BMJ Open

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Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-040078
Article Type:	Original research
Date Submitted by the Author:	05-May-2020
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Keywords:	OBSTETRICS, Urinary tract infections < UROLOGY, Urinary incontinences < UROLOGY

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Factors associated with the awareness of vaginal fistula among women of reproductive age: Findings from the 2018 Nigerian Demographic Health Survey

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ABSTRACT

Introduction: Involuntary leakage of urine and or stool (vaginal fistula) after childbirth remains a public health challenge in Africa and Southeast Asia. To our knowledge, there is no previous national data that examined the awareness of vaginal fistula among women in Nigeria.

Aim: To determine the prevalence of awareness of urinary/faecal incontinence, and the associated risk factors among women (18-49 years) with no previous experience of incontinence.

Methods: We used a cross-sectional study, the 2018 Nigerian Demographic Health Survey, to analyse awareness of vaginal fistula among women with no previous experience of leakage of urine or stool. The primary explanatory variable was childbirth experience, and other variables were demographics, access to information and reproductive or sexual history. The descriptive, univariate and multivariable models were presented.

Results: Of 26,585 women interviewed, 50 (0.2%) who had experienced fistula were excluded from the risk factor analysis. The mean age of women with childbirth experience was 32.8±8.6 years while that of women without childbirth experience was 20.3±6.2 years. There were significant differences in sociodemographic, access to information and reproductive or sexual history factors between those with and without childbirth experience. The prevalence of vaginal fistula awareness was 52.0%. Factors associated with the awareness include: childbirth experience; being 20-24 years and above; having atleast secondary education; wealth quintiles, ethnicity, regional location, religion, access to radio, TV and newspaper; age up to 17 years at first sex; history of previous termination of pregnancy and use of contraception.

Conclusion: A significant number of young women with no childbirth experience had low level of awareness. We recommended vaginal fistula awareness programs that will target younger women prior to childbirth as this may positively impact on the incidence of vaginal fistula and the inclusion of other useful questions to improve the quality of information that would be collected in future surveys.

Keyword(s): Vaginal fistula, awareness, urine or faecal incontinence, women, NDHS, Nigeria

Strengths and limitations of this study

- The study used a nationally representative large dataset of 26535 women of reproductive age (15-49years) to investigate factors associated with the awareness of fistula. It is possibly the largest data set analysed.
- This study provided an insight into the level of awareness of vaginal fistula, particularly, among women within the age range of highest risk.
- Given that the DHS has thankfully included relevant questions on awareness of incontinence of urine and stool in its data set, we identified that some useful information that could help to better under the context of awareness or knowledge are missing.
- This analysis relied on a secondary data with the possible attendant challenges of such data.
- The number of women who had experienced vaginal fistula were small (N=50) and do not allow for rigorous statistical approach except for descriptive summaries

INTRODUCTION

Urinary or feacal incontinence among women is a devastating medical morbidity that is mostly caused by prolonged obstructed labour[1]. The delay in relieving the obstructed labour is usually due to lack of access to essential maternity services [1]. According to Thaddeus and Maine (1991), the three delay models used to describe obstetric obstacles leading to maternal death are: (i) delay in seeking appropriate medical help for an obstetric emergency; (ii) delay in reaching an appropriate obstetric facility; and (iii) delay in receiving adequate care at the facility. Recently, the three delay models were modified and recategorized into four levels [2]. The new addition was delay in identifying the warning sign as the first level. These delays also contribute to the occurrence of severe morbidities including vaginal fistula – leading to urinary or feacal incontinence [3]. Aside neglected labour, vaginal fistula could also occur from complications of

gynaecological surgeries, caesarean sections, obstetric procedures, radiotherapy, gynaecological cancer and sexual assault[4,5].

Although the exact global estimates of urinary (vesico-vaginal fistula) and or feacal (recto-vaginal fistula) incontinence burden is unknown, estimates by the World Health Organisation (WHO) showed that more than two million women are currently living with the disorder and between 80,000 to 100,000 new cases are detected every year, largely in sub-Saharan Africa (SSA) and Southeast Asia[6-8]. Nigeria and Ethiopia have the highest burden of obstetric fistula in SSA[6]. According to the 2008 Nigerian Demographic Health Survey (NDHS), the prevalence of urinary incontinence was 0.4%, with highest prevalence in the Northern regions compared to the Southern regions[9]. Evidence abounds that the risk of vaginal fistula is common in settings with lack or inadequate qualitative emergency obstetric care, healthcare manpower challenges and poor investment in maternity services [1,10]. Beyond the medical factors, socio-cultural issues such as early marriage, harmful cultural practices like female genital mutilation and unsupervised childbirth at home; poor policy implementation of girl child education and misconceptions about childbirth practices are other drivers responsible for the huge burden of obstetric fistula in SSA and Southeast Asia [1,10].

Despite the huge burden of obstetric fistula in SSA, studies addressing the awareness of obstetric fistula among women are limited, particularly in Nigeria[11]. The prevalence of awareness was 20-61% in Ghana, Uganda, Ethiopia and Tanzania [12-15]. Generally, there are more studies that reported poor awareness level of vaginal fistula compared to those that reported high level of awareness among women. It is important to evaluate the level of awareness of women who are at risk of developing involuntary leakage of urine and or faeces, especially, in Nigeria, where the

burden is high. Adequate information on the risk factors associated with vaginal fistula would help women to take appropriate decision to prevent difficult labour, the commonest cause of vaginal fistula. Furthermore, findings from this analysis will assist policy makers and public health programmers to understand the level of awareness of vaginal fistula and the contributory factors. This study aimed to determine the prevalence of, and the factors that could contribute to the awareness of vaginal fistula among women of reproductive age in Nigeria.

METHODS

Study design and data

The study utilized data from the 2018 NDHS. Nigeria is divided into six geopolitical regions, which consists of 36 states and a federal capital territory (FCT). Each state and FCT is subdivided into local government areas (LGAs). The LGAs were further divided into localities to make up census enumeration areas (EAs). The NDHS adopted a two-stage stratified cluster sampling technique; the states and FCT were stratified into urban and rural areas. The first stage involved 1400 EAs that were selected with probability proportional to EA size across the states. While in the second stage; 30 households were selected in every EAs using equal probability sampling. Further details of sampling design, method and implementation can be found in the 2018 NDHS report [16].

Patient and public involvement statement

Participants were not directly involved in the planning of the Nigeria demographic health survey. Information was disseminated to the general public including the participants as part of the protocol for a demographic health survey.

Data management

Outcome variables

The data on vaginal fistula were extracted from the women's questionnaire. The fistula module in the NDHS sought information on the awareness of vagina fistula from all women of reproductive age 15-49, and information on the knowledge about the cause, health seeking behaviour including access and effective treatment were sought from only those with a complaint of fistula. Out of the 14 item questions in the fistula section, the first question asked if a woman had ever experienced a constant leakage of urine or stool from vagina during the day or night, which we defined as vaginal fistula (Supplementary Box 1). The fifty women that had experienced vaginal fistula were excluded from the analysis on vaginal fistula awareness. The question on ever heard of leakage of urine or stool per vaginam (vaginal fistula) was used as the primary outcome for this study, and as a measure of level of awareness among participants.

Explanatory variables

The explanatory variables in this analysis were categorized into 3 groups: demographic; access to information; and reproductive and sexual history characteristics. The demographic variables included in the model were: age groups (15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49) years; region (North Central, North East, North West, South East, South South, South West); place of residence (urban, rural); ethnicity (Fulani, Hausa, Igbo, Yoruba, other ethnic minorities); religion (Catholic, other Christians, Muslims, Traditional, others); highest educational level (no education, primary, secondary, higher) occupation (not currently working, working); and wealth quintiles (poorer, poor, middle, richer, richest).

Information related to access to media included: frequency of reading newspaper or magazine (not at all, less than once a week, at least once a week); frequency of listening to radio (not at all, less than once a week, at least once a week); frequency of watching television (not at all, less than once a week, at least once a week); own a mobile phone (no, yes); and use of internet (never, in the last 12 months, before last 12 months). Other related access to information were knowledge and use of family planning: knowledge of contraceptive method (knows no method, knows only folkloric method, knows only traditional method, knows modern methods); current use of contraceptive method (no method, folkloric method, traditional method, modern method); heard family planning on radio last few months (no, yes); heard family planning on television last few months (no, yes); heard family planning on newspaper and magazine last few months (no, yes); and heard family planning by text messages on mobile phone last few months (no, yes).

The variables that were considered under reproductive and sexual history characteristics included: childbirth experience (no, yes); currently pregnant (no or unsure, yes), and age at first sex (not had sex, <15years, 15-17years, 18-25years, >25years).

Data analysis

The main primary response in this analysis was ever had a childbirth experience. The percentage distribution and the test of association on the background characteristics between women who had no previous childbirth experience and at least a childbirth was presented, since obstetric fistula is associated with childbirth. The mean and standard deviation were presented for continuous variables or median and interquartile range (IQR) if the Shapiro-Wilk test for

normality has a p-value<0.05. The prevalence of fistula awareness and univariate analysis were presented. The outcome variable, ever heard of fistula was a binary response (no, yes).

Four different logistic regression model were fitted. In the first model we used childbirth experience and age of women *apriori.* In the second model, we adjusted for other reproductive and sexual history. In the third model we adjusted for demographic characteristics, and in the final model we adjusted for variables related to access to information. A pairwise correlation matrix and variance inflation factor (VIF > 5), were used to investigate collinearity between the outcome measure and dependent variables[17]. None of the dependent variables was excluded due to collinearity. Analyses were performed with Stata 15.0 software, at 0.05 level of significance. We also presented a descriptive summary of women who had previously experienced fistula A geospatial visual representation showing the prevalence of fistula awareness across states in Nigeria was generated using the ArcGIS software (version 10.4).

RESULTS

There were 26,585 women who responded to the questions in the fistula module. Only 50 (0.2%) women reported ever experienced fistula and most said it occurred after a difficult delivery (82.5% [33/40]) and livebirth (70.0% [35/50]). Two (4.0%) respondents reported developing fistula after sexual assault. The reported median duration from the time of injury to leakage of urine or stool was a day with a range of 1.0 to 5.0 days. The median age of respondents who had experienced vaginal fistula was 16.0 (15.0 to 20.0) years (Table 1). Only 41 (82%) out of 50 women had sought treatment for their fistula. Of the 41 treated, 27 (66%) reportedly had surgical repair.

Table 1 (Insert)

Table 1: Characteristics of women (15-49 year) that had experienced Fistula in the 2018 NDHS Data

Variable	Frequency (%)
Age at onset of vaginal fistula symptom (Median, Q1-Q3)	16(15-20)
<15	12/50(24.0%)
15-19	23/50(46.0%))
20-24	10/50(20.0%)
>24	5/50(10.0%)
Time problem occur	
After the delivery of a live baby	35/50(70.0%)
After a stillbirth	5/50(10.0%)
Neither	10/50(20.0%)
Risk factor for vaginal fistula	
After normal labour/delivery[a]	7/40(17.5%)
After very difficult labour/delivery[a]	33/40(82.5%)
Following sexual assault[b]	2/10(20%)
Others[b]	3/10(30%)
Onset of vaginal fistula[c] (Median, Q1-Q3)	1(1-5)
0	7/45(15.5%)
1-2	20/45(44.4%)
3-4	4/45(9.7%)
5-6	4/45(9.7%)
>=7	10/45(22.2%)
Previous vaginal fistula treatment	
No	9/50(18%)
Yes	41/50(82%)
Cadre of health worker that offered treatment for vaginal fistula [d]	
Doctor	34/41(82.9%)
Nurse/midwife	2/41(4.9%)
Community/Village health worker	2/41(4.9)
Other	3/41(7.3%)
Had had surgical fistula repair [d]	
No	14/41(34.2%)
Yes	27/41(65.8%)
Outcome of vaginal fistula repair [d]	
Yes, stopped completely	37/41(90.2%)
Not, stopped but reduced	3/41(7.3%)
Not stopped at all	1/41(2.4%)

[a] asked from participants who experienced fistula from delivery complication (n=40)
[b] asked from participants whose fistula experience were not pregnancy related, there were 5 missing responses (n=10)
[c] asked from participants whose fistula experience were from delivery complication or not, there were 5 missing responses (n=45)
[d] ask from participants who sought treatment for fistula (n=41)

The background characteristics of participants that answered the question on vaginal fistula awareness were presented according to their childbirth experience (Table 2). The mean age of women with at least one previous childbirth experience was higher than those with no childbirth experience (32.8±8.6 years vs 20.3±6.2 years; p<0.001). There were significant differences in the selected demographics, access to information and reproductive/sexual history variables between participants with at least one previous childbirth and those with no childbirth experience (p<0.001). For example, there were more adolescents (15-19years) who had not experienced childbirth compared to those with a previous childbirth experience (60.4% vs 4.0%; p<0.001). Although majority of participants were from the Northwest region, there were higher proportions of those from Northwest among women with a previous childbirth than those with no childbirth (27.5% vs 20.0%; p<0.001). There were more participants with at least secondary education (60.0%) among women with no childbirth experience, while those that had childbirth experience were mostly with no formal education (43.7%). There were higher proportion of women that were not currently working (53.8% vs 28.1%; p<0.001) and from richer/richest quintiles (50.8% vs 35.4%; p<0.001) among those with no childbirth compared to women that had had a previous childbirth.

