived risk of HIV	0.708	0.153	21.389	1	<0.001	2.029	1.503	2.739
Cultural belief	-0.148	0.041	13.046	1	<0.001	0.862	0.796	0.934
Constant	-3.047	0.094	1047.589	1	<0.001	0.048		

Demographic Predictors of HIV Testing in Women of Childbearing Age in Nigeria

Hassana Bashir Yakasai

Outlet for Manuscript

The *African Journal of AIDS Research* (AJAR) will be the outlet journal for this manuscript. AJAR is a peer reviewed journal that publishes research papers that make an original contribution to the social aspect of HIV/AIDS in Africa. In addition to research papers, AJAR also publishes short communications and review papers. The manuscript is expected to have between 5000 and 7000 words. The abstract is expected to be 250 words or less. There is no specification for the main body of the manuscript, but there must be an introduction and a conclusion. The manuscript will be prepared in MS word with headings and text formatted in 12- point Arial or Calibri font with 1.5 line spacing. The headings are to be in not more than three levels, bold, bold italics, and italics. The referencing style is APA 6th Edition. Tables and figures are to be presented as separate files.

My research is based on understanding how demographic factors can predict HIV testing in women aged 15 – 49 years in Nigeria. The manuscript's content is in line with the journal's objective which is targeted at understanding the social aspect of HIV/AIDS in Africa, which includes Nigeria. The use of secondary data derived from the 2013 National Demographic and Health Survey dataset will take care of ethical issues because ethical approval was obtained before conducting the survey. Therefore, I am optimistic that my manuscript will be accepted for publication in the AJAR.

Website: https://www.nisc.co.za/products/1/journals/african-journal-of-aids-research

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Abstract

Nigeria accounts for about one third of global mother to child transmission of HIV (MTCT). HIV testing is the entry point for the prevention of MTCT. Therefore, there is a need to strengthen HIV testing in women of childbearing age to achieve the sustainable goal of zero new infections by 2030. This study examined demographic factors as predictors of HIV testing in women of childbearing age using data from the 2013 Nigeria Demographic and Health Survey. Age, marital status, educational status and employment status were positive predictors of HIV testing. Women aged 24 to 34 years (OR = 3.05, 95% CI 2.89 - 3.22), living with a partner but not married (OR = 3.46, 95% CI 2.99 - 3.98), separated from husband (OR = 3.56, 95% CI 2.91 – 4.31), employed (OR = 2.18, 95% CI 2.08 - 2.29) and having post-secondary education (OR = 23.95, 95% CI 21.87 – 26.29) were more likely to test for HIV. The geographic location had a negative predictive effect on HIV testing (OR = 0.34, 95% CI 0.33 – 0.36), with women living in rural areas less likely to test for HIV. The result suggests the need to focus on adolescents and older women, unemployed women, less educated women and women living in rural areas to enhance HIV testing towards the positive social change of eliminating MTCT. It is recommended that future research will use recent HIV testing to examine predictors of HIV testing in contract to lifetime HIV testing used in this study.

Introduction

HIV is still a disease of public health importance despite the efforts geared to control HIV/AIDS. According to the Joint United Nations Programme on HIV/AIDS (UNAIDS), 37.9 million people lived with HIV globally by the end of 2018 (UNAIDS, 2019a). Nigeria is having the second highest burden of HIV globally (Awofala & Ogundele, 2018). It was estimated that about 1.7 million new HIV infections occurred in 2018 with 770,000 dying from HIV related illnesses (UNAIDS, 2019a). It was also estimated that 6000 young women aged 15 – 24 years become infected with HIV weekly worldwide and the chance of women living with HIV is higher than that of men of the same age group (UNAIDS, 2019b).

In Nigeria, the prevalence of HIV in women aged 15 – 49 years is 1.9% which is higher than that of males of same age group (National Agency for the Control of AIDS [NACA], 2019). Nigeria also accounts for 30% of mother to child transmission of HIV (MTCT) globally (Inyang & Rimande-Joel, 2015; NACA, n.d.). HIV testing is the entry point for HIV treatment as prevention and the entry point for utilization of prevention of mother to child transmission of HIV (PMTCT) services. In Nigeria, various studies have found low HIV testing rates of less than 40% among adolescents and pregnant women which is lower than the target of 90% (Alabi et al., 2018; Olowokere et al.,2018; Oyefabi et al., 2018). Various factors, including demographic factors can influence HIV testing among women of childbearing age which is a vital step in the elimination of new HIV infections. In this study, I determined to what extent demographic factors of age, marital

status, geographic location, educational status, and employment status predict HIV testing in women of childbearing age in Nigeria.

Some of the demographic factors studied by previous authors affect various aspects of HIV testing and treatment: geographic location, age, marital status, educational status, and employment status. Educational status was associated with HIV testing in a study conducted amongst people who inject drugs in Tehran but age was not significantly associated with HIV testing in the study (Noroozi et al., 2017). The marital and educational status were associated with HIV tests in men in Haiti. The married men were more likely to conduct HIV tests than unmarried men. The higher the educational level, the higher the odds of testing for HIV (Conserve et al., 2017).

Similarly, higher educational status and being married were significantly associated with higher odds of testing for HIV by men in Malawi (Mandiwa & Namondwe, 2019). Area of residence and age were significantly associated with HIV tests by men in Malawi. The men in the age group 30 – 39 years and those residing in the central and southern regions were more likely to test for HIV than adolescents and those residing in the northern region (Mandiwa & Namondwe, 2019). A 2010 Ethiopian Demographic and Health Survey review showed that urban residence, higher education, and wealth status were significantly associated with HIV testing in both men and women (Nigatu et al., 2015).

In Nigeria, most of the studies were conducted on pregnant women attending antenatal care. Pregnant women older than 24 years, with higher educational status, and

those living in urban areas were more likely to test for HIV (Ajayi et al., 2021; Gunn et al., 2016).

