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Full Length Research Article

KNOWLEDGE OF MOTHER-TO-CHILD TRANSMISSION OF HIV AS A PREDICTOR OF HIV TESTING IN SOME WOMEN OF CHILDBEARING AGE IN NIGERIA

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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 to be 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 human immunodeficiency virus infection. Human immunodeficiency virus (HIV) infection is still a disease of public 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 the prevention of mother to child transmission of HIV (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 the prevention of mother to child transmission of HIV. After testing for HIV, HIV negative women are counseled on how to take measures to remain negative while HIV positive women are enrolled in prevention of mother to child transmission of HIV (PMTCT) 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 5 % (WHO, 2020). Studies have shown that HIV testing rate is low in the general population and pregnant women in Nigeria (Abiodun *et al*., 2014; Asaolu *et al*., 2016; Alabi *et al*., 2018; 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 (UNAIDS, 2017b; Odiachi *et al*., 2018). The present study investigated the relationship between knowledge of MTCT in women of childbearing age with HIV testing. 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 mother to child transmission 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; Olowokere *et al*., 2018; Oyefabi *et al*., 2018; Kate *et al*., 2019; Onalu *et al*., 2019;). The present study will utilize 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 prevention of mother to child transmission of HIV and HIV testing is the gateway to HIV treatment which can also serve as prevention. The present study, unlike others, will relate the knowledge of MTCT in women of childbearing age to HIV testing in a nationally representative sample. The understanding of which will be used in strategizing on how to eliminate new infections in children as a result of mother to child transmission of HIV.

This study aims 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 five 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 *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 in 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. The utilization of PMTCT in the study 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 regards 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 non-pregnant 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. 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; National Population Commission (NPC) [Nigeria] and ICF, 2014; Alabi *et al*., 2018). 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. The study filled this gap by studying how knowledge of MTCT predicts HIV testing in Nigeria. The research questions for this study are: "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.

MATERIALS AND METHODS

The study is a quantitative cross-sectional study using the 2013 NDHS dataset. The 2013 NDHS was a national survey conducted by the National Population Commission in Nigeria. Details of the method and mode of data collection for the survey can be found in the report of the 2013 NDHS (National Population Commission (NPC) [Nigeria] and ICF, 2014). The content of the questionnaires used for the survey was based on model questionnaires developed by the MEASURE DHS programme. 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. A representative sample of 40,680 households was selected for the survey, with a minimum target of 943 completed interviews per each state in Nigeria and the federal capital territory. 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 independent (predictor) variables are knowledge of transmission of HIV from mother to child during pregnancy, knowledge of transmission of HIV from mother to child during delivery, knowledge of transmission of HIV from mother to child during breastfeeding and comprehensive knowledge of MTCT. The dependent (outcome) variable is HIV testing. The variable "Ever tested for HIV" in the 2013 NDHS dataset was used in this study as HIV testing variable which has a dichotomous response of "yes" or "no". 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. 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" was used as such in the study. 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" was used as such in the study. The comprehensive knowledge of MTCT variable was computed as a composite of the knowledge of transmission of HIV from mother to child during pregnancy, delivery and breastfeeding. Correct response was scored as one. A score of three indicates good comprehensive knowledge of MTCT. The response to the question "Drugs to avoid HIV transmission to the baby during pregnancy" which has a dichotomous response of "yes" and "no" was used 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. The survey protocol for the 2013 NDHS was reviewed and approved by the National Health Research Ethics Committee of Nigeria (NHREC) and the ICF Institutional Review Board. Ethical approval for the secondary analysis of the 2013 NDHS data in this study 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 in the selected households 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) calculator was 395 women. A minimum sample size of 395 women was required to detect significance when such significance exists (Faul *et al*., 2009). A priori power analysis was done using a minimum power of 80 %, an effect size of 20 %, and a significant alpha error of 0.05. The likelihood of committing a Type II error by accepting a false null hypothesis is reduced by using adequate power. Out of the 38,948 women that participated in the survey, 7,896 (20.3 %) had missing data for the question on HIV transmission during pregnancy, 8,295 (21.3 %) had missing data for the question on HIV transmission during delivery, 7,576 (19.5 %) had missing data for the question on HIV transmission during breastfeeding. The cases with complete data on all the independent variables, dependent variable 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 I. About one 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 study showed that only 42.3 % of the women included in the study had ever tested for HIV.

Table I: Demographic characteristic of respondents.

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

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 II. 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 II.

Table II: HIV uptake by outcome variable

			HIV testing status		
Outcome variable		**Total**	**Never tested**	**Ever tested**	**p-value**
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 %)	

Key: *Significant (P < 0.05)

The result of logistic regression shown in Table III 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, 95 % 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).

Table III: 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**

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

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, 2017a). 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 & 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 study also found 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 & Dessie, 2018) and contrary to findings in previous studies in Tanzania (Haile *et al*., 2016), northwestern Ethiopia (Alemu *et al*., 2018), 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. This study utilized the 2013 NDHS data because the 2018 NDHS data had no response on HIV testing, which is the dependent variable. Therefore, it will not reflect the changes over the five years. 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.

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.

Data Availability

The quantitative data utilized for this study was extracted from the 2013 Nigeria Demographic and Health Survey dataset which is available at the dhs website (dhsprogram.com).

Conflicts of Interest

We declare no conflict of interest.

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