Women with no childbirth had lower proportion of those that have never read newspaper (77.6% vs 88.2%; p<0.001), listened to radio (43.3% vs 47.4%; p<0.001), watched television (38.5% vs 55.9%; p<0.001), owned mobile phone (45.6% vs 47.0%; p<0.001) and used internet (72.1% vs 90.1%; p<0.001) compared to those with women who had had a childbirth. However, there were higher proportion of those that never used any contraceptive methods among participants that had no previous childbirth compared to those with a previous childbirth (93.4% vs 84.8%;

p<0.001). Women with previous childbirth had higher proportion of those that were currently pregnant (11.4% vs 6.0%; p<0.001) and ever terminated a pregnancy (14.3% vs 3.5%; p<0.001) relative to those with no previous childbirth. However, there were more women among those with no childbirth that had their first sexual exposure before 15 years of age compared to those with no childbirth (21.3% vs 4.1%; p<0.001).

Table 2 (Insert)

Table 2: The background characteristics of women of reproductive age in Nigeria

Variables	No childbirth experience N=7933	At least a childbirth experience N=18602	Total N=26535	p-value
	n(% column)	n(% column)	n(% column)	
Demographic				
Age (year)				
Mean (SD)	20.3(6.2)	32.8(8.6)	29.1(9.8)	<0.001
Age group (years)				<0.001
15-19	4789(60.4%)	742(4.0%)	5531(20.8%)	
20-24	1700(21.4%)	2705(14.5%)	4405(16.6%)	
25-29	760(9.6%)	3690(19.8%)	3690(19.8%)	
30-34	318(4.0%)	3343(18.0%)	3343(18.0%)	
35-39	177(2.2%)	3129(16.8%)	3129(16.8%)	
40-44	105(1.3%)	2550(13.7%)	2550(13.7%)	
45-49	84(1.1%)	2443(13.1%)	2443(13.1%)	
Region				<0.001
North Central	1537(19.4%)	3412(18.3%)	4949(18.7%)	
North East	1274(16.1%)	3740(20.1%)	5014(18.9%)	
North West	1588(20.0%)	5115(27.5%)	6703(27.5%)	
South East	1359(17.1%)	2073(11.1%)	2073(11.1%)	
South South	1011(12.7%)	2074(11.2%)	2074(11.2%)	
South West	1164(14.7%)	2188(11.8%)	2188(11.7%)	
Place of residence				
Urban	3885(49.0%)	6745(36.3%)	10630(40.1%)	
Rural	4048(51.0%)	11857(63.7%)	15905(59.9%)	
Ethnicity				<0.001
Fulani	372(4.7%)	1586(8.5%)	1958(7.4%)	
Hausa	1674(21.1%)	5411(29.1%)	7085(26.7%)	
Igbo	1649(20.8%)	2525(13.6%)	4174(15.7%)	
Yoruba	1140(14.4%)	2133(11.5%)	3273(12.3%)	
Others ethnic minorities	3098(39.1%)	6947(37.3%)	10045(37.8%)	

Religion				<0.001
Catholic	1042(13.1%)	1747(9.4%)	2789(10.5%)	
Other Christians	3507(44.2%)	6417(34.5%)	9924(37.4%)	
Islam	3336(42.1%)	10275(55.2%)	1361151.3%)	
Traditional	23(0.3%)	73(0.4%)	96(0.4%)	
Others	25(0.3%)	90(0.5%)	115(0.4%)	
Highest education level				<0.001
No education	1290(16.2%)	8127(43.7%)	9417(35.5%)	
Primary	698(8.8%)	3271(17.6%)	3969(15.0%)	
Secondary	4758(60.0%)	5600(30.1%)	10358(39.0%)	
Higher	1187(15.0%)	1604(8.6%)	2791(10.5%)	
Occupation				<0.001
Not currently working	4272(53.8%)	5225(28.1%)	9497(35.8%)	
Working	3661(46.2%)	13377(71.9%)	17038(64.2%)	
Wealth quintiles				<0.001
Poorest	968(12.2%)	4150(22.3%)	5118(19.3%)	
Poorer	1297(16.4%)	4104(22.1%)	5401(20.4%)	
Middle	1640(20.7%)	3838(20.6%)	5478(20.6%)	
Richer	1957(24.7%)	3542(19.4%)	5499(20.7%)	
Richest	2071(26.1%)	2968(16.0%)	5039(19.0%)	
Access to information				
Frequency of reading newspaper or magazine				<0.001
Not at all	6158(77.6%)	16409(88.2%)	22567(85.1%)	
Less than once a week	1197(15.1%)	1528(8.2%)	2725(10.3%)	
At least once a week	578(7.3%)	665(3.6%)	1243(4.7%)	
Frequency of listening to radio				<0.001
Not at all	3438(43.3%)	8822(47.4%)	12260(46.2%)	
Less than once a week	2188(27.6%)	4629(24.9%)	6817(25.7%)	
At least once a week	2307(29.1%)	5151(27.7%)	7458(28.1%)	
Frequency of watching TV				<0.001
Not at all	3059(38.5%)	10391(55.9%)	13450(50.7%)	
Less than once a week	1776(22.4%)	3405(18.3%)	5181(19.5%)	
At least once a week	3098(39.1%)	4806(25.8%)	7904(29.8%)	
Owns a mobile phone				0.032
No	3617(45.6%)	8749(47.0%)	12366(46.6%)	
Yes	4316(54.4%)	9853(53.0%)	14169(53.4%)	
Use of Internet				<0.001
Never	5724(72.1%)	16763(90.1%)	22487(84.74%)	
In the last 12 months	2045(25.8%)	1614(8.7%)	3659(13.8%)	
Before last 12 months	164(2.1%)	225(1.2%)	225(1.2%)	
Current use of contraceptive method				<0.001
No method	7412(93.4%)	15778(84.8%)	23190(87.4%)	
Folkloric method	7(0.1%)	90(0.5%)	97(0.4%)	
Traditional method	104(1.3%)	597(3.2%)	701(2.6%)	
Modern method	410(5.2%)	2137(11.5%)	2547(9.6%)	
Reproductive/Sexual history				
Currently pregnant				<0.001

No or unsure	7454(94.0%)	16477(88.6%)	23931(90.2%)	
Yes	479(6.0%)	2125(11.4%)	2604(9.8%)	
Ever had a terminated pregnancy				<0.001
No	7652(96.5%)	15939(85.7%)	23591(88.9%)	
Yes	281(3.5%)	2663(14.3%)	2944(11.1%)	
Age at first sex				<0.001
Not had sex	4481(56.5%)	0 (0.0%)	4481(16.9%)	
<15years	323(4.1%)	3961(21.3%)	4284(16.2%)	
15-17years	1399(17.6%)	8375(45.1%)	9774(36.9%)	
18-25years	1630(20.5%)	5963(32.1%)	7593(28.6%)	
>25years	100(1.3%)	280(1.5%)	380(1.4%)	

Statistically significant variables at p<0.05 are shown in bold

The overall prevalence of awareness of vaginal fistula among the participants was 52.0% (13,066/26,535) (Table 3). There was a linear trend between the prevalence of awareness of fistula and age group of participants. The prevalence of awareness of fistula was highest among women aged 45-49 years (55.8%) compared to other age groups. Generally, the prevalence of awareness of fistula was higher in the northern regions than the southern regions (Figure 1). Women living in the Northwest had the highest proportion of those that had ever heard of fistula (80.2%). Participants from rural communities (59.0%) had higher proportion of awareness of fistula than those from urban communities (43.4%). There were more women that had heard of fistula among Muslims (64.5%) than other religious groups. The prevalence of awareness of fistula was highest among women with no formal education (67.7%) followed by those with tertiary education (54.0%). The awareness of fistula was highest among women in the poorest wealth quintiles and lowest among those in the richer wealth quintiles (41.9%). Women who read newspaper at least once a week (53.5%), never listened to radio (55.2%), never watched television (61.4%), never owned a mobile phone (57.5%) and never used internet (53.5%) had the highest proportions of those that had ever heard of fistula. The awareness of fistula was

highest among women with history of termination of pregnancy (61.8%), currently pregnant (60.5%), had a previous childbirth (56.6%), and never used a contraceptive method (53.7%).

In the unadjusted analyses (table 3), the odds of ever heard of fistula by participants was associated with demographic factors. Specifically, the odds of awareness of fistula was higher among women aged 20-24 years and above compared to those whose age was 15-19 years. Women living in the Northeast and Northwest had higher odds of ever reporting to have had heard of fistula than those from Northcentral region. However, women in all the three Southern regions of Nigeria had lower odds of awareness of fistula relative to those in the Northern region. The odds of being aware of fistula was 1.87 times (95% CI, 1.68-2.09) among women living in the rural communities compared to those in the urban communities. There was a higher odd of awareness of fistula among participants from Islamic religion (OR=2.85; 95% CI, 2.42-3.37) compared to those from Catholic faith group. However, participants who professed traditional and other religions had lower odds of being aware of fistula relative to those from Catholic faith group. The odds of awareness of fistula was lower among the participants that had primary, secondary and tertiary education compared to those with no formal education. There was an inverse relationship between the odds of reporting awareness of fistula and wealth quintiles of participants. For example, women from richer (OR=0.37; 95%CI, 0.27-0.41) and richest (OR=0.37; 95%CI, 0.31-0.44) wealth quintiles had the lowest odds of being aware of fistula compared to those with no education.

The odds of ever heard of fistula by the participants was associated with access to information factors: Generally, there was an inverse relationship between the odds of ever being aware of fistula and the frequency of reading newspaper/magazine, listening to radio, watching television,

frequency of using internet and ownership of mobile phone. For example, women who reported reading newspaper at least once a week (OR=64; 95%CI, 0.57-0.83) were associated with lower odds of being aware of fistula compared to those that had never read newspaper. Concerning the reproductive/sexual history factors, women that had a child were associated with 1.87 (95%CI, 1.73-2.02) odds of been aware of fistula relative to those with no previous childbirth. Higher odds of ever heard of fistula was associated being currently pregnant (OR=1.47; 95%CI, 1.33-1.63) and history of ever terminated pregnancy (OR=1.57, 95%CI, 1.42-1.75) relative to those who were not currently pregnant and never terminated pregnancy, respectively. Women that reported having used any form of contraception were associated with the lower odds of ever been aware of fistula compared to those with those with no history of contraceptive use.