In a study of university students by Kanma-Okafor et al. (2019), the mother's educational status was significantly associated with HIV testing by female students. Bibiana et al. (2018), in a study of women of childbearing age in one community in Nigeria, found that occupation and age were significantly associated with the level of awareness of voluntary counseling and consequently testing of HIV. No literature addresses all women of childbearing age regardless of whether they are pregnant or not, attending an antenatal clinic or not. I addressed this gap by targeting all women aged 15 – 49 years in Nigeria, which is vital to preventing HIV in women even before becoming pregnant to avoid transmission to their babies and their partners.

Understanding demographic factors that influence HIV testing is vital in developing strategies to ensure that 95% of people, including women aged 15 – 49 years know their status. UNAIDS launched the 90-90-90 and the 95-95-95 target in 2017 to achieve the sustainable development goal of eliminating HIV infection as a public health problem by the year 2030 (United Nations, n.d., UNAIDS 2017a). The UNAIDS' 95-95-95 target is aimed at 95% of people infected with HIV knowing their status, 95% of those who know their status placed on antiretroviral therapy, and 95% of those on antiretroviral therapy achieving viral suppression by the year 2025 (UNAIDS, n.d.b; UNAIDS, 2017b). Effective HIV treatment leads to viral suppression, which reduces the chance of transmitting HIV infection. Treatment can only occur when HIV status is known through HIV testing. The purpose of this study is to examine the extent to which demographic

variables predict HIV testing in women aged 15 – 49 years at a national level in Nigeria. Women aged 15 – 49 years are the sexually active age group and the childbearing age; therefore, increasing HIV testing in this age group can prevent transmission of HIV to their sexual partners and their children.

Methods

In this quantitative study, I conducted a secondary data analysis utilizing data from the 2013 Nigeria Demographic and Health Survey (NDHS) conducted nationwide using questionnaires administered on a representative sample of households. A three-stage stratified sampling method was used in selecting the households included in the sample for the 2013 NDHS. Women aged 15 – 49 years and men aged 15 – 59 years were the target population for the survey. The survey was conducted in all 36 states, including the federal capital territory covering all the 744 local government areas in Nigeria. Thirty-eight thousand nine hundred and forty-eight women (38,948) women out of 39,902 identified eligible women were interviewed in the survey yielding a response rate of 97.6%. I used the responses to the women's questionnaire as the data for this study. The survey result provided information on the demographic variables and HIV testing among women aged 15 – 49.

Variables

The independent (predictor) variables were age, marital status, educational status, occupational status, and geographical location, while the dependent variable was HIV testing. The aim of this study is to determine to what extent the independent variables are predictive of HIV testing which is the dependent (outcome) variable.

HIV Testing

The dependent (outcome) variable was lifetime HIV testing. I used the variable "Ever tested for HIV" in the 2013 NDHS dataset as HIV testing variable. "Ever tested for HIV" variable has a dichotomous response of "yes" or "no" was used as such in this study.

Age

The 2013 NDHS female questionnaire dataset has a variable "Age in 5-year groups" in which the ages were grouped as 1 – 19, 20 – 24. 25 – 19, 30 – 34, 35 – 39, 40 – 44, and 45 – 49 years. I regrouped the age in 5-year into 4 groups (15 – 24, 25 – 34, 35 – 44, and 45 – 49) and used as "Age" variable in this study.

Geographic Location

I used the variable "Type of place of residence" with a dichotomous response of "urban" and "rural" in the 2013 NDHS dataset as "Geographic location" variable in this study.

Educational Status

I used the variable "Educational level" with a response of "no education, primary, secondary, and higher" as" Educational status" variable in this study.

Marital Status

I used the variable "Current marital status" in the 2013 NDHS data with options of "never in a union, married, living with a partner, widowed, divorced, and no longer living together /separated" as "Marital status" variable for this study.

Occupational Status

I used the variable "currently working" in the 2013 NDHS dataset, which has options of "yes" or "no," as "occupational status" variable for this study.

Descriptive statistics and logistic regression were used to summarize the data and to determine the presence or absence of a significant association between independent variables and HIV testing (the dependent variable). The study was approved by Walden University institutional review board (IRB). The IRB approval number for this study is 07-17-20-0544515).

Results

Out of the 38,948 women who participated in the survey, 209 and 482 women had no response to employment status and HIV testing questions, respectively. I excluded the cases with missing data from the analysis resulting in a final sample size of 38,258 women. IBM SPSS version 27 was used for data analysis. The analysis showed an HIV testing rate of 30.5% amongst the women aged 15 – 49 years in Nigeria. The frequency distribution of the predictor variables shows that most of the women are within the age range of 15 – 34 years (69.2%), married (67.6%), live in the rural area (60%), and are employed (61.9%) as shown in Table 4. The result also showed that about one-third of the women (35.2%) had no education while 37.1% had secondary education. A summary of the descriptive statistics of the independent variables is shown in Table 5.

Age

Results of binary logistic regression as shown in Table 6 revealed that there is a significant positive predictive relationship between age and HIV testing for women aged

25-34 years (OR = 3.05, 95% CI 2.89 – 3.22, $p < 0.001$), 35-44 years (OR = 2.46, 95% CI 2.32 – 2.62, $p < 0.001$) and 45-49 years (OR = 1.18, 95% CI 1.08 – 1.29, $p < 0.001$). The reference age was 15 – 24 years. The model correctly classified 69.5% of the cases., indicating the model was able to distinguish between participant HIV testing. The result also showed that age explained 5% (Cos & Snell R^2) to 7% (Nagelkerke R^2) of the variance in HIV testing by women aged 15-49 years. Hosmer and Lemeshow's test is insignificant ($p > 0.001$), further supporting the significance of age. Age was a significantly associated with HIV testing; χ^2 (3, N = 38258) = 1946.780, $p < 0.001$

Marital status

Results from the logistic regression test as shown in Table 6 indicated that there is a statistically significant association between marital status HIV testing; χ^2(5, N = 38258) = 718.961, $p < 0.001$. There is a positive predictive association between marital status and HIV testing as shown in Table 6. Women living with a partner were 3.45 times more likely to test for HIV than single women. Women separated from their partners are also 3.55 times more likely to test for HIV than single women who are not in a relationship. The result also showed that marital status explained 19% (Cos & Snell R^2) to 26% (Nagelkerke R^2) of the variance in HIV testing by women aged 15 – 49 years. Furthermore, the model correctly classified 69.5% of the cases, indicating the model was able to distinguish between participant HIV testing.

