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RESEARCH ARTICLE

Determinants Of Taking Adequate Tetanus Toxoid Vaccination Among Mothers In Their Last Pregnancy In Nigeria

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ABSTRACT

Background: Nigeria records considerable morbidity and mortality from tetanus, predominantly in newborns and women of reproductive age group. This is largely due to poor tetanus toxoid-containing vaccine (TTCV) uptake. This study investigated the factors influencing the uptake of adequate Tetanus toxoid vaccination among women in their last pregnancy in Nigeria.

Methods: This descriptive cross-sectional study used data sets extracted from the Nigeria Multiple Indicator Cluster Survey. It includes data collected from 4,855 women, aged 15-49 years across the six geopolitical zones in Nigeria. Data analysis, chi-square test and logistic regression analysis were then performed.

Results: Out of the 4,855 women recruited, slightly half of the respondents (51.7%) were between the ages of 25 and 34. All respondents had tetanus injections, the majority of which (86.7%) were adequate. Some factors identified to influence TTCV uptake positively were younger age group ($p<0.001$, OR=1.377), tertiary education ($p<0.001$, OR=2.093), wealth ($p<0.001$, OR=2.217), owning an immunisation card ($p<0.001$, OR=0.69), exposure to radio and television ($p<0.001$, OR=1.749), residence in southern Nigeria ($p=0.020$, OR=1.571), prenatal care ($p=0.019$, OR=0.585) and delivery in health care facility ($p<0.019$, OR=0.448).

Conclusion: This study found that the TTCV uptake in Nigeria among mothers in their last pregnancy was in keeping with the standard recommended by WHO for any country aspiring to eliminate maternal and neonatal tetanus. However, the lowest uptake was observed in the Northern region. We recommend that national policies on maternal and child care should be reviewed to improve TTCV uptake and aid the elimination of maternal and neonatal tetanus across all geopolitical zones in Nigeria.

Introduction

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Maternal and neonatal tetanus remains a major preventable cause of neonatal mortality in many developing countries, with a case fatality rate of 80-100% (1,2). In 2015, 56,743 babies died of tetanus within the first four weeks of life, with Sub-Saharan Africa and Southeast Asia accounting for 89% of these deaths (3). Nigeria, as a country, contributes two-thirds of the global burden of neonatal tetanus (4). Deaths from tetanus are a major public health concern, yet the uptake of tetanus toxoid-containing vaccine (TTCV) in pregnancy in Nigeria has remained considerably low (5,6). According to the 2013 National Demographic Health Survey results in Nigeria, 48 per cent of women received two or more tetanus injections during their last pregnancy (7). Sule reported a TTCV uptake rate (2 doses) of about 20% in his study among females of reproductive age in Lagos, Nigeria (8), while Bello, in his national study in 2018, reported a TTCV rate (two doses) of less than 60% among first-time mothers (6).

Tetanus is a vaccine-preventable disease caused by the bacterium Clostridium tetani, whose spores are ubiquitous in the environment. In low- and middle-income countries, women and infants are particularly susceptible to tetanus infections due to various factors, including unhygienic delivery or pregnancy termination practices by unskilled attendants and poor cord practices, making this disease of public health importance (2, 9). Neonatal tetanus affects newborns within their first month of life, while maternal tetanus occurs during pregnancy or within six weeks of the end of a pregnancy, regardless of the outcome—live birth, stillbirth, miscarriage, or abortion (10-11). Since 1991, when the Maternal and Neonatal Tetanus Elimination (MNTE) goal was endorsed (12), various efforts have been put in place by the WHO to eliminate tetanus. The principal strategy of MNTE is the provision of tetanus toxoid vaccination to females of the reproductive age group (15-49 years). As a result of this, as of March 2022, tetanus has been eliminated in 47 out of 59 countries at risk for MNTE. Unfortunately, Nigeria is among the 12 countries yet to achieve this target of elimination (13).