Table 3 (Insert)

Table 3: Prevalence and bivariate analysis between explanatory variables and ever heard of fistula among women of reproductive age

Variable	Ever heard of fistula		
	Prevalence (%)	Crude OR (95%CI)	p value
Demographic			
Age group (years)			
15-19	41.5	Reference	
20-24	53.8	1.64(1.49-1.81)	<0.001
25-29	55.5	1.76(1.60-1.93)	<0.001
30-34	54.5	1.69(1.52-1.88)	<0.001
35-39	55.1	1.73(1.54-1.94)	<0.001
40-44	54.1	1.66(1.48-1.86)	<0.001
45-49	55.8	1.78(1.59-1.99)	<0.001
Region			
North Central	46.6	Reference	
North East	61.3	1.81(1.56-2.12)	<0.001
North West	80.6	4.76(4.06-5.59)	<0.001
South East	27.8	0.44(0.37-0.53)	<0.001
South South	35.9	0.64(0.55-0.76)	<0.001
South West	22.2	0.33(0.28-0.39)	<0.001
Place of residence			
Urban	43.4	Reference	

Rural	59.0	1.87(1.68-2.09)	<0.001
Ethnicity			
Fulani	63.7	Reference	
Hausa	79.2	2.17(1.71-2.77)	<0.001
Igbo	30.1	0.25(0.19-0.31)	<0.001
Yoruba	22.5	0.16(0.13-0.21)	<0.001
Others ethnic minorities	47.4	0.51(0.41-0.64)	<0.001
Religion			
Catholic	38.8	Reference	
Other Christians	36.7	0.91(0.77-1.07)	0.264
Islam	64.5	2.85(2.42-3.37)	<0.001
Traditional	29.5	0.66(0.47-0.92)	0.015
Others	3.7	0.06(0.02-0.20)	<0.001
Highest education level			
No education	67.7	Reference	
Primary	47.0	0.42(0.54-5.09)	<0.001
Secondary	38.6	0.30(0.27-0.33)	<0.001
Higher	54.0	0.56(0.48-0.64)	<0.001
Currently working			
No	52.5	Reference	
Yes	51.6	0.97(0.89-1.04)	0.376
Wealth quintiles			
Poorest	68.4	Reference	
Poorer	60.1	0.70(0.60-0.81)	<0.001
Middle	48.5	0.44(0.37-0.51)	<0.001
Richer	41.9	0.33(0.27-0.41)	<0.001
Richest	44.1	0.37(0.31-0.44)	<0.001
Access to Information			
Frequency of reading newspaper or magazine			
Not at all	53.2	Reference	
Less than once a week	42.1	0.64(0.57-0.72)	<0.001
Atleast once a week	53.5	1.01(0.87-1.19)	0.875
Frequency of listening to radio			
Not at all	55.2	Reference	
Less than once a week	48.2	0.75(0.68-0.83)	<0.001
Atleast once a week	50.3	0.82(0.75-0.91)	<0.001
Frequency of watching TV			
Not at all	61.4	Reference	
Less than once a week	42.3	0.46(0.41-0.51)	<0.001
Atleast once a week	43.4	0.48(0.42-0.55)	<0.001
Own a mobile phone			
No	57.5	Reference	
Yes	47.4	0.67(0.61-0.72)	<0.001

Use of Internet			
Never	53.5	Reference	
In the last 12 months	45.6	0.73(0.65-0.82)	<0.001
Before last 12 months	37.0	0.51(0.40-0.64)	<0.001
Reproductive/Sexual history			
Ever had a child			
No	41.1	Reference	
Yes	56.6	1.87(1.73-2.02)	<0.001
Age at first sex			
Not had sex	39.4	Reference	
<15years	64.1	2.75(2.41-3.15)	<0.001
15-17years	58.1	2.13(1.90-2.40)	<0.001
18-25years	45.3	1.28(1.15-1.42)	<0.001
≥25years	44.1	1.21(0.94-1.56)	0.131
Currently pregnant			
No or unsure	51.0	Reference	
Yes	60.5	1.47(1.33-1.63)	<0.001
Ever had a terminated pregnancy			
No	50.7	Reference	
Yes	61.8	1.57(1.42-1.75)	<0.001
Current use of contraceptive method			
No method	53.7	Reference	
Folkloric method	30.1	0.38(0.16-0.89)	0.026
Traditional method	31.3	0.39(0.32-0.48)	<0.001
Modern method	43.7	0.67(0.59-0.75)	<0.001

Statistically significant variables at p<0.05 are shown in bold

Figure 1 (Insert)

The results of adjusted analyses were presented in the multivariable logistic regression in table 4. The first model included childbirth experience and age of respondents: women who had had a previous childbirth experience had a higher odds (Adjusted odds ratio (AOR)=1.81; 95%CI, 1.63 to 2.01) of awareness of fistula. Only women whose ages were between 20-24 years and 25-29 years had higher odds of reporting having heard of fistula compared to women that were less than 15 to 19 years. The second model adjusted for the reproductive and sexual history, all variables including the model 1 variables (which were kept apriori), were statistically significant

except the women whose age at first sex were greater than 25years. The odds of awareness of fistula was higher among women who had their first sexual exposure at less than 15 years (AOR 1.59; 95%CI, 1.32 - 1.90) and between 15 to 17years (AOR=1.30; 95%CI, 1.11 - 1.52) compared to those who had no previous sexual exposure. However, a lower odds was observed among women aged 18-25 years (AOR=0.81; 95%CI, 0.70 - 0.95) compared to women who have never had sex.

The third model included the demographic characteristics: women that were living in the southern part of Nigeria were associated with the lower odds of fistula awareness while women in the Northwest (AOR=3.56; 95%CI, 2.84 - 4.47) and Northeast (AOR=1.82; 95%CI 1.53 - 2.17) regions had higher odds compared with women in the Northcentral region. Similarly, women from the Yoruba (AOR=0.47; 95%CI, 0.35 - 0.64) and Igbo (AOR=0.67; 95%CI, 0.46 -0.98) ethnic groups have a lower odds of fistula awareness. Women with secondary (AOR=1.24; 95%CI, 1.09 - 1.41) and tertiary education (AOR=2.38; 95%CI, 2.00 - 2.83) had a higher odds of fistula awareness. However, women from the poorer and middle wealth quintiles had the lower odds of been aware of fistula compared with women in the poorest wealth quintiles. The variables related with access to information that were significantly associated with the higher odds of fistula awareness included: the ownership of a mobile phone (AOR=1.16; 95%CI, 1.05 - 1.27), report of using the internet in the last 12 months (AOR=1.57; 95%CI, 1.33 - 1.86) and the history of reading newspaper or magazine at least once a week (AOR=1.29; 95%CI, 1.07-1.57) and listening to radio less than once a week (AOR=1.23; 95%CI, 1.09-1.38) relative to women without the history of these factors.

Table 4 (Insert)

Table 4: Multivariable logistic regression models of factors associated with the awareness of fistula among women of reproductive age

Characteristics	Model 1 OR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)	Model 4 AOR (95% CI)
Had a childbirth				
Yes(vs No)	**1.81(1.63-2.01)**	**1.45(1.30-1.62)**	1.05(0.92-1.20)	**1.14(1.01-1.30)**
Age(years)				
15-19	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
20-24	**1.25(1.12-1.39)**	**1.38(1.22-1.56)**	**1.47(1.28-1.69)**	**1.36(1.18-1.56)**
25-29	**1.17(1.05-1.31)**	**1.41(1.24-1.59)**	**1.64(1.43-1.89)**	**1.53(1.33-1.76)**
30-34	1.08(0.95-1.22)	**1.32(1.14-1.53)**	**1.62(1.37-1.91)**	**1.54(1.30-1.81)**
35-39	1.08(0.94-1.24)	**1.37(1.18-1.59)**	**1.91(1.61-2.26)**	**1.81(1.53-2.14)**
40-44	1.02(0.89-1.17)	**1.27(1.09-1.49)**	**1.80(1.50-2.16)**	**1.71(1.43-2.06)**
45-49	1.09(0.95-1.25)	**1.31(1.13-1.51)**	**2.11(1.78-2.50)**	**2.04(1.72-2.41)**
Age at first sex				
Not had sex		1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
<15years		**1.58(1.32-1.90)**	**1.32(1.09-1.59)**	**1.27(1.05-1.53)**
15-17years		**1.30(1.11-1.52)**	**1.30(1.10-1.53)**	**1.25(1.06-1.47)**
18-25years		**0.81(0.70-0.95)**	**1.19(1.00-1.42)**	1.14(0.96-1.35)
≥25years		0.78(0.59-1.03)	1.02(0.74-1.41)	0.95(0.69-1.32)
Currently pregnant				
Yes (vs No)		**1.18(1.07-1.30)**	1.02(0.92-1.14)	1.04(0.93-1.16)
Had terminated pregnancy				
Yes (vs No)		**1.37(1.22-1.52)**	**1.17(1.05-1.31)**	**1.17(1.04-1.31)**
Use of contraceptive				
No method		1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
Only folkoric method		**0.30(0.13-0.72)**	0.58(0.30-1.11)	0.58(0.31-2.20)
Only traditional method		**0.40(0.32-0.50)**	**0.73(0.58-0.91)**	**0.70(0.56-0.88)**
Modern method		**0.64(0.57-0.73)**	**0.83(0.73-0.94)**	**0.81(0.71-0.92)**
Region				
North Central			1.0 (Reference)	1.0 (Reference)
North East			**1.82(1.53-2.17)**	**1.84(1.55-2.20)**
North West			**3.56(2.84-4.47)**	**3.57(2.85-4.48)**
South East			**0.45(0.33-0.61)**	**0.42(0.31-0.58)**
South South			**0.56(0.47-0.67)**	**0.53(0.44-0.63)**
South West			**0.40(0.32-0.49)**	**0.37(0.30-0.45)**
Place of residence				
Rural (vs Urban)			1.08(0.94-1.23)	1.11(0.97-1.27)
Educational status				
No education			1.0 (Reference)	1.0 (Reference)
Primary			1.03(0.90-1.18)	1.02(0.89-1.18)
Secondary			**1.24(1.09-1.41)**	**1.14(1.00-1.30)**
Higher			**2.38(2.00-2.83)**	**1.74(1.45-2.08)**
Ethnicity				
Fulani			1.0 (Reference)	1.0 (Reference)
Hausa			**1.66(1.33-2.09)**	**1.67(1.33-2.09)**

Igbo	**0.67(0.46-0.98)**	**0.67(0.46-0.97)**
Yoruba	**0.47(0.35-0.64)**	**0.47(0.34-0.64)**
Others	0.83(0.64-1.06)	0.84(0.65-1.08)
Religion		
Catholic	1.0 (Reference)	1.0 (Reference)
Other Christian	**0.82(0.70-0.95)**	**0.83(0.71-0.97)**
Islam	**0.77(0.63-0.95)**	**0.78(0.63-0.96)**
Traditionalist	**0.22(0.12-0.43)**	**0.24(0.12-0.46)**
Others	**0.05(0.02-0.18)**	**0.05(0.01-0.16)**
Currently working		
Yes (vs No)	**1.39(1.26-1.54)**	**1.35(1.22-1.49)**
Wealth quintiles		
Poorest	1.0 (Reference)	1.0 (Reference)
Poorer	**0.82(0.71-0.95)**	**0.81(0.70-0.93)**
Middle	**0.79(0.67-0.95)**	**0.76(0.63-0.91)**
Richer	0.89(0.74-1.06)	**0.80(0.66-0.96)**
Richest	1.22(0.99-1.49)	0.99(0.80-1.22)
Read newspaper or magazine		
Not at all		1.0 (Reference)
Less than once a week		0.93(0.82-1.06)
Atleast once a week		**1.29(1.07-1.57)**
Listen to radio		
Not at all		1.0 (Reference)
Less than once a week		**1.23(1.09-1.38)**
Atleast once a week		**1.23(1.10-1.38)**
Watch TV		
Not at all		1.0 (Reference)
Less than once a week		0.92(0.81-1.04)
Atleast once a week		1.05(0.91-1.22)
Own a mobile phone		
Yes (vs No)		**1.16(1.05-1.27)**
Use of Internet		
Never		1.0 (Reference)
Last 12 months		**1.57(1.33-1.86)**
before last 12 months		1.01(0.78-1.30)

Statistically significant variables at p<0.05 are shown in bold

DISCUSSION

This study is probably the first largest nationally representative sample of women in SSA that investigated the level of awareness of vaginal fistula among women of reproductive age. The finding showed that only about half (52%) of Nigerian women interviewed had ever heard of

vaginal fistula. There was a high fistula awareness among young adults and those with previous childbirth experience. In addition, participants living in the North and rural communities had higher prevalence of awareness of fistula than women in the Southern region and urban settings in Nigeria. The awareness of vaginal fistula was associated with childbirth experience, 20-24 years and above, reported age at first sexual intercourse of up to 17 years, history of ever terminated a pregnancy, use of modern or traditional contraception, place of residence, having at least secondary education, ethnicity, wealth quintile and access to the source of information dissemination (radio, television and newspaper or magazine). The association between childbirth and vaginal fistula awareness strengthens the role of antenatal care education, counseling and health promotion in the prevention and prompt of obstructed labour and vaginal treatment. Other sources of information dissemination will be useful in educating other groups of women especially the adolescents on positive reproductive health information and behaviours.