Geographic location

The result a statistically significant association between geographic location and HIV testing; χ^2 (1, N = 38258) = 2278.296, $p < 0.001$. Geographic location was also

found to be negatively predictive of HIV testing as shown in Table 6. Women living in rural areas were 0.34 times less likely to test for HIV than women living in urban areas. The result also showed that geographic location explained 5.8% (Cos & Snell R^2) to 8.2% (Nagelkerke R^2) of the variance in HIV testing by women aged 15 – 49 years. The model also correctly classified 69.5% of the cases indicating that model could distinguish between participant HIV testing.

Employment status

The results showed a statistically significant association between employment status and HIV testing; $\chi^2(1, N = 38258) = 1072.853$, $p < 0.001$. Logistic regression in Table 6 shows that employment status is positively predictive of HIV testing (OR = 2.18, 95% CI 2.08 – 2.29, $p < 0.001$), The model also correctly classified 69.5% of the cases indicating the model was able to distinguish between participant HIV testing. The result also showed that employment status explained 2.8% (Cos & Snell R^2) to 3.9% (Nagelkerke R^2) of the variance in HIV testing by women aged 15 – 49 years in Nigeria.

Educational status

The logistic regression test results as shown in Table 6 revealed a strong positive predictive association between educational status and HIV testing (OR = 23.94, 95% CI 21.87 – 26.29, $p < 0.001$) for post-secondary, (OR = 5.57, 95% CI 5.21 – 5.94, $p < 0.001$) for those with secondary education, and (OR = 3.89, 95% CI 3.60 – 4.19, $p < 0.001$) for those with primary education. The result also showed that employment status explained 15.5% (Cos & Snell R^2) to 21.9% (Nagelkerke R^2) of the variance in HIV testing by women aged 15-49 years. The model also correctly classified 73.9% of the cases. There

is also a statistically significant relationship between educational status and HIV testing. χ^2 (3, N = 38258) = 6431.955, $p < 0.001$

Discussion

The study showed that the demographic factors of age, marital status, geographic location, educational status are significantly associated with lifetime HIV testing in women aged 15 – 49 years in Nigeria. The findings on age as predictive of HIV testing is similar to the result of studies by other researchers amongst men in Malawi (Mandiwa & Namondwe, 2019), amongst men and women in Ethiopia (Nigatu et al., 2015), and in pregnant women in Nigeria (Ajayi et al., 2019; Gunn et al., 2016). But age was not a significant predictor of HIV testing in the study conducted among people who inject drugs in Tehran (Noroozi et al., 2018). The result of this study showed that the age range of 25 – 34 years had higher odds which is contrary to the findings by Ajayi et al. (2019) and Gunn et al. (2016) wherein pregnant women 34 years and above had higher odds for HIV testing. Therefore, this study indicates a need to target all women, including the younger than 25 years and older than 35 years, because they are within the reproductive age and can transmit HIV to their babies and partners when infected.

The result of this study also showed that marital status a significant predictor of HIV testing. This is similar to reports from Conserve et al. (2017) in Haiti and Mandiwa and Namondwe (2019) in Malawi. However, those that are married had higher odds of testing for HIV contrary to the findings of this study whereby those living with a partner and those separated had higher odds testing for HIV. This implies a need to stress the importance of HIV testing and encourage single, married, widowed, and divorced women

to test for HIV to reach the 95-95-95 target by the year 2030. Respondents in urban areas were more likely to test for HIV, similar to the finding amongst men and women in Ethiopia (Nigatu et al., 2015) and amongst pregnant women in Nigeria (Ajayi et al., 2021; Gunn et al., 2016). Occupational status, in this study was predictive of HIV testing. This agrees with the findings of Nigatu et al. (2015). Employed women had a higher odd of testing for HIV. The educational status also significantly associated with HIV testing. Other authors asserted to this finding in previous studies (Ajayi et al., 2019; Conserve et al., 2017; Gunn et al., 2016; Mandiwa and Namondwe, 2019; Nigatu et al., 2015; Noroozi et al., 2018). Women with secondary and higher education had higher odds of testing for HIV. Therefore, the education of the girl child seems to play an important role in HIV testing. The inclusion of sex education in the school curriculum may play an important role in awareness of HIV and improving the testing rate amongst girls and young women. There is a need for sustained efforts to educate women of childbearing age, including targeted and tailored messages on HIV prevention, including HIV testing, to prevent mother-to-child transmission.

The study was conducted using the 2013 NDHS dataset because the 2018 NDHS dataset had no response for the dependent variable in the study, limiting the generalization of the result of this study. I used a dataset from a cross-sectional survey for this study, therefore, the result is limited to how respondents responded at one moment in time rather than over some time and there could also be recall bias. The result of the study is specific to Nigeria. As such, it cannot be generalized to other African or non-African countries.

The study showed a need for concerted effort to improve HIV testing amongst women aged 15-49 years to achieve the 95-95-95 target by the year 2025 and zero new infections. The target groups are the single, married, divorced, uneducated, unemployed, and women living in rural areas. The findings can have the social impact of influencing future policies of HIV prevention targeting women of childbearing age, starting from young girls out of school and those in various school levels. It is recommended that this study should be replicated with the next version of the Nigeria demographic and health survey, which may likely include response on HIV testing or the 2018 NAIIS survey when the dataset is available to the public to ascertain the present level of HIV testing amongst women aged 15-49 years in Nigeria and the possible predictors as a means of HIV prevention. I also recommend researching the effect of COVID 19 on HIV testing by women of childbearing age,

Conclusion

Demographic factors of age, marital status, geographic location, employment status and educational status are all significant predictors of HIV testing in women aged 15-49 years (childbearing age) in Nigeria. Women within the age of 24-35 years, living with a partner or separated, living in urban areas, employed, and with higher education were more likely to test for HIV. Therefore, other categories need to be targeted to improve HIV testing as an HIV prevention strategy.