Immunization of women of childbearing age reduces neonatal tetanus mortality by an estimated 94% (9). The World Health Organization recommends 5 consecutive doses of tetanus toxoid vaccination for women of reproductive age per schedule to offer lifelong protection; however, at least two doses are considered adequate for maternal and neonatal protection during pregnancy (14-15). Across the globe, various factors have been associated with tetanus toxoid vaccination, grouped into individual, community, and health system factors (16-17). Individual factors that reduce TTCV uptake include low socio-economic class, no source of income, low/no level of education, single marital status, and age at an extreme reproductive period (18-19). Health system factors associated with low uptake of TTCV vaccination include poor antenatal clinic attendance, distance from health facilities, cost of consumables to administer TTCV, and lack of manpower in health care facilities (19). Community-related factors include low awareness of mothers and negative beliefs about vaccination (20-21).

In his 2019 study conducted in Ethiopia, Gessesse identified urban residence, educational status, and the quality of healthcare service delivery as influential factors affecting tetanus toxoid vaccination (22). Another study conducted in the same country added factors such as antenatal care and media exposure (23). In a study conducted among first-time mothers in Nigeria, marital status, antenatal care, wealth quintiles, region of residence, and polygamous family were significant factors associated with TTCV among this population group (6). Another study conducted in Lagos, Nigeria which assessed the knowledge, awareness, and perception of TTCV coverage among women of childbearing age reported that parity and marital status were positive factors associated with tetanus toxoid vaccination, especially the number of doses taken (8).

In recent years, the government of Nigeria has rolled out several strategies to reduce the burden of maternal and neonatal tetanus, including the introduction of routine immunization with TTCV during antenatal care and an increase in the proportion of deliveries supervised by skilled attendants (24). To maximize the positive impact of TTCV in Nigeria and

estimate the effectiveness of implemented strategies over time, factors influencing adequate TTCV coverage must be scrutinized for the development of policies and interventions to promote TTCV uptake in women. Hence, this research sought to examine the determinants and factors influencing adequate TTCV uptake among mothers in Nigeria during their last pregnancy. This would be useful in offering recommendations for future policy and investment toward achieving the elimination of maternal and neonatal tetanus in the country.

Materials and Methods

Data Overview

This cross-sectional study used survey data sets from 2021 of the Nigeria Multiple Indicator Cluster Surveys (MICS). We extracted data for women aged 15–49 years from the dataset of the survey. After cleaning the missing values, the data from 4855 women were included in the final analysis.

Outcome Variables

The participants were questioned whether or not they took the Tetanus Toxoid vaccination during their last pregnancy. Additionally, according to WHO, Tetanus Toxoid is considered adequate with the administration of a minimum of two doses, less than this is considered inadequate.

Finding Covariates

The variables included age (15-24, 25-34, 35-44, 45 and above), education (Primary, Junior Secondary, Senior Secondary, Higher/tertiary), area (rural, urban), wealth status (poorest, second, middle, fourth, Richest), geopolitical zone (North Central, North East, North West, South East, South-South, South West), ANC care (yes, no, other), immunization card (no, card seen, card not seen, other), received prenatal care (yes, no)and place of delivery (private service, government service, respondents home, other). We also considered electronic media exposure variables like watching television and listening to the radio.

Statistical Analyses

IBM SPSS statistics 25.0 version was used for the analysis. First, group frequencies, percentages, minimum, maximum, and range were done to observe to observe simple descriptive tests. Then, to imprint the association of covariates with the two dependent variables, Pearson chi-square tests were carried out. After that, using logistic regression models for the binary outcome, we analyzed the multivariable association between covariates and outcomes. All tests were two-sided and had statistically eligible significant values below 0.05 with 95% confidence intervals. Graphical representation of the significant findings was done using Forest plots.

Results

After excluding missing values, our study included 4,855 women aged 15-49 years. As depicted in Fig 1, the majority (86.7%) received an adequate dose of TTCV (at least two doses). Percentage summaries of participants' characteristics are presented in Table 1, and the analysis of their association with and influence on adequate TTCV uptake is provided in Tables 2 and 3.

Socio-demographic Characteristics.

Approximately half of the participants (51.7%) fell within the age range of 25 to 34 years. Nearly half (48.7%) had completed senior secondary education, and a significant majority (62.4%) resided in rural areas. A portion of respondents (21.4%) originated from the north-central region, while others (19.7%) were classified as affluent based on the wealth index quintile. Every participant (100%) received tetanus injections during their last pregnancy, but a subset (13.3%) had fewer than two tetanus doses. A little over half (50.4%) chose to deliver in a public health facility (Table 1).