Although the awareness level about vaginal fistula in this study has increased compared to the 2008 NDHS report of 30.7%, it is still a source of concern, particularly, among young population relative to older adults in Nigeria[9]. The observed modest increase in the prevalence of vaginal fistula awareness in the 2018 NDHS might be due to the increased priority and investment in obstetric fistula prevention and treatment by the Government of Nigeria and development partners in the last decade [18]. Vaginal fistula is more common among young people, who are usually at risk of obstructed labour due to inadequate pelvis. Pregnant adolescents often have difficulties in accessing timely obstetric emergency services should they develop obstructed labour. The reported prevalence of awareness of fistula from previous studies were mixed,

majority were in the range of 20-46% while a few others reported a higher figure than 52% found in this study. For example, two studies in Northern Ghana among 390 prenatal women (18-49 years) and 1982 (17-60 years) women in the community found that the awareness of fistula was 28.8% and 45.8%, respectively [12,19]. However, a study (2010) in Mtwara region of Tanzania showed that 61.1% out of 334 women aged 18-49 years were aware of vaginal fistula [15]. Higher prevalence (81%) of fistula awareness was recorded in an Eritrean study after the implementation of health education and community mobilization programme among women; this study however, included those living with fistula[20].

Some of the risk factors associated with awareness of vaginal fistula in this study had been previously reported elsewhere[13,21]. Expectedly, high awareness level of vaginal fistula which was found to be significantly associated with education status, age older than 20 years, wealth quintiles and access to information dissemination platforms in this study, had also been previously reported[11-14,19]. The high awareness level among women in the Northern region relative to the southern part of Nigeria and Hausa/Fulani than other ethnic groups could be due to the high burden of vaginal fistula and information diffusion from the high concentration of interventions on obstetric fistula in North and among Hausa/Fulanis. Surprisingly, women living in the rural communities were more likely to be aware of vaginal fistula compared to those in urban setting. This observation is against the general belief that were often associated with better healthcare awareness among people in the urban setting. It is plausible that women living in rural setting might have experienced more cases of childbirth related complications including obstetric fistula than those in urban setting.

The level of awareness of vaginal fistula might not necessarily translates to adequate knowledge that can help women to make appropriate decision on the prevention and access to care. There are some studies that had reported significant proportion of misconceptions on the causes or risk factors for vaginal fistula even among those that claimed to be aware of fistula[13,21,22]. In a qualitative study in Malawi, Changole et al interviewed women who were said to be aware of vaginal fistula on probable causes[21]. The authors reported that majority of these women associated vaginal fistula with sexually transmitted infection, witchcraft, husband's infidelity and laziness to push during labour [21]. There were two other qualitative studies from Ethiopia that also showed that women including those suffering from incontinence had misconception on the probable risk factors for vaginal fistula[22,23].

Another limitation of the data on awareness is the inability to disaggregate the information on the subtle differences between urinary and feacal incontinence because the question was not asked separately. Other limitations include the use of secondary data and lack of information that may help to describe causes or risk factors of vaginal fistula.

It would be beneficial if other useful information to assess the knowledge of women on urinary and feacal incontinence is collected during the 2018 NDHS survey. It is difficult to appreciate the impact of awareness level of vaginal fistula from the 2018 Nigerian NDHS data because of lack of other necessary information. For example, there are no questions on the sources of information and causes or risk factors as well the preventive methods of vaginal fistula. It is imperative that future national survey consider some of the following questions with response options for participant to select: *Where did you first learn or hear about involuntary leakage of urine or stool*

after childbirth in a woman?; What did you think is/are responsible for the involuntary leakage of urine or stool after childbirth in a woman?; and *what are the ways of preventing the occurrence of involuntary leakage of urine or stool after childbirth in a woman?*. We believe that these suggested questions will add to the quality of information that will be collected to profile the public knowledge on vaginal fistula. This information will better guide the policy makers, programme planners and experts, to design a well-informed strategy for the control of vaginal fistula in the country.

In conclusion, the study showed that a large number of women, particularly, young women with no childbirth experience and from the Southern region of Nigeria had low level of awareness of vaginal fistula. It is recommended that more public health awareness on vaginal fistula should be incorporated in reproductive health messages, especially among women of reproductive age. We also advocate that other critical questions should be included in the future national survey to help policy makers and programme planner better execute public health intervention for the control of vaginal fistula that is still ravaging Nigeria.

Figure 1: Prevalence of Vaginal fistula awareness by states among women of reproductive age

Acknowledgement

We are grateful to DHS Program for providing access to the data.

Contributions

(I) Conception and design: Morhason-Bello IO and Yusuf Kareem (II) Data analysis: Yusuf Kareem and Imran Morhason-Bello (III) Spatial Data Analysis: Linda Abegunde; (IV) Data interpretation:

Imran Morhason-Bello, Yusuf Kareem, Rukiyat Abdus-Salam, Oluwasomidoyin Bello, Olatunji Lawal, Fatimah Akinlusi, Linda Abegunde and Oladosu Ojengbede; (V) Manuscript writing: All authors; (VI) Final approval of manuscript: All authors.

Funding

This research received no grant from any funding agency in the public, commercial or not-for-profit sectors

Competing interests

The authors declared no competing interest

Ethics approval

Ethical approval is not needed, the study used secondary data from the Nigeria Demography Health Surveys (DHS). The DHS program maintain strict standards for protecting the privacy of respondents and the survey survey protocols are reviewed by the ICF and Institutional Review Board (IRB) in each country to ensure that the survey complies with the regulations for the protection of human subjects.

Data sharing statement

No additional data are available.

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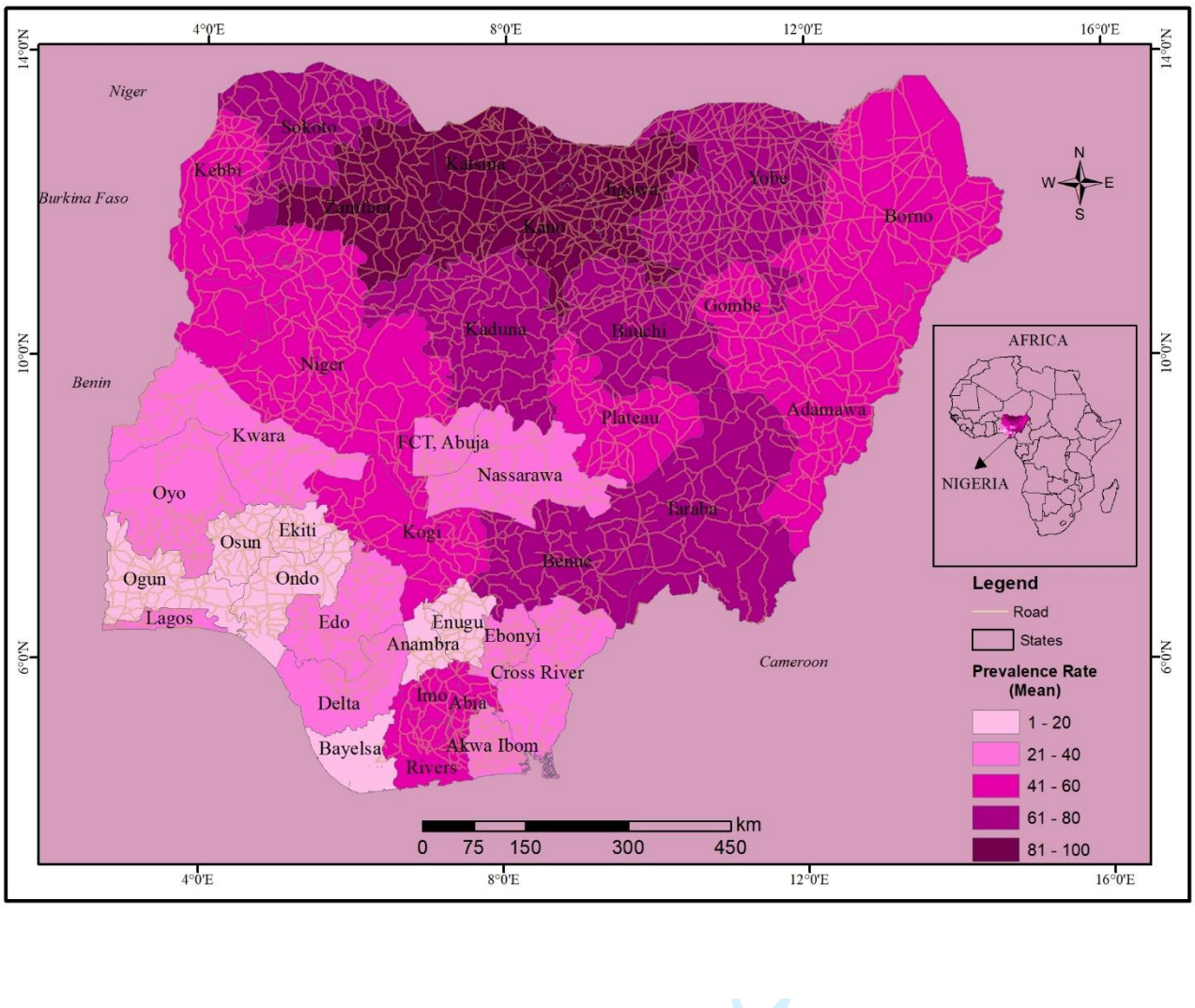
Figure 1: Prevalence of Vaginal fistula awareness by states among women of reproductive age



Box 1: Fistula Module questions asked in the 2018 NDHS data

S/N	Questions	Denominator
1.	Sometimes a woman can have a problem of constant leakage of urine or stool from her vagina during the day and night. This problem usually occurs after a difficult childbirth but may also occur after a sexual assault or after pelvic surgery. Have you ever experienced a constant leakage of urine or stool from your vagina during the day and night?	No=26535 Yes=50 N=26585
2.	**Have you ever heard of this problem?**	Yes=13469 No=13066 N=26535
3.	Did this problem start after you delivered a baby or had a stillbirth	50
4.	Did this problem start after a normal labor and delivery, or after a very difficult labor and delivery?	40
5.	What do you think caused this problem?	10
6.	How many days after (cause of problem from 3 or 5) did this leakage start?	45
7.	How old were you when you experienced this problem?	50
8.	Have you sought treatment for this condition?	50
9.	Why have you not sought treatment?	Nil
10.	From whom did you last seek treatment?	41
11.	Did you have an operation to fix the problem?	41
12.	Did the treatment stop the leakage completely? IF NO: did the treatment reduce the leakage?	41
13.	Are there any (other) women in your household who suffer from obstetric fistula?	Nil
14.	How many (other) women in your household suffer from obstetric fistula?	No observation

Questions 1, 3-14 *were answered by participants that had experienced vaginal fistula;* ***Question 2*** *was answered by all women*

Adapted checklist of items that should be included in reports of observational studies (STROBE)

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-7
Bias	9	Describe any efforts to address potential sources of bias	6-7
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-11
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	11
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	19-20
		(*b*) Report category boundaries when continuous variables were categorized	19-20
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	23
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	21-22
Generalisability	21	Discuss the generalisability (external validity) of the study results	24
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

BMJ Open

Factors associated with the awareness of vaginal fistula among women of reproductive age: Findings from the 2018 Nigerian Demographic Health Cross-sectional Survey

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-040078.R1
Article Type:	Original research
Date Submitted by the Author:	03-Aug-2020
Complete List of Authors:	Morhason-Bello, Imran; University of Ibadan College of Medicine, Department of Obstetrics and Gynaecology, Faculty of Clinical Sciences Kareem, Yusuf; University of Ibadan College of Medicine, Institute of Advanced Medical Research and Training Abdus-Salam, Rukiyat; University of Ibadan College of Medicine, Department of Obstetrics and Gynaecology, Faculty of Clinical Sciences Bello, Oluwasomidoyin; University of Ibadan College of Medicine, Department of Obstetrics and Gynaecology, Faculty of Clinical Sciences Lawal, Olatunji; University of Ibadan College of Medicine, Department of Obstetrics and Gynaecology, Faculty of Clinical Sciences Akinlusi, Fatimat; Lagos State University College of Medicine, Department of Obstetrics and Gynaecology Abegunde, Linda; Obafemi Awolowo University, Cooperative Information Network (COPINE), National Space Research and Development Agency Ojengbede, Oladosu; University of Ibadan College of Medicine, Centre for Population and Reproductive Health
Primary Subject Heading:	Obstetrics and gynaecology
Secondary Subject Heading:	Epidemiology, Global health, Public health
Keywords:	OBSTETRICS, Urinary tract infections < UROLOGY, Urinary incontinences < UROLOGY

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Factors associated with the awareness of vaginal fistula among women of reproductive age: Findings from the 2018 Nigerian Demographic Health Cross-sectional Survey

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ABSTRACT

Introduction: Involuntary leakage of urine and or stool per vaginam (vaginal fistula) after childbirth remains a public health challenge in Africa and Southeast Asia. To our knowledge, there is no previous national data that examined the awareness of vaginal fistula among women in Nigeria.