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Table 4

Frequency Distribution of Independent Variables for Manuscript 2

Sociodemographic variables	Frequency (n)	Percentage (%)
Age distribution (years)		
15 - 24	14363	37.5
25 - 34	12133	31.7
35 - 44	8244	21.4
45 - 49	3518	9.2
Marital status		
Single	8715	25.4
Married	25862	67.6
Living with partner	848	2.2
Widowed	986	2.6
Divorced	421	1.1
Separated	426	1.1
Place of residence		
Urban	15291	40.0
Rural	22967	60.0
Employment status		
Not Employed	14560	38.1
Employed	23698	61.9
Educational status		
No education	13456	35.2
Primary	6970	18.2
Secondary	14178	37.1
Higher	3654	9.6

Table 5

Descriptive Statistics for Independent Variables for Manuscript 2

Variable	Mean	Standard deviation	Skewness	Standard error of skewness	Kurtosis	Standard error of kurtosis
Age	28.88	9.708	0.388	0.013	-0.923	0.025
Marital status	0.90	0.804	2.282	0.013	8.690	0.025
Geographic location	1.60	0.490	-0.410	0.013	-1.832	0.025
Employment status	0.62	0.486	-0.492	0.013	-1.758	0.025
Educational status	1.21	1.030	0.097	0.013	-1.328	0.025

Table 6

Logistic Regression Predicting HIV Testing by Demographic Variables

Predictor variable	Category	β	S.E	Wald	Df	Sig	Odds Ratio	95% confidence interval	
								Lower	Upper
Age	15-24			1841.710	3	<0.001			
	25-34	1.114	0.028	1579.149	1	<0.001	3.048	2.885	3.220
	35-44	0.901	0.031	838.282	1	<0.001	2.463	2.317	2.617
	45-49	0.165	0.046	12.838	1	<0.001	1.179	1.077	1.290
	Constant	-1.431	0.021	4594.732	1	<0.001	0.238		
Marital status	Single			682.524	5	<0.001			
	Married	0.627	0.028	492.443	1	<0.001	1.871	1.771	1.978
	Living with partner	1.237	0.073	285.919	1	<0.001	3.445	2.985	3.976
	Widowed	0.782	0.071	122.594	1	<0.001	2.187	1.904	2.511
	Divorced	0.481	0.109	19.325	1	<0.001	1.617	1.305	2.003
	Separated	1.265	0.100	159.784	1	<0.001	3.545	2.913	4.313
	Constant	-1.331	0.025	2845.813	1	<0.001	0.264		
Geographic location	Rural	-1.080	0.023	2224.124	1	<0.001	0.340	0.325	0.355
	Constant	-0.226	0.016	192.429	1	<0.001	0.798		
Employment status	Employed	0.779	0.024	1014.195	1	<0.001	2.179	2.077	2.286
	Constant	-1.333	0.020	4273.844	1	<0.001	0.264		
Educational status	No Educational			4979.701	3	<0.001			
	Primary	1.356	0.039	1238.944	1	<0.001	3.882	3.600	4.187
	Secondary	1.716	0.033	2660.413	1	<0.001	5.564	5.212	5.939
	Post secondary	3.177	0.047	4578.543	1	<0.001	23.974	21.866	26.285
	Constant	-2.173	0.028	5830.168	1	<0.001	0.114		

Knowledge of Mother -to-Child Transmission of HIV as a Predictor of HIV Testing in Women of Childbearing Age in Nigeria

Hassana Bashir Yakasai

Outlet for Manuscript

The *Journal of AIDS Education and Prevention* will be the outlet journal for this manuscript. This is a peer reviewed journal that publishes original manuscript and reviews. The length of the manuscript is expected to be less than 20 pages including references and tables/figures. The format and style are in accordance with the Publication Manual of the American Psychological Association, 6th edition (2009). The materials are to be assembled in the following order: Cover letter, title page, acknowledgements, abstract, main body, references, tables, figures, supplemental materials, and copyright. The acknowledgement and abstract are to appear on separate pages with the abstract being 150 words or less. The main body will include an introduction, methods, results, discussion, and conclusion. Tables and figures should not be more than four and submitted as separate files.

My research aims to understanding how knowledge of mother to child transmission affects HIV testing which is the gateway for preventing mother to child transmission of HIV. Therefore, the manuscript is in line with the journal's focus which is AIDS education and prevention. Ethical issues will be minimal because I used secondary data (2013 Nigeria Demographic and Health Survey) for the research. As such I am optimistic that my manuscript will be accepted for publication.

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Abstract

Nigeria accounts for 30% of cases of mother to child transmission of HIV (MTCT) globally. HIV testing is the entry point for the prevention of mother to child transmission of HIV (PMTCT). This study examined knowledge of MTCT as a predictor of HIV testing in women of childbearing age. Logistic regression was performed on 2013 Nigeria Demographic and Health Survey data using SPSS V27. This study showed that knowledge of PMTCT (AOR = 2.33, 95% CI 2.12 – 2.56), knowledge of MTCT during delivery (AOR =1,14, 1.25 – 1.59), and knowledge of MTCT during breastfeeding (AOR = 1.38, CI 1.16 – 1.65) were positive predictors of HIV testing. The result suggests a need to educate women of childbearing age on all the modes of transmission with its prevention to enhance HIV testing and eliminate MTCT.

Keywords: HIV testing, Women, Nigeria, MTCT

Introduction

Mother to child transmission is one of the routes of transmission of HIV infection. HIV infection is still a disease of public health importance. By the end of the year 2018, it was estimated that about 37.9 million people were living with HIV and more than half a million people died from HIV related causes (The Joint United Nations Programme on HIV/AIDS [UNAIDS], 2019). Nigeria has the second highest burden of HIV infection globally second to South Africa (Awofala & Ogundele, 2018). In Nigeria, the prevalence of HIV in women aged 15 – 49 years is 1.9% which is higher than the prevalence of HIV in men of the same age group (National Agency for the Control of AIDS [NACA], 2019). HIV infected women can transmit HIV to their babies during pregnancy, delivery, or breastfeeding. Globally, about 90% of HIV infections in children less than 15 years are from mother to child transmission (Namara-Lugolobi et al., 2017).