Table 1: Socio-demographic characteristics of the participants

Variables	Frequency (N)	Percentage (%)
Age (years)		
15-24	1285	26.5
25-34	2510	51.7
35-44	991	20.4
45 and above	69	1.4
Education		
Primary	1140	23.5
Junior Secondary	632	13.0
Senior Secondary	2363	48.7
Higher/tertiary	720	14.8
Geographical Area of Residence		
Urban	1824	37.6
Rural	3031	62.4
Geopolitical zone		
North Central	1040	21.4
North East	733	15.1
North West	696	14.3
South East	865	17.8
South South	809	16.7
South West	712	14.7
Wealth Index quintile		
Poorest	599	12.3
Second	939	19.3
Middle	1200	24.7
Fourth	1160	23.9
Richest	957	19.7
Has own immunization card		
Yes (card or another document seen)	1801	37.1
Yes (card or other documents not seen)	1677	34.5
No	1377	28.4
Received prenatal care		
Yes	4733	97.5
No	122	2.5
Any tetanus toxoid injection during the last pregnancy		
Yes	4855	100
Frequency of listening to the radio		
Not at all	2322	47.8
Less than once a week	732	15.1
At least once a week	935	19.3
Almost everyday	866	17.8
Frequency of watching TV		
Not at all	2066	42.6
Less than once a week	529	10.9
At least once a week	864	17.8
Almost everyday	1396	28.8
Place of delivery		
Public	2447	50.4
Private	1054	21.7
Home	1276	26.3
Others	78	1.6
Tetanus toxoid dose during last pregnancy		
Less than 2 doses	645	13.3
2 and above doses	4210	86.7
Adequate TT doses		
No	645	13.3
Yes	4210	86.7

Association between the socio-demographic variables and adequate tetanus toxoid intake

The association between all socio-demographic variables and tetanus toxoid immunization rate was analyzed using chi-square.

Analysis revealed a significant association between TT immunization rate and age (x^2=13.466, p=0.004), education (x^2=62.519, p<0.001), and geopolitical zone (x^2=143.496, p<0.001). Furthermore, it was observed that there was a significant association between TT immunization rate and wealth index quintile score (x^2=45.994, p<0.001), place of delivery (x^2=79.618, p<0.001), and tetanus vaccine dosage (x^2=4855, p<0.001). There was no significant association between TT immunization rate and geographical area (x^2=3.799, p=0.051).

Table 2: Association between the socio-demographic variables and adequate tetanus toxoid intake

Variables	Adequate tetanus toxoid intake (No)	Adequate tetanus toxoid intake (Yes)	Df	X^2	p-value
Age (years)					
15-24	205(16.0%)	1080(84.0%)	3	13.466	0.004*
25-34	304(12.1%)	2206(87.9%)			
35-44	123(13.0%)	868(87.6%)			
45 and above	13(18.8%)	56(81.2%)			
Education					
Primary	207(18.2%)	933(81.8%)	3	62.519	<0.001*
Junior Secondary	118(18.7%)	514(81.3%)			
Senior Secondary	251(10.6%)	2112(89.4%)			
Tertiary	69(9.6%)	651(90.4%)			
Geographical Area					
Urban	220(12.1%)	1604(87.9%)	1	3.799	0.051
Rural	425(14.0%)	2606(86.0%)			
Geopolitical Zone					
North Central	150(14.4%)	890(85.6%)	5	143.496	<0.001*
North East	100(13.6%)	633(86.4%)			
North West	178(25.6%)	518(74.4%)			
South East	52(6.0%)	813(94.0%)			
South South	100(12.4%)	709(87.6%)			
South West	65(9.1%)	647(90.9%)			
Wealth index quintile					
Poorest	122(20.4%)	477(79.6%)	4	45.994	<0.001*
Second	149(15.9%)	790(84.1%)			
Middle	151(12.6%)	1049(87.4%)			
Fourth	99(10.3%)	1036(89.3%)			
Richest	645(13.3%)	858(89.7%)			
Has own immunization card					
Yes (card or another document seen)	201(11.2%)	1600(88.8%)	2	12.821	0.002*
Yes (card or another document not seen)	232(13.8%)	1445(86.2%)			
No	212(15.4%)	1165(84.6%)			
Received prenatal care					
Yes	620(13.1%)	4113(86.9%)	1	5.642	0.018*
No	25(20.5%)	97(79.5%)			
Frequency of listening to the radio					
Not at all	376(16.2%)	1946(83.8%)	3	33.495	<0.001*
Less than once a week	84(11.5%)	648(88.5%)			
At least once a week	93(9.9%)	842(90.1%)			
Almost every day	92(10.6%)	774(89.4%)			
Frequency of watching TV					
Not at all	348(16.8%)	1718(83.2%)	3	40.424	<0.001*
Less than once a week	61(11.5%)	468(88.5%)			
At least once a week	85(9.8%)	779(90.2%)			
Almost everyday	151(10.8%)	1245(89.2%)			