Aim: To determine the prevalence of awareness of urinary/faecal incontinence due to vaginal fistula, and the associated risk factors among women with no previous experience of incontinence.

Methods: We used a cross-sectional study, the 2018 NDHS, to analyse awareness of vaginal fistula among women with no previous leakage of urine or stool. The primary outcome was childbirth experience, and other variables were demographics, access to information and reproductive or sexual history. The descriptive, univariate and multivariable models were presented.

Results: Of 26,585 women interviewed, 50 (0.2%) who had experienced fistula were excluded from the risk factor analysis. The mean age of women with childbirth experience was 32.8±8.6 years while that of women without childbirth experience was 20.3±6.2 years. The prevalence of vaginal fistula awareness was 52.0%. Factors associated with the awareness include: childbirth experience (Adjusted odds ratio (AOR)=1.14; 95% CI, 1.01 – 1.30); age of 20-24 years (AOR=1.36; 95%CI, 1.18 – 1.56) and older; currently working (AOR=1.35; 95%CI, 1.22 – 1.49); ownership of a mobile phone (AOR=1.16; 95%CI, 1.05-1.27). Other associated factors include: having atleast secondary education; wealth quintiles, ethnicity, regional location, religion, access to radio, newspaper and internet; age up to 17 years at first sex; history of previous termination of pregnancy and use of contraception.

Conclusion: A significant number of young women with no childbirth experience had low level of awareness. We recommend vaginal fistula awareness programs that will target women at risk of vaginal fistula and the inclusion of other useful questions to improve the quality of information in future surveys.

Keyword(s): Vaginal fistula, awareness, urine or faecal incontinence, women, NDHS, Nigeria

Strengths and limitations of this study

- The study used a nationally representative large dataset of 26535 women of reproductive age (15-49years) to investigate factors associated with the awareness of fistula. It is possibly the largest data set analysed.
- This study provided an insight into the level of awareness of vaginal fistula, particularly, among women within the age range of highest risk.
- Given that the DHS has thankfully included relevant questions on awareness of incontinence of urine and stool in its data set, we identified that some useful information that could help to better under the context of awareness or knowledge are missing.
- This analysis relied on a secondary data with the possible attendant challenges of such data.
- The number of women who had experienced vaginal fistula were small (N=50) and do not allow for rigorous statistical approach except for descriptive summaries

INTRODUCTION

Urinary or feacal incontinence among women is a devastating medical morbidity that is mostly caused by prolonged obstructed labour[1]. The delay in relieving the obstructed labour is usually due to lack of access to essential maternity services [1]. According to Thaddeus and Maine (1991), the three delay models used to describe obstetric obstacles leading to maternal death are: (i) delay in decision to seek appropriate medical help for an obstetric emergency; (ii) delay in reaching an appropriate obstetric facility; and (iii) delay in receiving adequate care at the facility. Indeed, Thaddeus and Maine identified recognition of danger signs as the initial step to accessing health care by women with obstetric complication, it was not established as a definite phase in the model until recently when the delay models were modified and recategorized into four levels

[2]. The new addition was delay in identifying the warning sign as the first level. These delays also contribute to the occurrence of severe morbidities including vaginal fistula – leading to urinary or feacal incontinence [3]. Aside neglected labour, vaginal fistula could also occur from complications of gynaecological surgeries, caesarean sections, obstetric procedures, radiotherapy, gynaecological cancer and sexual assault[4,5].

Although the exact global estimates of urinary (vesico-vaginal fistula) and or feacal (recto-vaginal fistula) incontinence burden is unknown, estimates by the World Health Organisation (WHO) showed that more than two million women are currently living with the disorder and between 80,000 to 100,000 new cases are detected every year, largely in sub-Saharan Africa (SSA) and Southeast Asia[6-8]. Nigeria and Ethiopia have the highest burden of obstetric fistula in SSA[6]. According to the 2008 Nigerian Demographic Health Survey (NDHS), the prevalence of urinary incontinence was 0.4%, with highest prevalence in the Northern regions compared to the Southern regions[9]. Evidence abound that the risk of vaginal fistula is common in settings with lack or inadequate qualitative emergency obstetric care, healthcare manpower challenges and poor investment in maternity services [1,10]. Beyond the medical factors, socio-cultural issues such as early marriage, harmful cultural practices like female genital mutilation and unsupervised childbirth at home; poor policy implementation of girl child education and misconceptions about childbirth practices are other drivers responsible for the huge burden of obstetric fistula in SSA and Southeast Asia [1,10].

Despite the huge burden of obstetric fistula in SSA, studies addressing the awareness of obstetric fistula among women are limited, particularly in Nigeria[11]. The prevalence of awareness was 20-61% in Ghana, Uganda, Ethiopia and Tanzania [12-15]. Generally, there are more studies that

reported poor awareness level of vaginal fistula compared to those that reported high level of awareness among women. It is important to evaluate the level of awareness of women who are at risk of developing involuntary leakage of urine and or faeces, especially, in Nigeria, where the burden is high. Adequate information on the risk factors associated with vaginal fistula would help women to take appropriate decision to prevent difficult labour, the commonest cause of vaginal fistula. Furthermore, findings from this analysis will assist policy makers and public health programmers to understand the level of awareness of vaginal fistula and the contributory factors. This study aimed to determine the prevalence of, and the factors that could contribute to the awareness of vaginal fistula among women of reproductive age in Nigeria.

METHODS

Study design and data

The study utilized data from the 2018 NDHS. Nigeria is divided into six geopolitical regions, which consists of 36 states and a federal capital territory (FCT). Each state and FCT is subdivided into local government areas (LGAs). The LGAs were further divided into localities to make up census enumeration areas (EAs). The NDHS adopted a two-stage stratified cluster sampling technique; the states and FCT were stratified into urban and rural areas. The first stage involved 1400 EAs that were selected with probability proportional to EA size across the states. While in the second stage; 30 households were selected in every EAs using equal probability sampling. Further details of sampling design, method and implementation can be found in the 2018 NDHS report [16].

Patient and public involvement statement

Participants were not directly involved in the planning of the Nigeria demographic health survey. Information was disseminated to the general public including the participants as part of the protocol for a demographic health survey.

Data management

Outcome variables

The data on vaginal fistula were extracted from the women's questionnaire. The fistula module in the NDHS sought information on the awareness of vagina fistula from all women of reproductive age 15-49, and information on the knowledge about the cause, health seeking behaviour including access and effective treatment were sought from only those with a complaint of fistula. Out of the 14 item questions in the fistula section, the first question asked if a woman had ever experienced a constant leakage of urine or stool from vagina during the day or night, which we defined as vaginal fistula (Supplementary Box 1). The fifty women that had experienced vaginal fistula were excluded from the analysis on vaginal fistula awareness. The question on ever heard of leakage of urine or stool per vaginam (vaginal fistula) was used as the primary outcome for this study, and as a measure of level of awareness among participants.

Explanatory variables

The explanatory variables in this analysis were categorized into 3 groups: demographic; access to information; and reproductive and sexual history characteristics. The demographic variables included in the model were: age groups (15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49) years; region (North Central, North East, North West, South East, South South, South West); place of residence (urban, rural); ethnicity (Fulani, Hausa, Igbo, Yoruba, other ethnic minorities); religion

(Catholic, other Christians, Muslims, Traditional, others); highest educational level (no education, primary, secondary, higher) occupation (not currently working, working); and wealth quintiles (poorer, poor, middle, richer, richest).

Information related to access to media included: frequency of reading newspaper or magazine (not at all, less than once a week, at least once a week); frequency of listening to radio (not at all, less than once a week, at least once a week); frequency of watching television (not at all, less than once a week, at least once a week); own a mobile phone (no, yes); and use of internet (never, in the last 12 months, before last 12 months). Other related access to information were knowledge and use of family planning: knowledge of contraceptive method (knows no method, knows only folkloric method, knows only traditional method, knows modern methods); current use of contraceptive method (no method, folkloric method, traditional method, modern method); heard family planning on radio last few months (no, yes); heard family planning on television last few months (no, yes); heard family planning on newspaper and magazine last few months (no, yes); and heard family planning by text messages on mobile phone last few months (no, yes).

The variables that were considered under reproductive and sexual history characteristics included: childbirth experience (no, yes); currently pregnant (no or unsure, yes), and age at first sex (not had sex, <15years, 15-17years, 18-25years, >25years).

Data analysis

The main primary response in this analysis was ever had a childbirth experience. The percentage distribution and a chi-squared test of association on the background characteristics between women who had no previous childbirth experience and at least a childbirth was presented, since

obstetric fistula is associated with childbirth. The mean and standard deviation were presented for continuous variables or median and interquartile range (IQR) if the Shapiro-Wilk test for normality has a p-value<0.05. The prevalence of fistula awareness and univariate analysis were presented. The outcome variable, ever heard of fistula was a binary response (no, yes).

Four different logistic regression model were fitted. In the first model we used childbirth experience and age of women *apriori.* In the second model, we adjusted for other reproductive and sexual history. In the third model we adjusted for demographic characteristics, and in the final model we adjusted for variables related to access to information. A pairwise correlation matrix and variance inflation factor (VIF > 5), were used to investigate collinearity between the outcome measure and dependent variables[17]. None of the dependent variables was excluded due to collinearity. Analyses were performed with Stata 15.0 software, at 0.05 level of significance. We also presented a descriptive summary of women who had previously experienced fistula. A geospatial visual representation showing the prevalence of fistula awareness across states in Nigeria was generated using the ArcGIS software (version 10.4).

RESULTS

There were 26,585 women who responded to the questions in the fistula module. Only 50 (0.2%) women reported ever having vaginal fistula and most said it occurred after a difficult delivery (82.5% [33/40]) and livebirth (70.0% [35/50]). Two (4.0%) of the 50 women with history of vaginal fistula reported that their fistula was due to sexual assault. The median duration from the time of injury to leakage of urine or stool was a day with a range of 1.0 to 5.0 days. The median age of respondents who had experienced vaginal fistula was 16.0 (15.0 to 20.0) years

(Table 1). Only 41 (82%) out of 50 women had sought treatment for their fistula. Of the 41 treated, 27 (66%) reportedly had surgical repair.