A four-pronged strategy was introduced by the world health organization (WHO) in 2001 for PMTCT (Oyefabi et al., 2018). The first prong involves primary prevention of HIV infection in women of childbearing age. The second prong involves the prevention of unwanted pregnancy in HIV positive women. The third prong involves using antiretroviral drugs and other measures to prevent transmission from mothers to their babies while the last prong involves providing support for HIV infected mothers, their babies, and their families. HIV testing is the entry point for PMTCT. After testing for HIV, HIV negative women are counseled on how to take measures to remain negative while HIV positive women are enrolled in program to prevent transmission to their babies. About 15 – 40% of babies of HIV positive women will become infected with HIV

in the absence of intervention, but with effective intervention, the rate of transmission reduces to less than five percent (WHO, 2020). Studies have shown that the HIV testing rate is low in the general population and pregnant women in Nigeria (Abiodun et al., 2014; Alabi et al., 2018; Asaolu et al., 2016; Oleribe et al., 2018; Olowokere et al., 2018). HIV is still a public health problem in Nigeria with a high rate of mother to child transmission.

The prevention and control of HIV are embedded in the targets of the sustainable development goal 3.1, which aims to end HIV as a public health problem by the year 2030 (United Nations, n.d.). Ending the HIV epidemic implies eliminating new infections that include infection in children from infected HIV women who are not enrolled in the PMTCT services. HIV testing by women of childbearing age is key to PMTCT because they can only utilize PMTCT services when they are aware of their positive HIV status. The use of HIV treatment as prevention also protects their partners from getting HIV infections.

The Joint United Nations Programme on HIV/AIDS (UNAIDS) in 2017 launched the 90-90-90 strategy by 2020 and the 95-95-95 target by 2025 (UNAIDS, 2017a). The 95-95-95 aims at 95 of people with HIV knowing their status, 95% of those identified with HIV linked to effective antiretroviral therapy and 95% achieving viral suppression by the year 2025 towards the elimination of new HIV infections by the year 2030 (UNAIDS, n.d.; UNAIDS, 2017a).

The HIV testing coverage for young people aged 15 – 49 years in Nigeria is low. According to UNAIDS, only 34% of people aged 15 – 49 years are aware of their status

in Nigeria (Odiachi, 2018; UNAIDS, 2017b). I investigated the relationship between knowledge of MTCT in women of childbearing age with HIV testing in this study. The result will allow for developing a strategy to improve HIV testing in women of childbearing age which will prevent transmission of HIV from the women to their partners and their children which is a step towards eliminating new infections in the year 2030.

Most studies on MTCT were done as they relate to the utilization of PMTCT services and were conducted amongst pregnant women attending antenatal clinic and HIV positive women (Dada et al., 2017; Kate et al., 2019; Olowokere et al., 2018; Onalu et al., 2019; Oyefabi et al., 2018). In this study I utilized the data from a survey involving women of childbearing age regardless of their pregnancy status because preventing HIV in women of childbearing age is the first prong of PMTCT and HIV testing is the gateway to HIV treatment which can also serve as prevention. In the present study, unlike others, I will relate the knowledge of MTCT in women of childbearing age to HIV testing in a nationally representative sample. This understanding will be used policy makers and public health practitioners in strategizing on how to eliminate new infections in children as a result of MTCT.

The aim of this study is to investigate how knowledge of MTCT in women of childbearing age relates to HIV testing in Nigeria. Understanding the relationship between HIV testing and knowledge of MTCT will allow for interventions targeted at women of childbearing age to improve HIV testing and prevent transmission of HIV from women to their children and their partners. Optimizing HIV test is vital to the

elimination of HIV as a public health problem which is one the sustainable development goals. Effective HIV treatment leads to an undetectable viral load which renders the virus untransmissible to another person, thereby serving as a preventive measure.

Knowledge of MTCT has been described as part of factors in the utilization of PMTCT services. Sagna and Schopflocher (2015) studied women aged 15 – 49 years that had a live birth within 5 years before the survey and attended antenatal clinic in Swaziland, the result showed that only about 62% of the women received pretest counseling as part of PMTCT, but only 56% accepted to test for HIV in Swaziland. The women's educational level was found to be significantly associated with the chance of pretest counseling, and pretest counseling was found to increase the likelihood of HIV testing by the women (Sagna & Schopflocher, 2015). In Tanzania, Haile et al. (2016) examined the covariates of adequate knowledge of MTCT and PMTCT using a population based survey. They found that knowledge of MTCT and PMTCT was as low as 46% and was significantly associated with having some education, knowing a place to get HIV test, residing in the urban area, having higher household wealth, having knowledge of HIV/AIDS, having at least one pregnancy and testing for HIV.

Similarly, a study conducted among pregnant women in Ethiopia revealed low knowledge of PMTCT which was also significantly associated with urban residence, young age of 15 – 24 years, having secondary education or more, having five or more children, being employed, having perceived susceptibility to HIV and having a positive attitude to living with HIV (Alemu et al., 2018).

Another study in Ethiopia that focused on factors affecting utilization of PMTCT services found 9.7% level of utilization of PMTCT services among pregnant women attending antenatal clinics, and the utilization of PMTCT was significantly associated with knowledge of MTCT (Tessema et al., 2019). A study conducted in northwest Ethiopia also found a low knowledge of MTCT (57.5%) and lower level of PMTCT (17.4%), knowledge of MTCT and PMTCT were significantly associated with adequate knowledge of HIV (Abtew et al., 2016). In another study in southern Ethiopia, Tigabu, and Dessie (2018) found that 92.8% of the respondents were aware of MTCT while 83.5% were aware of PMTCT. Utilization of PMTCT services was significantly associated with follow up in the last pregnancy, partner testing during ANC and being employed by the government. While the overall correct knowledge of MTCT and PMTCT in Ethiopia was low (34.9%) using a national population based survey (Luba et al., 2017). Residence in the urban area, higher education, currently in union, occupation and exposure to mass media were found to be significantly associated with the correct knowledge of MTCT and PMTCT in the survey (Luba et al., 2017).