Table 2 *(Continued)*

Variables	Adequate tetanus toxoid intake (No)	Adequate tetanus toxoid intake (Yes)	Df	X^2	p-value
Place of delivery					
Public	254(10.4%)	2193(89.6%)	3	79.618	<0.001*
Private	120(11.4%)	934(88.6%)			
Home	262(20.5%)	1014(79.5%)			
Others	9(11.5%)	69(88.5%)			
Dose of tetanus toxoid during last pregnancy					
Less than 2 doses	645(100%)	0(0.0%)	1	4855.000	<0.001*
2 and above doses	0(0.0%)	4210(100.0%)			
Media exposure					
No	259 (17.6%)	1213 (82.4%)	1	34.061	<0.001*
Yes	386 (11.4%)	2997 (88.6%0			

*Significant association

Factors affecting adequate TT immunization rate

Women aged 25-34 exhibited a 1.4-fold higher likelihood of achieving adequate TT immunization compared to their 15-24 age counterparts (p<0.001, OR=1.377, CI 1.137-1.668). Furthermore, those with tertiary education showed a 2.1 times greater likelihood of adequate TT immunization compared to those with only primary education (p<0.001, OR=2.093, CI 1.566-2.798). The wealthiest individuals demonstrated a 2.2-fold higher probability of achieving adequate TT immunization than the least affluent (p<0.001, OR=2.217, CI 1.662-2.956). Regionally, women from the south-south exhibited higher odds than their north-central counterparts (p=0.020, OR=1.571, CI 1.075-2.295). Conversely, those lacking immunization cards showed a 31% decreased likelihood (p<0.001, OR=0.690, CI 0.561-0.849). Home births or births in others' homes were associated with a 55.2% lower likelihood compared to births in public/tertiary hospitals (p<0.001, OR=0.448, CI 0.371-0.541). Women without prenatal care demonstrated a 41.5% decreased likelihood (p=0.019, OR=0.585, CI 0.374-0.915). Regular radio listeners exhibited a 1.7 times higher likelihood (p<0.001, OR=1.749, CI 1.375-2.226). Similarly, women watching TV at least once a week were 1.8 times more likely to have adequate TT immunization than those who did not watch TV at all.

Table 3: Summary of factors affecting TTCV uptake among women in their last pregnancy in Nigeria

Variables	Significant	OR	95% Confidence Interval
Age			
15-24 **(Ref)**	-	-	-
25-34	0.001*	1.377	1.137-1.668
35-44	0.017*	1.340	1.053-1.704
45 and above	0.526	0.818	0.439-1.522
Education			
Primary **(Ref)**	-	-	-
Junior Secondary	0.789	0.966	0.752-1.241
Senior Secondary	<0.001*	1.867	1.529-2.279
Tertiary	<0.001	2.093	1.566-2.798
Geopolitical zone			
North Central **(Ref)**	-	-	-
North East	0.001*	0.596	0.438-0.811
North West	0.007*	0.636	0.457-0.885
South East	<0.001*	0.292	0.215-0.397
South South	0.020*	1.571	1.075-2.295
South West	0.044*	0.712	0.512-0.991