Table 1 (Insert)

Table 1: Characteristics of women (15-49 year) that had experienced Fistula in the 2018 NDHS Data

Variable	Frequency (%)
Age at onset of vaginal fistula symptom (Median, Q1-Q3)	16(15-20)
<15	12/50(24.0%)
15-19	23/50(46.0%))
20-24	10/50(20.0%)
>24	5/50(10.0%)
Time problem occur	
After the delivery of a live baby	35/50(70.0%)
After a stillbirth	5/50(10.0%)
Neither	10/50(20.0%)
Risk factor for vaginal fistula	
After normal labour/delivery[a]	7/40(17.5%)
After very difficult labour/delivery[a]	33/40(82.5%)
Following sexual assault[b]	2/10(20%)
Others[b]	3/10(30%)
Onset of vaginal fistula[c] (Median, Q1-Q3)	1(1-5)
0	7/45(15.5%)
1-2	20/45(44.4%)
3-4	4/45(9.7%)
5-6	4/45(9.7%)
>=7	10/45(22.2%)
Previous vaginal fistula treatment	
No	9/50(18%)
Yes	41/50(82%)
Cadre of health worker that offered treatment for vaginal fistula [d]	
Doctor	34/41(82.9%)
Nurse/midwife	2/41(4.9%)
Community/Village health worker	2/41(4.9)
Other	3/41(7.3%)
Had had surgical fistula repair [d]	
No	14/41(34.2%)
Yes	27/41(65.8%)
Outcome of vaginal fistula repair [d]	
Yes, stopped completely	37/41(90.2%)
Not, stopped but reduced	3/41(7.3%)
Not stopped at all	1/41(2.4%)

[a] asked from participants who experienced fistula from delivery complication (n=40)
[b] asked from participants whose fistula experience were not pregnancy related, there were 5 missing responses (n=10)
[c] asked from participants whose fistula experience were from delivery complication or not, there were 5 missing responses (n=45)
[d] ask from participants who sought treatment for fistula (n=41)

The background characteristics of participants that answered the question on vaginal fistula awareness were presented according to their childbirth experience (Table 2). The mean age of women with at least one previous childbirth experience was higher than those with no childbirth experience (32.8±8.6 years vs 20.3±6.2 years; p<0.001). There were significant differences in all the selected demographics, access to information and reproductive/sexual history variables between participants with at least one previous childbirth and those with no childbirth experience (p<0.001). For example, there were more adolescents (15-19years) who had not experienced childbirth compared to those with a previous childbirth experience (60.4% vs 4.0%; p<0.001). On access to information, women that owned a mobile phone were higher among women with no childbirth experience compared to those with previous childbirth (54.4% vs 53.0%; p=0.032). Regarding the reproductive and sexual history, there were more women with previous history of termination of pregnancy among those with previous childbirth relative to women with no childbirth experience (14.3% vs 3.5%; p<0.001).

Table 2 (Insert)

Table 2: The background characteristics of women of reproductive age in Nigeria

Variables	No childbirth experience N=7933	At least a childbirth experience N=18602	Total N=26535	p-value
	n(% column)	n(% column)	n(% column)	
Demographic				
Age (year) Mean (SD)	20.3(6.2)	32.8(8.6)	29.1(9.8)	<0.001

Age group (years)				<0.001
15-19	4789(60.4%)	742(4.0%)	5531(20.8%)	
20-24	1700(21.4%)	2705(14.5%)	4405(16.6%)	
25-29	760(9.6%)	3690(19.8%)	3690(19.8%)	
30-34	318(4.0%)	3343(18.0%)	3343(18.0%)	
35-39	177(2.2%)	3129(16.8%)	3129(16.8%)	
40-44	105(1.3%)	2550(13.7%)	2550(13.7%)	
45-49	84(1.1%)	2443(13.1%)	2443(13.1%)	
Region				<0.001
North Central	1537(19.4%)	3412(18.3%)	4949(18.7%)	
North East	1274(16.1%)	3740(20.1%)	5014(18.9%)	
North West	1588(20.0%)	5115(27.5%)	6703(27.5%)	
South East	1359(17.1%)	2073(11.1%)	2073(11.1%)	
South South	1011(12.7%)	2074(11.2%)	2074(11.2%)	
South West	1164(14.7%)	2188(11.8%)	2188(11.7%)	
Place of residence				
Urban	3885(49.0%)	6745(36.3%)	10630(40.1%)	
Rural	4048(51.0%)	11857(63.7%)	15905(59.9%)	
Ethnicity				<0.001
Fulani	372(4.7%)	1586(8.5%)	1958(7.4%)	
Hausa	1674(21.1%)	5411(29.1%)	7085(26.7%)	
Igbo	1649(20.8%)	2525(13.6%)	4174(15.7%)	
Yoruba	1140(14.4%)	2133(11.5%)	3273(12.3%)	
Others ethnic minorities	3098(39.1%)	6947(37.3%)	10045(37.8%)	
Religion				<0.001
Catholic	1042(13.1%)	1747(9.4%)	2789(10.5%)	
Other Christians	3507(44.2%)	6417(34.5%)	9924(37.4%)	
Islam	3336(42.1%)	10275(55.2%)	1361151.3%)	
Traditional	23(0.3%)	73(0.4%)	96(0.4%)	
Others	25(0.3%)	90(0.5%)	115(0.4%)	
Highest education level				<0.001
No education	1290(16.2%)	8127(43.7%)	9417(35.5%)	
Primary	698(8.8%)	3271(17.6%)	3969(15.0%)	
Secondary	4758(60.0%)	5600(30.1%)	10358(39.0%)	
Higher	1187(15.0%)	1604(8.6%)	2791(10.5%)	
Occupation				<0.001
Not currently working	4272(53.8%)	5225(28.1%)	9497(35.8%)	
Working	3661(46.2%)	13377(71.9%)	17038(64.2%)	
Wealth quintiles				<0.001
Poorest	968(12.2%)	4150(22.3%)	5118(19.3%)	
Poorer	1297(16.4%)	4104(22.1%)	5401(20.4%)	
Middle	1640(20.7%)	3838(20.6%)	5478(20.6%)	
Richer	1957(24.7%)	3542(19.4%)	5499(20.7%)	
Richest	2071(26.1%)	2968(16.0%)	5039(19.0%)	
Access to information				
Frequency of reading newspaper or magazine				<0.001
Not at all	6158(77.6%)	16409(88.2%)	22567(85.1%)	

Less than once a week	1197(15.1%)	1528(8.2%)	2725(10.3%)	
At least once a week	578(7.3%)	665(3.6%)	1243(4.7%)	
Frequency of listening to radio				<0.001
Not at all	3438(43.3%)	8822(47.4%)	12260(46.2%)	
Less than once a week	2188(27.6%)	4629(24.9%)	6817(25.7%)	
At least once a week	2307(29.1%)	5151(27.7%)	7458(28.1%)	
Frequency of watching TV				<0.001
Not at all	3059(38.5%)	10391(55.9%)	13450(50.7%)	
Less than once a week	1776(22.4%)	3405(18.3%)	5181(19.5%)	
At least once a week	3098(39.1%)	4806(25.8%)	7904(29.8%)	
Owns a mobile phone				0.032
No	3617(45.6%)	8749(47.0%)	12366(46.6%)	
Yes	4316(54.4%)	9853(53.0%)	14169(53.4%)	
Use of Internet				<0.001
Never	5724(72.1%)	16763(90.1%)	22487(84.74%)	
In the last 12 months	2045(25.8%)	1614(8.7%)	3659(13.8%)	
Before last 12 months	164(2.1%)	225(1.2%)	225(1.2%)	
Current use of contraceptive method				<0.001
No method	7412(93.4%)	15778(84.8%)	23190(87.4%)	
Folkloric method	7(0.1%)	90(0.5%)	97(0.4%)	
Traditional method	104(1.3%)	597(3.2%)	701(2.6%)	
Modern method	410(5.2%)	2137(11.5%)	2547(9.6%)	
Reproductive/Sexual history				
Currently pregnant				<0.001
No or unsure	7454(94.0%)	16477(88.6%)	23931(90.2%)	
Yes	479(6.0%)	2125(11.4%)	2604(9.8%)	
Ever had a terminated pregnancy				<0.001
No	7652(96.5%)	15939(85.7%)	23591(88.9%)	
Yes	281(3.5%)	2663(14.3%)	2944(11.1%)	
Age at first sex				<0.001
Not had sex	4481(56.5%)	0 (0.0%)	4481(16.9%)	
<15years	323(4.1%)	3961(21.3%)	4284(16.2%)	
15-17years	1399(17.6%)	8375(45.1%)	9774(36.9%)	
18-25years	1630(20.5%)	5963(32.1%)	7593(28.6%)	
>25years	100(1.3%)	280(1.5%)	380(1.4%)	

The overall prevalence of awareness of vaginal fistula among the participants was 52.0% (13,066/26,535) (Table 3). There was a linear trend between the prevalence of awareness of fistula and age group of participants. The prevalence of awareness of fistula was highest among women aged 45-49 years (55.8%) compared to other age groups. Generally, the prevalence of awareness of fistula was higher in the northern regions than the southern regions (Figure 1). The

awareness of fistula was highest among women in the Northwest (80.2%), those living in the rural communities (59.0%), who are Muslims (64.5%), with no formal education (67.7%) and from the poorest wealth quintiles (68.4%).

Women who read newspaper at least once a week (53.5%), never listened to radio (55.2%), never watched television (61.4%), never owned a mobile phone (57.5%) and never used internet (53.5%) had the highest proportions of those that had ever heard of fistula. The awareness of fistula was highest among women with history of termination of pregnancy (61.8%), currently pregnant (60.5%), had a previous childbirth (56.6%), and never used a contraceptive method (53.7%).

In the unadjusted analyses (table 3), the odds of ever heard of fistula by the participants was associated with demographic factors. Specifically, the odds of awareness of fistula was higher among women aged 20-24 years and older compared to those whose age was 15-19 years. Women living in the Northeast and Northwest had higher odds of ever reporting to have heard of fistula than those from Northcentral region. However, women in all the three Southern regions of Nigeria had lower odds of awareness of fistula relative to those in the Northern region. The odds of being aware of fistula was 1.87 times (95% CI, 1.68-2.09) among women living in the rural communities compared to those in the urban communities. There was a higher odds of awareness of fistula among participants from Islamic religion (OR=2.85; 95% CI, 2.42-3.37) compared to those from Catholic faith group. However, the participants who professed traditional and other religions had a lower odds of being aware of fistula relative to those from the Catholic faith group. The odds of awareness of fistula was lower among the participants that

had primary, secondary and tertiary education compared to those with no formal education. There was an inverse relationship between the odds of reporting awareness of fistula and wealth quintiles of participants. For example, women from richer (OR=0.33; 95%CI, 0.27-0.41) and richest (OR=0.37; 95%CI, 0.31-0.44) wealth quintiles had the lowest odds of being aware of fistula compared to those in the poorest wealth quintile.

The odds of ever heard of fistula by the participants was associated with access to information factors. Generally, there was an inverse relationship between the odds of ever being aware of fistula and the frequency of reading newspaper/magazine, listening to radio, watching television, frequency of using internet and ownership of mobile phone. For example, women who reported reading newspaper at least once a week (OR=0.64; 95%CI, 0.57-0.83) were associated with lower odds of being aware of fistula compared to those that had never read newspaper. Concerning the reproductive/sexual history factors, women that had at least a child had 1.87 (95%CI, 1.73-2.02) odds of been aware of fistula relative to women with no previous childbirth. There were higher odds of been aware of fistula among women that were currently pregnant (OR=1.47; 95%CI, 1.33-1.63) relative to those who were not currently pregnant. There was also a higher odds of fistula awareness among women with history of previous termination of pregnancy (OR=1.57, 95%CI, 1.42-1.75) compared to those with no such experience. Women that reported history of contraceptive use were associated with the lower odds of ever been aware of fistula compared to those with those with no history of contraceptive use.