The relationship between knowledge of MTCT and PMTCT with HIV sero-conversion in pregnancy was studied by Egbe et al. (2016). The result indicated a high level of MTCT and PMTCT knowledge in both HIV negative and HIV positive group, but only 31% of the pregnant women knew their HIV status before booking for antenatal care in Cameroon (Egbe et al., 2016). Another study in South West Cameroon by Sama et al., (2016) found that 100% of the pregnant women studied were aware of HIV infection, but only 79.3% were aware of MTCT, and only 23.7% had adequate knowledge of

PMTCT. While in South Africa, Ramoshaba and Sithole, (2017) in a qualitative study among HIV positive pregnant women, found that majority of the respondents were aware of MTCT and PMTCT but not the mode of transmission from mother to child. But in Tanzania, the proportion of pregnant HIV positive women with high knowledge of PMTCT was as low as 53.3% (Musvipa et al., 2018). Some studies were also done in Nigeria with regard to knowledge of MTCT and PMTCT (Dada et al.,2017; Onalu et al., 2019).

Most of the studies on PMTCT in Nigeria were conducted in pregnant women attending ANC excluding nonpregnant women and pregnant women that do not attend ANC. The result of the 2013 NDHS showed that antenatal care coverage (at least one visit) for women aged 15 – 49 years is 60.6% (National Population Commission (NPC) [Nigeria] and The International Classification of Functioning, Disability and Health [ICF], 2014). In Anambra South, Anambra state Nigeria, a study among HIV positive women of childbearing age showed that 86% of the women were aware of PMTCT, age, marital status, and place of residence were found to be associated with utilization of PMTCT services (Onalu et al., 2019), while Dada et al. (2017) studied HIV positive pregnant women attending antenatal clinics to determine the factors affecting utilization of PMTCT services. Dada et al. (2017) found that only about half of the respondents had adequate knowledge of MTCT. Lack of awareness of HCT, poor male involvement in PMTCT, and late presentation to ANC were factors associated with poor utilization of PMTCT services (Dada et al., 2017). In a similar study in Enugu, Kate et al., (2019) found that all the participants experience some form of barrier to utilization of PMTCT

and educational status with parity were found to significantly influence barrier to PMTCT. Studies in Northern Nigeria revealed poor awareness of PMTCT among pregnant women attending ANC (Yusuf et al., 2016; Oyefabi et al., 2018). On the contrary, good knowledge of PMTCT was found among pregnant women in Abia State, Nigeria.

Testing for HIV is the entry point for the use of HIV treatment as prevention and also the prevention of MTCT. HIV testing rate in Nigeria was found to be low in some studies (Abiodun et al., 2014; Alabi et al., 2018; National Population Commission (NPC) [Nigeria] and ICF (2014). A study in southern Nigeria showed that only 20.7% of pregnant women had ever tested for HIV while in Oshogbo, Osun State Nigeria, only 36.6% of pregnant women were willing to test for HIV (Olowokere et al., 2018; Oyefabi et al., 2018).

There is a need to optimize HIV testing in women of childbearing age to achieve the sustainable development goal of eliminating HIV as a public health problem in 2030. There is little literature on the influence of knowledge of MTCT on HIV testing by women of childbearing age at a national level in Nigeria. I filled this gap by studying how knowledge of MTCT predict HIV testing in Nigeria. The research question for this study was: To what extent is there an association between, comprehensive knowledge of MTCT, knowledge of MTCT during pregnancy, delivery and breastfeeding associated with HIV testing in women of childbearing age? The socioecological model of health promotion provided the framework for this study.

Methods

The study was a quantitative cross-sectional analysis using the 2013 NDHS dataset. The target population for this study were Nigerian women of childbearing age (15 – 49 years). This target population is the same as part of the 2013 Nigeria Demographic and Health Survey sample. Stratified sampling method was used to select households included in the survey. All eligible women aged 15 – 49 years resident in the selected households were interviewed using the women questionnaire component of the survey. Among the questions in the questionnaire used for the survey were questions on knowledge of MTCT by the women and whether they have ever tested for HIV. The response rate was 97.6%, 38,948 women were interviewed in the 2013 NDHS survey. The minimum sample size for this study as calculated using the G Power (3.1.9.4) calculator was 395. However, all the women (21,640) with complete information were included in the study.

Variables

The independent (predictor) variables were knowledge of MTCT during pregnancy, knowledge of MTCT during delivery, knowledge of MTCT during breastfeeding comprehensive knowledge of MTCT, and knowledge of PMTCT. The dependent (outcome) variable is HIV testing.

HIV Testing

I used the variable “Ever tested for HIV” in the 2013 NDHS dataset as HIV testing variable which has a dichotomous response of “yes” or “no”.

Knowledge of MTCT During Pregnancy

The "Knowledge of transmission of HIV from mother to child during pregnancy variable in the 2013 NDHS data with a dichotomous response of "yes" or "no" was used as such in the study.

Knowledge of MTCT During Delivery

I used the knowledge of transmission of HIV from mother to child during delivery variable in the 2013 NDHS data with a dichotomous response of "yes" or "no" as such in the study.

Knowledge of MTCT During Breastfeeding

I used the knowledge of transmission of HIV from mother to child during breastfeeding variable in the 2013 NDHS data with a dichotomous response of "yes" or "no" as such in the study.

Comprehensive Knowledge of MTCT

I computed the comprehensive knowledge of MTCT variable as a composite of the knowledge of transmission of HIV from mother to child during pregnancy, delivery and breastfeeding. Each correct response was scored as one. A score of three indicates good comprehensive knowledge of MTCT.

Knowledge of PMTCT

I used the response to the question "Drugs to avoid HIV transmission to the baby during pregnancy" which has a dichotomous response of "yes" and "no" as the knowledge of PMTCT variable.

The data was analyzed using SPSS version 27. Chi square and binary logistic regression was utilized to assess the association between the variables and the predictability of the independent variables on the outcome variable. Ethical approval was received from Walden University institutional review board (Approval number 07-17-20-0544515).