Table 3 *(Continued)*

Variables	Significant	OR	95% Confidence Interval
Wealth index quintile			
Poorest **(Ref)**	-	-	-
Second	0.024*	1.356	1.040-1.767
Middle	<0.001*	1.777	1.367-2.309
Fourth	<0.001*	2.317	1.627-2.806
Richest	<0.001*	2.217	1.662-2.956
Has own immunization card			
Yes (card or another document seen) **(Ref)**	-	-	-
Yes (card or another document not seen)	0.017*	0.782	0.639-0.957
No	<0.001*	0.690	0.561-0.849
Received prenatal care			
Yes **(Ref)**	-	-	-
No	0.019*	0.585	0.374-0.915
Frequency of listening to the radio			
Not at all **(Ref)**	-	-	-
Less than once a week	0.002*	1.491	1.158-1.919
At least once a week	<0.001*	1.749	1.375-2.226
Almost everyday	<0.001*	1.626	1.275-2.072
Frequency of watching TV			
Not at all **(Ref)**	-	-	-
Less than once a week	0.003*	1.554	1.162-2.078
At least once a week	<0.001*	1.856	1.443-2.388
Almost everyday	<0.001*	1.670	1.361-2.049
Place of delivery			
Public **(Ref)**	-	-	-
Private	0.377	0.901	0.716-1.135
Home	<0.001*	0.448	0.371-0.541
Others	0.742	0.888	0.438-1.800
Media exposure			
No **(Ref)**	-	-	-
Yes	<0.001*	1.658	1.397-1.967