Table 3 (Insert)

Table 3: Prevalence and bivariate analysis between explanatory variables and ever heard of fistula among women of reproductive age

Variable	Ever heard of fistula

	Prevalence (%; 95% CI)	Crude OR (95%CI)	p value
Demographic			
Age group (years)			
15-19	41.5 (39.5-43.5)	Reference	
20-24	53.8 (51.8-55.8)	1.64(1.49-1.81)	<0.001
25-29	55.5 (53.6-57.4)	1.76(1.60-1.93)	<0.001
30-34	54.5 (52.2-56.9)	1.69(1.52-1.88)	<0.001
35-39	55.1 (52.3-57.8)	1.73(1.54-1.94)	<0.001
40-44	54.1 (51.6-56.5)	1.66(1.48-1.86)	<0.001
45-49	55.8 (53.3-58.3)	1.78(1.59-1.99)	<0.001
Region			
North Central	46.6 (44.1-49.1)	Reference	
North East	61.3 (58.5-64.0)	1.81(1.56-2.12)	<0.001
North West	80.6 (78.6-82.5)	4.76(4.06-5.59)	<0.001
South East	27.8 (24.8-30.9)	0.44(0.37-0.53)	<0.001
South South	35.9 (33.0-39.0)	0.64(0.55-0.76)	<0.001
South West	22.2 (19.9-24.7)	0.33(0.28-0.39)	<0.001
Place of residence			
Urban	43.4 (41.3-45.6)	Reference	
Rural	59.0 (57.5-60.5)	1.87(1.68-2.09)	<0.001
Ethnicity			
Fulani	63.7 (58.6-68.5)	Reference	
Hausa	79.2 (77.2-81.2)	2.17(1.71-2.77)	<0.001
Igbo	30.1 (27.6-32.8)	0.25(0.19-0.31)	<0.001
Yoruba	22.5 (19.9-25.2)	0.16(0.13-0.21)	<0.001
Others ethnic minorities	47.4 (45.5-49.2)	0.51(0.41-0.64)	<0.001
Religion			
Catholic	38.8 (35.6-42.1)	Reference	
Other Christians	36.7 (34.7-38.7)	0.91(0.77-1.07)	0.264
Islam	64.5 (62.2-66.6)	2.85(2.42-3.37)	<0.001
Traditional	29.5 (23.6-36.2)	0.66(0.47-0.92)	0.015
Others	3.7 (1.2-11.0)	0.06(0.02-0.20)	<0.001
Highest education level			
No education	67.7 (65.8-69.6)	Reference	
Primary	47.0 (44.4-49.7)	0.42(0.54-5.09)	<0.001
Secondary	38.6 (36.8-40.3)	0.30(0.27-0.33)	<0.001
Higher	54.0 (51.2-56.8)	0.56(0.48-0.64)	<0.001
Currently working			
No	52.5 (50.6-54.4)	Reference	
Yes	51.6 (50.2-53.1)	0.97(0.89-1.04)	0.376
Wealth quintiles			
Poorest	68.4 (65.5-71.1)	Reference	
Poorer	60.1 (57.6-62.6)	0.70(0.60-0.81)	<0.001
Middle	48.5 (46.1-50.9)	0.44(0.37-0.51)	<0.001
Richer	41.9 (38.4-45.4)	0.33(0.27-0.41)	<0.001
Richest	44.1 (41.3-46.9)	0.37(0.31-0.44)	<0.001
Access to Information			

Frequency of reading newspaper or magazine			
Not at all	53.2 (51.7-54.7)	Reference	
Less than once a week	42.1 (39.5-44.7)	0.64(0.57-0.72)	<0.001
Atleast once a week	53.5 (49.7-57.2)	1.01(0.87-1.19)	0.875
Frequency of listening to radio			
Not at all	55.2 (53.3-57.1)	Reference	
Less than once a week	48.2 (46.3-50.1)	0.75(0.68-0.83)	<0.001
Atleast once a week	50.3 (48.2-52.4)	0.82(0.75-0.91)	<0.001
Frequency of watching TV			
Not at all	61.4 (59.7-63.1)	Reference	
Less than once a week	42.3 (40.0-44.5)	0.46(0.41-0.51)	<0.001
Atleast once a week	43.4 (40.8-45.9)	0.48(0.42-0.55)	<0.001
Own a mobile phone			
No	57.5 (55.8-59.2)	Reference	
Yes	47.4 (45.7-49.0)	0.67(0.61-0.72)	<0.001
Use of Internet			
Never	53.5 (51.9-55.0)	Reference	
In the last 12 months	45.6 (43.1-48.1)	0.73(0.65-0.82)	<0.001
Before last 12 months	37.0 (31.8-42.4)	0.51(0.40-0.64)	<0.001
Reproductive/Sexual history			
Ever had a child			
No	41.1 (39.4-42.9)	Reference	
Yes	56.6 (55.1-58.1)	1.87(1.73-2.02)	<0.001
Age at first sex			
Not had sex	39.4 (36.8-41.9)	Reference	
<15years	64.1 (61.8-66.3)	2.75(2.41-3.15)	<0.001
15-17years	58.1 (56.2-59.9)	2.13(1.90-2.40)	<0.001
18-25years	45.3 (43.5-47.1)	1.28(1.15-1.42)	<0.001
≥25years	44.1 (37.9-50.4)	1.21(0.94-1.56)	0.131
Currently pregnant			
No or unsure	51.0 (49.6-52.4)	Reference	
Yes	60.5 (58.0-62.8)	1.47(1.33-1.63)	<0.001
Ever had a terminated pregnancy			
No	50.7 (49.3-52.1)	Reference	
Yes	61.8 (59.4-64.1)	1.57(1.42-1.75)	<0.001
Current use of contraceptive method			
No method	53.7 (52.4-55.0)	Reference	
Folkloric method	30.1 (15.7-51.2)	0.38(0.16-0.89)	0.026
Traditional method	31.3 (26.9-36.0)	0.39(0.32-0.48)	<0.001
Modern method	43.7 (40.7-46.7)	0.67(0.59-0.75)	<0.001

Figure 1 (Insert)

The results of the adjusted analyses were presented in the multivariable logistic regression in table 4. The first model included childbirth experience and age of respondents: women who had had a previous childbirth experience had a higher odds (odds ratio (OR)=1.81; 95%CI, 1.63 to 2.01) of awareness of fistula. Only women whose ages were between 20-24 years and 25-29 years had higher odds of reporting having heard of fistula compared to women that were less than 15 to 19 years. The second model adjusted for the reproductive and sexual history, all variables including the model 1 variables (which were kept apriori), were statistically significant except among women that reported that their age at first sex was 25 years and older . The odds of awareness of fistula was higher among women who had their first sexual exposure at less than 15 years (Adjusted odds ratio (AOR)=1.58; 95%CI, 1.32 - 1.90) and between 15 to 17years (AOR=1.30; 95%CI, 1.11 - 1.52) compared to those who had no previous sexual exposure. However, a lower odds was observed among women aged 18-25 years (AOR=0.81; 95%CI, 0.70 - 0.95) compared to women who have never had sex.

The third model included the demographic characteristics: women that were living in the southern part of Nigeria were associated with a lower odds of fistula awareness while women in the Northwest (AOR=3.56; 95%CI, 2.84 - 4.47) and Northeast (AOR=1.82; 95%CI 1.53 - 2.17) regions had higher odds compared with women in the Northcentral region. Similarly, women from the Yoruba (AOR=0.47; 95%CI, 0.35 - 0.64) and Igbo (AOR=0.67; 95%CI, 0.46 -0.98) ethnic groups had a lower odds of fistula awareness. Women with secondary (AOR=1.24; 95%CI, 1.09 - 1.41) and tertiary education (AOR=2.38; 95%CI, 2.00 - 2.83) had a higher odds of fistula awareness. However, women from the poorer and middle wealth quintiles had the lower odds of been aware of fistula compared with women in the poorest wealth quintiles. The variables

related with access to information that were significantly associated with the higher odds of fistula awareness included: the ownership of a mobile phone (AOR=1.16; 95%CI, 1.05 - 1.27), report of using the internet in the last 12 months (AOR=1.57; 95%CI, 1.33 - 1.86) and the history of reading newspaper or magazine at least once a week (AOR=1.29; 95%CI, 1.07-1.57) and listening to radio less than once a week (AOR=1.23; 95%CI, 1.09-1.38) relative to women without the history of these factors.

Table 4 (Insert)

Table 4: Multivariable logistic regression models of factors associated with the awareness of fistula among women of reproductive age

Characteristics	Model 1 OR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)	Model 4 AOR (95% CI)
Had a childbirth				
Yes(vs No)	**1.81(1.63-2.01)**	**1.45(1.30-1.62)**	1.05(0.92-1.20)	**1.14(1.01-1.30)**
Age(years)				
15-19	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
20-24	**1.25(1.12-1.39)**	**1.38(1.22-1.56)**	**1.47(1.28-1.69)**	**1.36(1.18-1.56)**
25-29	**1.17(1.05-1.31)**	**1.41(1.24-1.59)**	**1.64(1.43-1.89)**	**1.53(1.33-1.76)**
30-34	1.08(0.95-1.22)	**1.32(1.14-1.53)**	**1.62(1.37-1.91)**	**1.54(1.30-1.81)**
35-39	1.08(0.94-1.24)	**1.37(1.18-1.59)**	**1.91(1.61-2.26)**	**1.81(1.53-2.14)**
40-44	1.02(0.89-1.17)	**1.27(1.09-1.49)**	**1.80(1.50-2.16)**	**1.71(1.43-2.06)**
45-49	1.09(0.95-1.25)	**1.31(1.13-1.51)**	**2.11(1.78-2.50)**	**2.04(1.72-2.41)**
Age at first sex				
Not had sex		1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
<15years		**1.58(1.32-1.90)**	**1.32(1.09-1.59)**	**1.27(1.05-1.53)**
15-17years		**1.30(1.11-1.52)**	**1.30(1.10-1.53)**	**1.25(1.06-1.47)**
18-25years		**0.81(0.70-0.95)**	**1.19(1.00-1.42)**	1.14(0.96-1.35)
≥25years		0.78(0.59-1.03)	1.02(0.74-1.41)	0.95(0.69-1.32)
Currently pregnant				
Yes (vs No)		**1.18(1.07-1.30)**	1.02(0.92-1.14)	1.04(0.93-1.16)
Had terminated pregnancy				
Yes (vs No)		**1.37(1.22-1.52)**	**1.17(1.05-1.31)**	**1.17(1.04-1.31)**
Use of contraceptive				
No method		1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
Only folkoric method		**0.30(0.13-0.72)**	0.58(0.30-1.11)	0.58(0.31-2.20)
Only traditional method		**0.40(0.32-0.50)**	**0.73(0.58-0.91)**	**0.70(0.56-0.88)**
Modern method		**0.64(0.57-0.73)**	**0.83(0.73-0.94)**	**0.81(0.71-0.92)**
Region				

North Central	1.0 (Reference)	1.0 (Reference)
North East	**1.82(1.53-2.17)**	**1.84(1.55-2.20)**
North West	**3.56(2.84-4.47)**	**3.57(2.85-4.48)**
South East	**0.45(0.33-0.61)**	**0.42(0.31-0.58)**
South South	**0.56(0.47-0.67)**	**0.53(0.44-0.63)**
South West	**0.40(0.32-0.49)**	**0.37(0.30-0.45)**
Place of residence		
Rural (vs Urban)	1.08(0.94-1.23)	1.11(0.97-1.27)
Educational status		
No education	1.0 (Reference)	1.0 (Reference)
Primary	1.03(0.90-1.18)	1.02(0.89-1.18)
Secondary	**1.24(1.09-1.41)**	**1.14(1.00-1.30)**
Higher	**2.38(2.00-2.83)**	**1.74(1.45-2.08)**
Ethnicity		
Fulani	1.0 (Reference)	1.0 (Reference)
Hausa	**1.66(1.33-2.09)**	**1.67(1.33-2.09)**
Igbo	**0.67(0.46-0.98)**	**0.67(0.46-0.97)**
Yoruba	**0.47(0.35-0.64)**	**0.47(0.34-0.64)**
Others	0.83(0.64-1.06)	0.84(0.65-1.08)
Religion		
Catholic	1.0 (Reference)	1.0 (Reference)
Other Christian	**0.82(0.70-0.95)**	**0.83(0.71-0.97)**
Islam	**0.77(0.63-0.95)**	**0.78(0.63-0.96)**
Traditionalist	**0.22(0.12-0.43)**	**0.24(0.12-0.46)**
Others	**0.05(0.02-0.18)**	**0.05(0.01-0.16)**
Currently working		
Yes (vs No)	**1.39(1.26-1.54)**	**1.35(1.22-1.49)**
Wealth quintiles		
Poorest	1.0 (Reference)	1.0 (Reference)
Poorer	**0.82(0.71-0.95)**	**0.81(0.70-0.93)**
Middle	**0.79(0.67-0.95)**	**0.76(0.63-0.91)**
Richer	0.89(0.74-1.06)	**0.80(0.66-0.96)**
Richest	1.22(0.99-1.49)	0.99(0.80-1.22)
Read newspaper or magazine		
Not at all		1.0 (Reference)
Less than once a week		0.93(0.82-1.06)
Atleast once a week		**1.29(1.07-1.57)**
Listen to radio		
Not at all		1.0 (Reference)
Less than once a week		**1.23(1.09-1.38)**
Atleast once a week		**1.23(1.10-1.38)**
Watch TV		
Not at all		1.0 (Reference)
Less than once a week		0.92(0.81-1.04)
Atleast once a week		1.05(0.91-1.22)
Own a mobile phone		
Yes (vs No)		**1.16(1.05-1.27)**
Use of Internet		

Never	1.0 (Reference)
Last 12 months	**1.57(1.33-1.86)**
before last 12 months	1.01(0.78-1.30)

Statistically significant variables at p<0.05 are shown in bold

DISCUSSION

This study is probably the first largest nationally representative sample of women in SSA that investigated the level of awareness of vaginal fistula among women of reproductive age. The finding showed that only about half (52%) of Nigerian women interviewed had ever heard of vaginal fistula. There was a high fistula awareness among young adults and those with previous childbirth experience in this study. In addition, participants living in the North and rural communities had higher prevalence of awareness of fistula than women in the Southern region and urban settings in Nigeria. The awareness of vaginal fistula was associated with the following factors: history of childbirth experience, aged 20-24 years and older, reported age at first sexual intercourse of up to 17 years, history of ever terminated a pregnancy, use of modern or traditional contraception, place of residence, having at least secondary education, ethnicity, wealth quintile and access to the source of information dissemination (radio, television and newspaper or magazine). The association between the history of previous childbirth and vaginal fistula awareness strengthens the role of antenatal care education, counseling and health promotion in the prevention and prompt treatment of obstructed labour and vaginal fistula[18] . Other sources of information dissemination will be useful in educating other groups of women especially the adolescents on positive reproductive health information and behaviours.