Results

Out of 39,902 women aged 15-49 years identified for inclusion in the survey only 38,948 responded to the questions yielding a response rate was 97.6%. The minimum sample size that was calculated using the G power (3.1.9.4) was 395 women. Out of the 38,948 women that participated in the survey, 7,896 (20.3%) had missing data for the question on MTCT during pregnancy, 8,295 (21.3%) had missing data for the question on MTCT during delivery, 7,576 (19.5%) had missing data for the question on MTCT during breastfeeding. The cases with complete data on all the independent, dependent and control variables were selected for the study. The cases with incomplete information were excluded from the analysis. A final sample size of 21,640 women was used for analysis.

The demographic characteristics of the respondents are shown in Table 7. About two third of the respondents (68.5%) were between the ages of 15 – 34 years. Most of them were married (67.6%) and employed (65%). About half of them had had only secondary education (41.8%) and lived in rural areas (53%). The result of this study showed that only 42.3% of the women included in the study had ever tested for HIV. Most of the women were aware that HIV could be transmitted during pregnancy (78.7%), during delivery (82.5%), and during breastfeeding (94.4%), as shown in Table 8. The

knowledge of PMTCT (86.3%) and comprehensive knowledge of MTCT (69.4%) were high among the respondents. There is a statistically significant association between knowledge of PMTCT, comprehensive knowledge of MTCT, knowledge of MTCT during pregnancy, delivery and breastfeeding with lifetime HIV testing, as shown in Table 8. The result of logistic regression shown in Table 9 revealed that knowledge of PMTCT, knowledge of MTCT during delivery and breastfeeding are predictors of HIV testing. In contrast, knowledge of MTCT during pregnancy and comprehensive knowledge of MTCT are not significant predictors of HIV testing. Women with knowledge of PMTCT are twice more likely to test for HIV than those unaware of PMTCT (AOR = 2.33, 95% CI 2.12 – 2.56). Women aware of MTCT during delivery are 1.41 more likely to test for HIV (AOR =1,14, CI 1.25 – 1.59). Women that were aware of the transmission of HIV during breastfeeding were 1.38 times more likely to test for HIV (AOR = 1.38, CI 1.16 – 1.65) than those unaware of HIV transmission during breastfeeding. On the contrary, women that were aware of HIV transmission during pregnancy were 0.92 times less likely to test for HIV (AOR = 0.92, 95% CI 0.79 – 1.08), and those with comprehensive MTCT knowledge were also 0.78 times less likely to test for HIV (AOR = 0.78, 95% CI 0.65 – 0.93).

Discussion

The result of the study demonstrates that only about half of women of childbearing age in Nigeria (42.3%) had ever tested for HIV, which implies that there is still a gap towards attaining the 95-95-95 target by the year 2025 because more women have to test for HIV to identify 95% of those living with HIV infection. The HIV testing

found is higher than the estimate of 34% among men and women aged 15-49 years in Nigeria by UNAIDS (UNAIDS, 2017b). The HIV testing rate is also higher than in Cameroun in a previous study (Egbe et al., 2016) but lower than in an earlier study among pregnant women attending antenatal clinic in Swaziland (Sagna and Schopflocher, 2015). Low HIV testing rate was found in this study despite the finding of high knowledge of PMTCT and knowledge of the different modes of transmission from mother to child. But the result of the study also indicated that only about two thirds of the women had comprehensive knowledge of MTCT. Low HIV testing rate amongst women of childbearing age may be attributable to various factors such as fear and stigma associated with HIV testing in health care facilities, especially in adolescents. The finding of high knowledge of MTCT and PMTCT in this study is similar to that of previous research in southern Ethiopia (Tigabu and Dessie, 2018) and contrary to findings in previous studies in Tanzania (Haile et al., 2016), northwestern Ethiopia (Alemu et al., 2016), and a population-based study in Ethiopia (Luba et al., 2017). The result, therefore, shows that women of childbearing age in Nigeria are aware of HIV transmission from mother to child. However, Nigeria still accounts for a high level of the mother to child transmission of HIV globally. It is recommended that programs are developed to encourage women of childbearing age to know their status even before getting pregnant. The use of self-test kit may play an essential role in enhancing HIV testing in child bearing age women. Previous studies have shown a difference in PMTCT knowledge between Nigeria's northern and southern part (Yusuf et al., 2016; Oyefabi et al., 2018), implying that culture should be considered when planning programs to enhance HIV

testing and PMTCT uptake. In this study, the bivariate analysis showed that all the outcome variables were significant predictors of HIV testing except for knowledge of MTCT, which was marginally significant ($p = 0.045$). But the multivariable model revealed that knowledge of MTCT during pregnancy and comprehensive knowledge of MTCT were not significant predictors of HIV testing.

There are some limitations to the generalizability of the result of this study. The 2013 NDHS data was used in this study because the 2018 NDHS data had no response on HIV testing, which is the dependent variable. Therefore, the result obtained from this study may not reflect the changes over the five years (2013 to 2018). The assessment of HIV testing was based on self reporting, which could be subject to recall bias. Lifetime HIV testing was used in this study without indicating whether the respondents received their result or not. It is also possible that exposure to HIV could happen after the test. The result of the HIV test is essential for the prevention and control of HIV. It is recommended that the study can be replicated with the NAIIS survey data when available to the public to get recent data on predictors of HIV testing in women of childbearing age. I also recommend researching the effect of COVID 19 on HIV testing by women of childbearing age,

Conclusion

The findings of this study suggest the need to focus on educating women of childbearing age in Nigeria about all the modes of transmission of HIV from mother to child and how to prevent such transmission, with HIV testing being the starting point of preventing HIV. Developing programs to enhance HIV testing and promoting self-testing

will improve HIV testing towards achieving the 95-95-95 target and having zero new HIV infection by 2030.