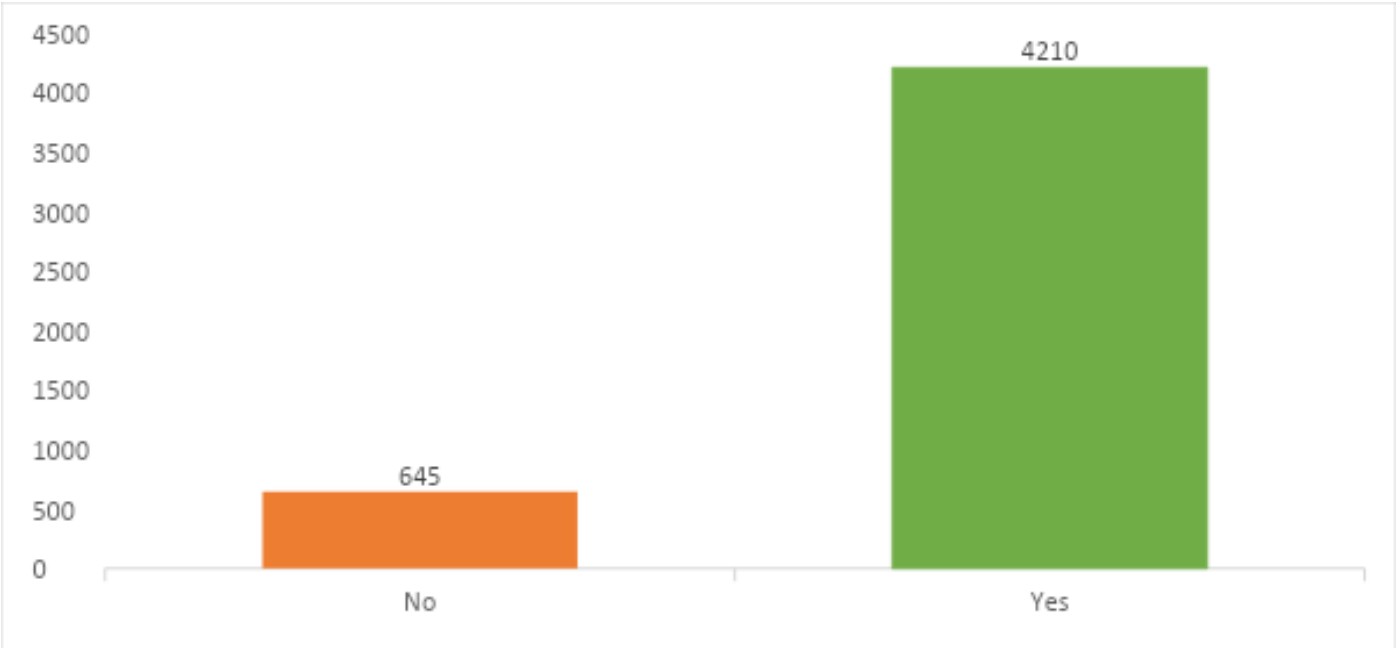

Fig 1: Adequate TT immunization

Discussion

This study provided information about the uptake of TTCV among mothers in their last pregnancy in Nigeria and factors that determine its uptake in this group of women. Our study found an 86.7% uptake in TTCV, aligning with WHO's recommended standard for countries aiming to eliminate maternal and neonatal tetanus. This standard entails achieving a minimum of 80% national coverage and 80% coverage in every district. Notably, our value surpasses figures reported in the 2018 Nigeria Demographic and Health Survey (62%), Gabriel (37.1%), and Morhason (59.6%). These figures pertain to women of reproductive age and first-time mothers, as per NDHS (2018), Gabriel-Job (2020), and Morhason (2022), (6,25-26) respectively. This study also examined factors associated with receiving at least two doses of tetanus toxoid among mothers in their last pregnancy.

Accordingly, educational status, geopolitical zone, wealth index quantile, pre-natal care, owning an immunization card, and age were significantly associated with tetanus toxoid vaccination amongst mothers in their last pregnancy in Nigeria. The likelihood of receiving tetanus toxoid was 2.2 times higher among the wealthiest individuals compared to the poorest. This pattern aligns with similar findings in studies conducted in Ethiopia, Kenya and Sierra Leone (18,27-28). We perceive that women from wealthy households have the financial means and are more exposed to seeking healthcare services compared to their counterparts (18,28).

Women with tertiary education were twice as likely to receive adequate tetanus toxoid vaccination compared to those with only a primary school certificate. This aligns with findings from studies in Ethiopia and Nigeria, where women with higher education had increased odds of receiving adequate TTCV (23,29). The association between educational status and tetanus toxoid vaccination can be explained by the likelihood that women with higher education levels are more knowledgeable, understand the risks of tetanus, and often have greater decision-making power regarding their health.

Additionally, women exposed to media were more likely to receive adequate tetanus toxoid. The odds were 1.8 times higher for those who watched TV and 1.7 times higher for those who listened to the radio, consistent with findings in Bangladesh and Ethiopia (23,28). This suggests that media exposure may play a crucial role in increasing women's knowledge about the benefits of tetanus toxoid immunization.

In our study, we observed that women who gave birth at home or in other non-healthcare settings, as well as those who did not receive prenatal care, were 55.2% and 41.5% less likely, respectively, to have adequate TT immunization compared to their counterparts. This outcome is anticipated, as Tetanus toxoid vaccines are typically administered in healthcare facilities. Therefore, the reluctance to seek care, including prenatal, antenatal, and intrapartum care, is associated with reduced uptake of TTCV (27,29). Furthermore, women from northern Nigeria had lower odds of receiving tetanus toxoid vaccination compared to their southern counterparts. This aligns with findings from previous studies, indicating that the northern region of Nigeria consistently exhibits the lowest TTCV uptake in the country (6,26).

Conclusion

In conclusion, this nationwide research aimed to identify factors affecting TTCV uptake among women in their last pregnancy. Variables associated with low uptake include regional variation, notably the lowest uptake in Northern Nigeria, and inaccessibility to healthcare, such as lack of prenatal care and home delivery. The paper recommends culturally sensitive education initiatives to promote Tetanus toxoid vaccination, particularly among the uneducated and those in Northern Nigeria. National policies on maternal and child care should be reviewed to consider these factors, contributing to the elimination of maternal and neonatal tetanus.

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None.

Authors' Contribution

IO and MA conceptualized the study and were involved in the data analysis. HA and RO were involved in the literature review and wrote the first draft of the manuscript. HA, RO, and TO were involved in writing the second and third draft of the manuscript. IO, MA, and RO were involved in the review and editing of the manuscript. IO, MA, HA, RO, TO, and EO were involved in writing the final manuscript draft. All authors contributed to the final draft of the manuscript.

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