Although the awareness level about the vaginal fistula in this study has increased compared to the 2008 NDHS report of 30.7%, it is still a source of concern, particularly, among young population relative to older adults in Nigeria[9]. The observed increase in the prevalence of vaginal fistula awareness in the 2018 NDHS might be due to the increased priority and investment in obstetric fistula prevention and treatment by the Government of Nigeria and development partners in the last decade [19]. Vaginal fistula is more common among young people, who are usually at risk of obstructed labour due to inadequate pelvis. Pregnant adolescents often have difficulties in accessing timely obstetric emergency services should they develop obstructed labour. The reported prevalence of awareness of fistula from previous studies were mixed, majority were in the range of 20-46% while a few others reported a higher figure than 52% found in this study. For example, two studies in Northern Ghana among 390 prenatal women (18-49 years) and 1982 (17-60 years) women in the community found that the awareness of fistula was 28.8% and 45.8%, respectively [12,20]. However, a study (2010) in Mtwara region of Tanzania showed that 61.1% out of 334 women aged 18-49 years were aware of vaginal fistula [15]. Higher prevalence (81%) of fistula awareness was recorded in an Eritrean study after the implementation of health education and community mobilization programme among women; this study however, included those living with fistula[21].

Some of the risk factors associated with awareness of vaginal fistula in this study had been previously reported elsewhere[13,22]. The high level of awareness of vaginal fistula which was found to be significantly associated with the educational status, age older than 20 years, wealth quintiles and access to information dissemination platforms in this study, had also been previously reported[11-14,20]. The high awareness level among women in the Northern region

relative to the southern part of Nigeria and Hausa/Fulani than other ethnic groups could be due to the high burden of vaginal fistula and information diffusion from the high concentration of interventions on obstetric fistula in North and among Hausa/Fulanis. Surprisingly, women living in the rural communities were more likely to be aware of vaginal fistula compared to those in urban setting. This observation is against the general belief that women in the urban settings tend to have better awareness about health related issues than their colleague in the rural setting . It is plausible that women living in rural setting might have experienced more cases of childbirth related complications including obstetric fistula than those in urban setting.

The level of awareness of vaginal fistula might not necessarily translates to adequate knowledge that can help women to make appropriate decision on the prevention and access to care. There are some studies that had reported significant proportion of misconceptions on the causes or risk factors for vaginal fistula even among those that claimed to be aware of fistula[13,22,23]. In a qualitative study in Malawi, Changole et al interviewed women who were said to be aware of vaginal fistula on probable causes[22]. The authors reported that majority of these women associated vaginal fistula with sexually transmitted infection, witchcraft, husband's infidelity and laziness to push during labour [22]. There were two other qualitative studies from Ethiopia that also showed that women including those suffering from incontinence had misconception on the probable risk factors for vaginal fistula[23,24].

Another limitation of the data on awareness is the inability to disaggregate the information on the subtle differences between urinary and feacal incontinence because the question was not asked separately. Other limitations include the use of secondary data and lack of information that may help to describe causes or risk factors of vaginal fistula.

It would have been beneficial if other useful information to assess the knowledge of women on urinary and feacal incontinence were collected during the 2018 NDHS . It is difficult to appreciate the impact of the awareness level of vaginal fistula from the 2018 Nigerian NDHS data because of lack of other necessary information. For example, there are no questions on the sources of information and risk factors as well the preventive methods of vaginal fistula. It is imperative that future national survey consider some of the following questions with response options for participant to select: *Where did you first learn or hear about involuntary leakage of urine or stool after childbirth in a woman?; What did you think is/are responsible for the involuntary leakage of urine or stool after childbirth in a woman?;* and *what are the ways of preventing the occurrence of involuntary leakage of urine or stool after childbirth in a woman?*. We believe that these suggested questions will add to the quality of information that will be collected to profile the public knowledge on vaginal fistula. This information will better guide the policy makers, programme planners and experts, to design a well-informed strategy for the control of vaginal fistula in the country.

In conclusion, the study showed that a large number of women, particularly, young women with no childbirth experience and from the Southern region of Nigeria had low level of awareness of vaginal fistula. It is recommended that more public health awareness on vaginal fistula should be incorporated in reproductive health messages, especially among women of reproductive age. We also advocate that other critical questions should be included in the future national survey to help policy makers and programme planner better execute public health intervention for the control of vaginal fistula that is still ravaging Nigeria.

Figure 1: Prevalence of Vaginal fistula awareness by states among women of reproductive age

Acknowledgement

We are grateful to DHS Program for providing access to the data.

Contributions

(I) Conception and design: Morhason-Bello IO and Yusuf Kareem (II) Data analysis: Yusuf Kareem and Imran Morhason-Bello (III) Spatial Data Analysis: Linda Abegunde; (IV) Data interpretation: Imran Morhason-Bello, Yusuf Kareem, Rukiyat Abdus-Salam, Oluwasomidoyin Bello, Olatunji Lawal, Fatimah Akinlusi, Linda Abegunde and Oladosu Ojengbede; (V) Manuscript writing: All authors; (VI) Final approval of manuscript: All authors.

Funding

This research received no grant from any funding agency in the public, commercial or not-for-profit sectors

Competing interests

The authors declared no competing interest

Ethics approval

Ethical approval is not needed, the study used secondary data from the Nigeria Demography Health Surveys (DHS). The DHS program maintain strict standards for protecting the privacy of respondents and the survey protocols are reviewed by the ICF and Institutional Review Board

(IRB) in each country to ensure that the survey complies with the regulations for the protection of human subjects.

Data availability

The data supporting this article is available at:

https://dhsprogram.com/data/dataset/Nigeria_Standard-DHS_2018.cfm, which can be downloaded after request from the DHS website.

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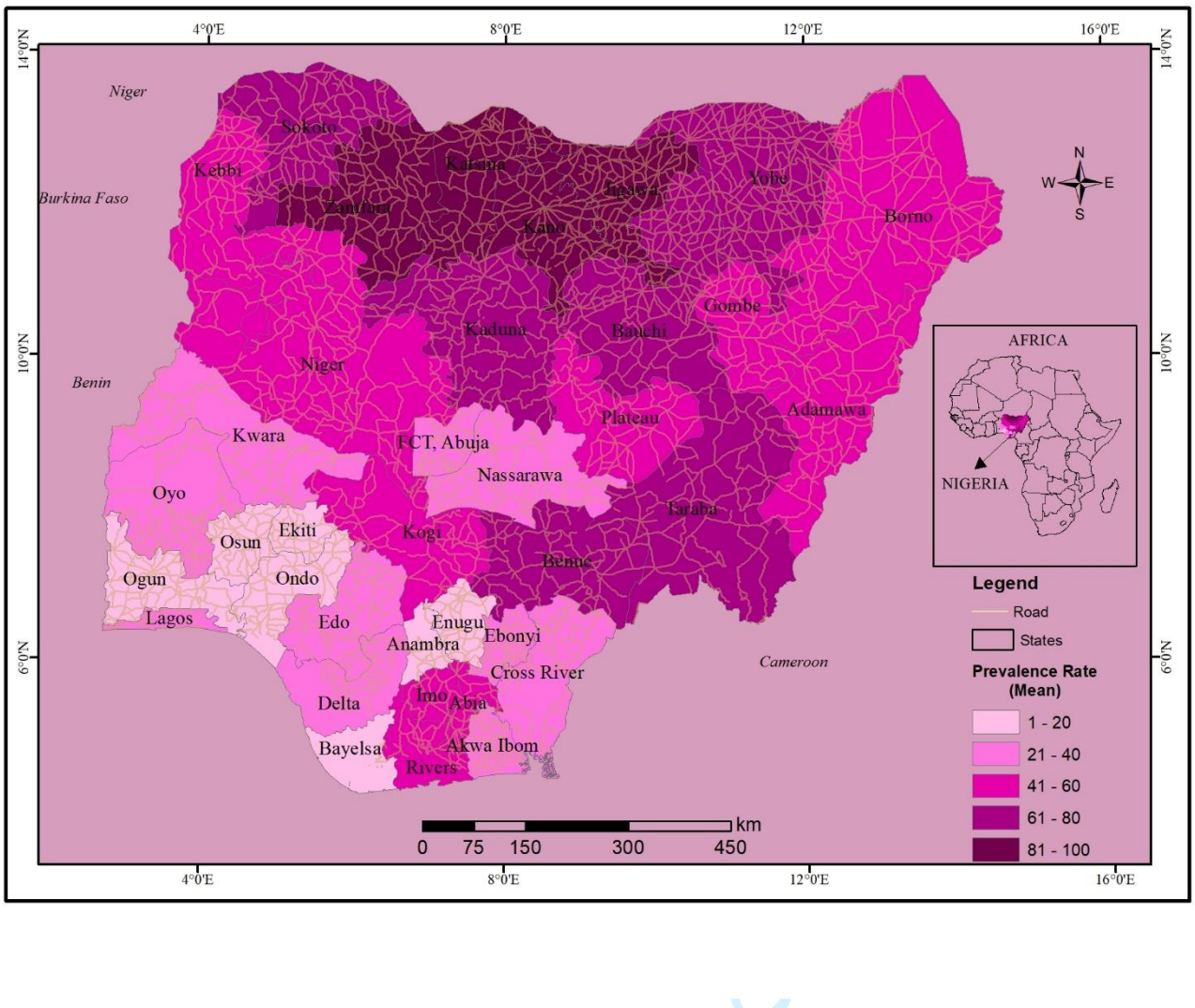
Figure 1: Prevalence of Vaginal fistula awareness by states among women of reproductive age



Box 1: Fistula Module questions asked in the 2018 NDHS data

S/N	Questions	Denominator
1.	Sometimes a woman can have a problem of constant leakage of urine or stool from her vagina during the day and night. This problem usually occurs after a difficult childbirth but may also occur after a sexual assault or after pelvic surgery. Have you ever experienced a constant leakage of urine or stool from your vagina during the day and night?	No=26535 Yes=50 N=26585
2.	**Have you ever heard of this problem?**	Yes=13469 No=13066 N=26535
3.	Did this problem start after you delivered a baby or had a stillbirth	50
4.	Did this problem start after a normal labor and delivery, or after a very difficult labor and delivery?	40
5.	What do you think caused this problem?	10
6.	How many days after (cause of problem from 3 or 5) did this leakage start?	45
7.	How old were you when you experienced this problem?	50
8.	Have you sought treatment for this condition?	50
9.	Why have you not sought treatment?	Nil
10.	From whom did you last seek treatment?	41
11.	Did you have an operation to fix the problem?	41
12.	Did the treatment stop the leakage completely? IF NO: did the treatment reduce the leakage?	41
13.	Are there any (other) women in your household who suffer from obstetric fistula?	Nil
14.	How many (other) women in your household suffer from obstetric fistula?	No observation

Questions 1, 3-14 *were answered by participants that had experienced vaginal fistula;* ***Question 2*** *was answered by all women*

Adapted checklist of items that should be included in reports of observational studies (STROBE)

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-7
Bias	9	Describe any efforts to address potential sources of bias	6-7
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-11
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	11
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	19-20
		(*b*) Report category boundaries when continuous variables were categorized	19-20
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	23
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	21-22
Generalisability	21	Discuss the generalisability (external validity) of the study results	24
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25