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Table 7

Demographic Characteristic of Women Analyzed in Manuscript 3

Demographic variables of respondents	Total	Percentage
Age distribution (years)		
15 - 24	7401	34.2
25 - 34	7420	34.3
35 - 44	4916	22,7
45 - 49	1903	8.8
Marital status		
Single	5403	25.0
Married	14628	67.6
Living with partner	482	2.2
Widowed	861	4.0
Divorced	266	1.2
Separated		
Place of residence		
Urban	10162	47.0
Rural	11478	53.0
Employment status		
Not Employed	7570	35.0
Employed	14070	65.0
Educational status		
No education	5842	26.1
Primary	3958	18.3
Secondary	9053	41.8
Higher	2987	13.8

Table 8

HIV uptake by outcome variable

Outcome variable		Total	HIV testing status		p-value
			Never tested	Ever tested	
Knowledge of MTCT during pregnancy	No	4608 (21.3%)	2693 (21.6%)	1915 (20.9%)	<0.001*
	Yes	17032 (78.7%)	9792 (78.4%)	7240 (79.1%)	
Knowledge of MTCT during delivery	No	3788 (17.5%)	2384 (19.1%)	1404 (15.3%)	<0.001*
	Yes	17852 (82.5%)	10101 (80.9%)	7751(84.7%)	
Knowledge of MTCT during breastfeeding	No	1214 (5.6%)	791(6.3%)	423 (4.6%)	<0.001*
	Yes	20426 (94.4%)	11694 (93.7%)	8732 (95.4%)	
Knowledge of PMTCT	No	2967 (13.7%)	2191 (17.5%)	776 (8.5%)	<0.001*
	Yes	18673 (86.3%)	10294 (82.5%)	8379 (91.5%)	
Comprehensive Knowledge of MTCT	Inadequate	6617 (30.6%)	3970 (31.8%)	2647 (28.9%)	<0.001*
	Adequate	15023 (69.4%)	8515 (68.2%)	6508 (71.1%)	

Table 9

Univariate and Multivariate Logistic regression of outcome variables

Outcome variable	COR	95%CI	p-value	AOR	95%CI	p-value
Knowledge of MTCT during pregnancy	0.81	0.75 - 0.87	<0.001*	0.92	0.79 – 1.08	0.304**
Knowledge of MTCT during delivery	1.16	1.07 - 1.25	<0.001*	1.41	1.25 – 1.59	<0.001*
Knowledge of MTCT during breastfeeding	1.30	1.14 – 1.49	<0.001*	1.38	1.16 – 1.65	<0.001*
Knowledge of PMTCT	2.38	2.17 – 2.72	<0.001*	2.33	2.12 – 2.56	<0.001*
Comprehensive Knowledge of MTCT	0.94	0.88 – 0.99	0.045*	0.78	0.65 – 0.93	0.007**

Note Abbreviations: AOR adjusted odds ratio, COR crude odds ratio. *Significant (P < 0.05); **Non-significant (P > 0.05)

Part 3: Summary

Integration of the Studies

In this 3-manuscript dissertation, I aimed to explore the predictors of HIV testing in women of childbearing age in Nigeria. The lifetime HIV testing rate of women of childbearing age that participated in the 2013 NDHS was 30.5%. This testing HIV rate is far from the target of getting 95% of people living with HIV to know their status by 2025 towards achieving the sustainable development goal of zero new infections by 2030, which includes zero transmission of HIV from mother to child. I explored the socioecological, demographic and knowledge of MTCT as predictors of HIV testing in women of childbearing age. The study showed that socioecological factors of knowledge about HIV, attitude to HIV, perceived risk of HIV and cultural beliefs were predictive of lifetime HIV testing in women of childbearing age, similar to findings in previous studies in different groups of people and pregnant women. But the predictive effect of cultural belief was negative, with those having good cultural having less likely hood of testing for HIV infection. Age, marital status, employment, and educational status positively predicted HIV testing, while geographic location had a negative predictive effect. Women aged 25 – 34 years, living with a partner or separated, who had post-secondary education, and were employed were more likely to test for HIV. The geographic location had a negative predictive effect. Women living in rural areas were less likely to test for HIV. Knowledge of PMTCT and knowledge of MTCT during delivery and breastfeeding were predictive of HIV testing. In contrast, knowledge of MTCT during pregnancy and comprehensive knowledge of MTCT were not predictive of HIV testing. The finding of

knowledge about HIV, perceived risk of HIV, attitude to HIV, age, marital status, educational status, employment status, knowledge of MTCT during delivery, knowledge of MTCT during breastfeeding and knowledge of prevention of MTCT as predictors of HIV testing further bolster the contribution of different factors to health promotion. These variables found to be predictive of HIV testing spans across the personal, interpersonal, community and organizational factors that influence HIV testing as a form of health promotion in the socioecological model of health promotion. Therefore, it is pertinent to target the categories of women that were less likely to test for HIV to enhance HIV testing as a form of prevention of HIV to achieve the sustainable goal of zero new infections by 2030 as a positive social change, which includes the elimination of mother to child transmission of HIV infection.

I recommend that public health policymakers focus on women of childbearing age, especially adolescents and middle-aged women, to enhance HIV testing and prevent transmission of HIV from mother to child. Therefore, in HIV sensitization for girls, there is a need for expatiating on modes of mother to child transmission of HIV with its prevention. Public health practitioner could use school-based and community-based sensitization programs to reach women of childbearing age. My recommendation for future research is to replicate this study using those tested for HIV recently and received their result as HIV testing variable to have a clearer view of the factors that predict HIV testing in women of childbearing age. I also recommend researching the effect of COVID 19 on HIV testing by women of childbearing age, The main lesson learnt in this research process is the limitation in the choice of variables associated with secondary data. I had

different HIV testing rates for the three manuscripts because of the removal of cases with missing data for the variables in the study.

Conclusion

My study supported the fact that there is a low testing rate among women of childbearing age. The study also showed that socioecological factors, demographic factors and knowledge of PMTCT and knowledge of MTCT during delivery and breastfeeding were predictive of HIV testing in women of childbearing age. Targeting the undiagnosed women living with HIV in a timely manner is an essential step in achieving the UNAIDS' 95–95-95 targets towards eliminating mother to child transmission of HIV and transmission of HIV to the partners of women of childbearing age.

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